

species are derived from other sightings.

### Discussion

Minimum estimates of density and group sizes in *Saguinus midas* are similar to those found during intensive studies at the same study site by Kessler (1995b): 16.5 ind/km<sup>2</sup>, 4.8±1.5 ind/group, n=4. Julliot (1992) calculated a higher density for *Alouatta seniculus* (17-22 ind/km<sup>2</sup>, 6.3±2 ind/group n=6) than estimated in the present study. This is best explained by the fact that howler groups are often missed, and, when resting, are difficult to count. Estimates from another study site in the Guianan region (Raleighvallen-Voltzberg Reserve, Surinam) for *Alouatta seniculus* (17 ind/km<sup>2</sup>), *Ateles paniscus* (7.1 ind/km<sup>2</sup>) and *Saguinus midas* (23.5 ind/km<sup>2</sup>) are comparable to results of the present study (Mittermeier, 1977; Van Roosmalen, 1980).

Observed group sizes of *Ateles paniscus* refer to foraging units rather than to social units. Spider monkeys are known to form social groups of up to 15-20 individuals, but forage in small sub-groups of 2-3 animals (Klein and Klein, 1979; Van Roosmalen, 1980). This pattern was also typical at Nouragues. The lack of data for *Cebus olivaceus* and *Pithecia pithecia* probably reflects very low densities. *Pithecia* is also a very shy and quiet species, and difficult to detect (pers. obs.).

Hunting pressure evidently exerts the major impact on primate populations in French Guiana, especially along large rivers such as the Approuague. *Cebus*, *Ateles* and *Alouatta* are the most-hunted primates (Roussillon, 1988). Comparing data from two localities, Raleighvallen-Voltzberg Nature Reserve and Brownsberg Nature Park in Surinam, with no hunting pressure, with a heavily hunted area in French Guiana (Saül) (Mittermeier *et al.* 1977), the population densities estimated for the Natural Reserve of Nouragues indicate that hunting pressure is absent or light.

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### References

- Charles-Dominique, P. 1993. Speciation and coevolution: an interpretation of frugivory phenomena. In: *Frugivory and Seed Dispersal: Ecological and Evolutionary Aspects*, T. H. Fleming and A. Estrada (eds.), pp.75-84. Kluwer Academic Publishers, Belgium.
- Julliot, C. 1992. Utilisation des ressources alimentaires

par le singe hurleur roux, *Alouatta seniculus* (Atelidae, Primates), en Guyane: Impact de la dissemmination des Graines sur la régénération forestière. Thèse de doctorat, Université de Tours.

- Kessler, P. 1995a. Preliminary field study of the red-handed tamarin (*Saguinus midas*) in French Guiana. *Neotropical Primates* 3: 184-185.
- Kessler, P. 1995b. Reviervverhalten, Ernährungsstrategie und Habitatpräferenzen des Rothandtamarins (*Saguinus midas midas*) in Französisch-Guayana. M.Sc.thesis, University of Zürich-Irchel, Zürich.
- Klein, L. L. and Klein, D. J. 1979. Social and ecological contrasts between four taxa of Neotropical Primates. In: *Primate Ecology: Problem Oriented Field Studies*, R.W. Sussman (ed.), pp. 107-131. John Wiley and Sons, New York.
- Mittermeier, R. A. 1977. The Distribution, Synecology and Conservation of Surinam monkeys. PhD thesis, University of Harvard, Cambridge.
- Mittermeier, R. A., Bailey, R. A. and Coimbra-Filho, A. F. 1977. Conservation Status of the Callitrichidae in Brazilian Amazonia, Surinam, and French Guiana. In: *The Biology and Conservation of the Callitrichidae*, D. G. Kleiman (ed.), pp. 137-146. Smithsonian Institution Press, Washington D.C.
- National Research Council (US), Committee on Nonhuman Primates, and Subcommittee on Conservation of Natural Populations. 1981. *Techniques for the Study of Primate Population Ecology*. National Academy Press, Washington, D.C.
- Van Roosmalen, M. G. M. 1980. Habitat Preferences, Diet, Feeding Strategy and Social Organization of the Black Spider Monkey (*Ateles paniscus paniscus* Linnaeus 1758) in Surinam. Ph.D. thesis, Wageningen.
- Roussillon, C. 1988. The general status of monkeys in French Guiana. *Primate Conservation* (9): 70-74.
- Zhang, S.-Y. 1995. Activity and ranging patterns in relation to fruit utilization by brown capuchin monkeys (*Cebus apella*) in French Guiana. *Int. J. Primatol.* 16: 489-507.

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## TEMPORAL AND ACOUSTIC PROPERTIES OF LONG-DISTANCE CALLS OF THE MASKED TITI MONKEY, *CALLICEBUS PERSONATUS*

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Adelaide H. P. Silva

Vocal communication is important for forest primate species with structural features of the environment limiting visual contact. Long-distance calls, often produced by primates and used in intra and inter-group signalling, may have spacing and other coordinative functions (Chivers, 1969).

The titi monkeys, genus *Callicebus*, are distributed in the Brazilian Atlantic coastal forest and forested areas of the basins of the Rios Amazonas, Orinoco and Paraguai (Kinzey, 1988). *Callicebus* monkeys emit loud calls de-

scribed as long vocal sequences of varying phrases (Moynihan, 1966; Robinson, 1979). These vocalizations are frequently uttered by a reproductive pair. Robinson (1979) described duetting for *Callicebus moloch* as coordinated vocalizations between a mated male and female with individuals producing identical sequences.

The analysis of the acoustic properties of long-distance calls of neotropical cebid primates are almost entirely restricted to the howler monkeys *Alouatta* (Baldwin & Baldwin, 1975; Bonvicino, 1989; Drubbel & Gautier, 1993; Whitehead, 1995) and squirrel monkeys *Saimiri* (Newman, 1985; Boinski & Newman, 1988). Robinson (1979) documented the structural variations in loud vocalizations of *Callicebus moloch*. Here, we present a temporal and spectrographic analysis of the long-calls of free-ranging *Callicebus personatus nigrifrons*.

### Study Site and Methods

The study was carried out in a 17-ha forest fragment of a privately-owned farm in Monte Belo, Minas Gerais, Brazil (21° 23'S, 46° 15'W), c. 820 m above sea level. The vegetation is secondary, tropical, semideciduous forest with a discontinuous canopy reaching a height of up to 30m. The fragment is surrounded by coffee and sugar-cane plantations and pasture. The data were obtained during a long-term study on the feeding ecology of a buffy-tufted-ear marmoset group, *Callithrix aurita*. Two adults and a juvenile *C. personatus* were resident in the area and frequently observed. In August 1994, only one of the adults and the young were seen, and in August 1995 another adult joined these two individuals and was apparently accepted.

Duration and time of long-distance calls were registered between May 1994 and January 1995. Whenever possible, location and the posture of the callers were recorded. Close recording (<3m) of a loud-call emitted by an adult and a young masked titi monkey was obtained using a portable Panasonic RQ-L307 recorder of frequency ranging from 0.2 to 6 kHz. The call was recorded on 11th, December 1994 at 2:12pm.

Selected plots of the call were digitized at 30 kHz. Spec-

trograms were generated on SpectroGram 3.2 in the Laboratory of Biology, Ecology and Bioacoustics of Amphibians (LABEBA) of the State University of Campinas (Unicamp). We used a resolution of 16bit, and frequency scale of 1024 FFT over a temporal scale of 6 seconds. Terminology used follows Robinson (1979) and Whitehead (1995): a syllable is an uninterrupted spectrographic tracing and the emphasized or dominant frequency is the band of greatest energy (blackest part of a spectrogram). Intersyllable intervals, the period between the end of one syllable and the beginning of the next, were measured. These correspond to the pause in Robinson's study.

### Results and Discussion

Twenty-five long-distance calls were registered. Fifteen were heard between 0700 and 0900 h, seven between 0900 and 1100 h, two between 0500 and 0700 h and one between 1300 and 1500 h. The titi family, therefore, showed a peak of calling early in the morning as has been found for *Alouatta seniculus* (Sekulic, 1982; Drubbel & Gautier, 1993). Callers usually positioned themselves on the top of a tree, facing another forest fragment where another *Callicebus* group had been heard on several occasions. During the call recording, however, both animals were about 2 m above the ground. The younger titi did not always participate in calling. Unfortunately, it was not possible to determine which calls belonged to which sex. The shortest call lasted 28 seconds and the longest 12 minutes and 19 seconds. Average duration was 3 minutes and 27 seconds, which is very similar to the 3 minutes and 28 seconds reported for *A. seniculus* (Drubbel & Gautier, 1993).

The acoustic measurements may have been affected by the low frequency range (0.2 to 6 kHz) offered by the recorder used in the present study. Thus, as frequency range above 10 kHz is poorly sampled, the spectrogram must be interpreted with caution. An average maximum frequency of  $6917.9 \pm 332.1$  Hz was registered for the adult titis while for the younger animal, the average maximum frequency was  $2073.6 \pm 684.6$  Hz. Maximum dominant frequency of the adult titi was at  $750.7 \pm 25.96$  Hz and for the younger at  $458.7 \pm 44.2$  Hz. These values correspond to the range of 300 and 1000 Hz of howlers roars recorded by Whitehead (1995), and, as pointed out by the author, fits a window in the ambient noise spectrum, thus improving sound propagation in arboreal environments.

The recorded call lasted 4 minutes, and was composed of two sequences with an interval of 17 seconds of silence between them. Robinson (1979) described seven sound categories based on acoustic characteristics, but the limitations of the present study make categorization difficult. Spectrographic analysis showed two structurally distinct phases. The initial phase (Fig. 1A), produced only by the older individual, was characterized by short syllables which may correspond to the moaning phase cited by Robinson (1979). The second phase (Fig. 1B) corresponds to a "duetting sequence" in which both individuals participated,

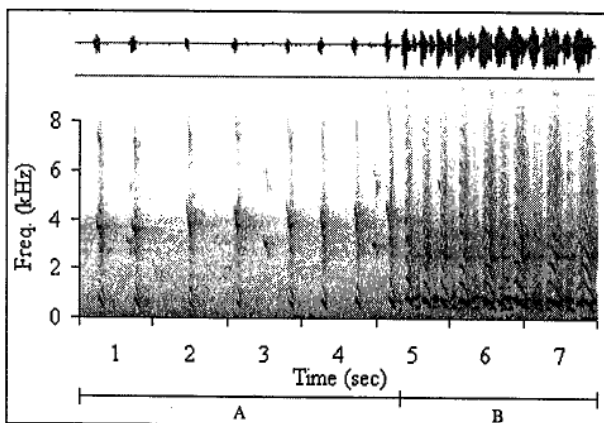


Figure 1. Spectrographic analysis of a long-distance call of *Callicebus personatus* A) initial phase B) "duet" phase.

but the sequences produced by each one are totally different, not corresponding to a normal duet. The sequence produced by the older seems to alternate between pants and bellows, such as was registered for *C. moloch* by Robinson (1979).

In the recorded call, the rhythm of syllables emitted by the older titi varied between phases. During the initial phase, intersyllable intervals were, on average,  $345.6 \pm 57.8$  msec ( $N = 15$  intervals). Close to or during the "duet" sequence, the rhythm was accelerated ( $141.2 \pm 52.1$  msec;  $N = 5$ ). Absence of similar data in the literature precludes comparisons with a conventional duet. On the other hand, discernible structural differences between the syllables produced by the older and the younger individuals, besides the major degree of definition presented by the older one, is indicative that participation in "duets" with one or both parents may be a way of learning vocal signs. Time intervals between syllables may function as a clue to coordinate vocalization.

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#### References

- Baldwin, J. D. and Baldwin, J. I. 1975. The vocal repertoire of howler monkeys (*Alouatta palliata*) in south-western Panama. Library of Natural History Sounds, Laboratory of Ornithology, Cornell University, Ithaca, NY.
- Boinski, S. and Newman, J. D. 1988. Preliminary observations on squirrel monkey (*Saimiri oerstedii*) vocalizations in Costa Rica. *Am. J. Primatol.* 14: 329-343.
- Bonvicino, C. R. 1989. Ecologia e comportamento de *Alouatta belzebul* (Primates: Cebidae) na mata Atlântica. *Rev. Nordestina Biol.* 6(2): 81-108.
- Chivers, D. J. 1969. On the daily behaviour and spacing in howling monkeys groups. *Folia Primatol.* 10: 48-102.
- Drubbel, R. V. and Gautier, J.-P. 1993. On the occurrence of nocturnal and diurnal loud calls, differing in structure and duration, in red howlers (*Alouatta seniculus*) of French Guyana. *Folia Primatol.* 60: 195-209.
- Kinzey, W. G. 1988. The Titi Monkey, Genus *Callicebus*. In: *Ecology and Behavior of Neotropical Primates*, vol. 1, A. F. Coimbra-Filho and R. A. Mittermeier (eds.), pp. 241-276. Academia Brasileira de Ciências, Rio de Janeiro.
- Moynihan, M. 1966. Communication in the titi monkey *Callicebus*. *J. Zool., Lond.* 150: 77-127.
- Newman, J. D. 1985. Squirrel monkey communication.

- In *Handbook of Squirrel Monkey Research*, L. Rosenblum (ed.), pp. 99-126. Plenum Press, New York.
- Robinson, J. G. 1979. An analysis of the organization of vocal communication in the titi monkey *Callicebus moloch*. *Zeit. Tierpsych.* 49(4): 381-403.
- Sekulic, R. 1982. Daily and seasonal patterns of roaring and spacing in four red howler *Alouatta seniculus* troops. *Folia Primatol.* 39:22-48.
- Whitehead, J. M. 1995. Vox Alouattinae: a preliminary survey of the acoustic characteristics of long-distance calls of howling monkeys. *Int. J. Primatol.* 16: 121-144.

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### UNUSUAL SEXUAL POSTURE IN A HOWLER MONKEY COUPLE, *ALOUATTA FUSCA CLAMITANS*

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The sexual behavior of primates varies considerably from species to species. In some, copulation is performed rapidly, preceded by little or no courtship, and completed in just a few seconds, in others copulation is more elaborate, lasting for several hours, with courtship continuing over several days. Copulation usually takes place in a dorsal-ventral position, the male mounting the female from the rear (Chalmers, 1979). Mendes (1985) observed eight copulations of *Alouatta fusca clamitans*, all of them in a dorsal-ventral position. Other species of *Alouatta* have also been observed with the same postural copulatory pattern, for example, *A. palliata* - Bernstein (1964), Carpenter (1965); *A. belzebul* - Bonvicino (1989); *A. caraya* - Calegario-Marques (1992); and *A. seniculus* - Neville (1972). Here, we describe an unusual mount posture of the howler monkey *A. fusca clamitans*.

The observations were made while conducting a field study on the feeding ecology of neotropical squirrels (*Sciurus ingrami*) at the Cantareira State Park (23°22'S and 46°26'W), north of São Paulo, Brazil. On February 26th, 1998, at 09:32 h, we observed a couple of howler monkeys approximately 15 m above us. The female was dark brown and adult in size. The male was red-brown and bigger than the female. When we arrived, both individuals were seated side-by-side. After a few minutes, the female leaned back on the branch, with slightly flexed legs wide opened sideways. The male approached and, facing the female, took an almost seated position between her legs. The male then stood quadrupedally over her with his legs slightly flexed, and began a pelvic thrusting lasting 10 seconds. Meanwhile, the female remained still with her head sideways observing us. Intromission and ejaculation could not be reliably seen; difficult to ascertain in howler monkeys in general (Carpenter, 1965). The ejaculation in some copulations is determined by an interval between the thrusting pelvic movements of the male (Hanby and Brown, 1974).

After the ventro-ventral position mount and pelvic thrusting, the couple remained together embracing each other