A Broad-Band Contact Call by Female Mantled Howler Monkeys: Implications for Heterogeneous Conditions

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In 1975, Wilson considered howler monkeys (*Alouatta*) worthy of attention by sociobiologists because their communication is "primarily vocal", implying that non-damaging signals and displays dominated their communication system. Indeed, most students of the genus have been impressed with the vocal reportoire of howlers (e.g., Baldwin and Baldwin, 1976; Whitehead, 1995; Sekulic, 1982), and vocalizations appear to facilitate highly communal behavior and the resolution of interindividual conflicts of interest (e.g., Jones, 1982). As their name suggests, howlers are usually characterized by the sonorous roars of the adult male (e.g., Whitehead, 1995). Except for these long-distance vocalizations, the functions of howler calls are not well known (Whitehead, 1995). The spectrographic characteristics of howler vocalizations have been described by Baldwin (1976), Whitehead (1995), and others, however, providing a baseline for the following observations. This note describes a broad-band contact call (see Bradbury and Vehrencamp, 1998) emitted by female mantled howler monkeys (*A. palliata* Gray) in apparently related contexts.

In his discussion of primate vocal communication, Seyfarth (1987) concluded that "there is a direct relation between the function of a call and its acoustic properties" (p. 445). Low-frequency sounds traveling through tropical forests are less attenuated than high-frequency sounds, for instance, and Waser and Waser (1977) have shown that sounds in the range of 500 and 1,500 Hz exhibit relatively low attenuation as a function of distance. Figure 1 is a sonogram of the vocalization described in this note, the characteristics of wich are consistent with expectation for a call specialized for long-distance transmission, such as contact calls employed by forest primates (see Seyfarth, 1987, pp.445-446). This broad-band call may be equivalent to the "Wrah-ha, Type K" call described by Baldwin and Baldwin (1976, pp.100-101; J. Whitehead, pers. comm.). These authors identified this call as a contact vocalization given by adult females "when they became separated from their troops". Baldwin and Baldwin determined that the call was audible for about 100 m through the forest, and they had the impression that females emitting this vocalization were unaware of the location of their group.

My observations differ somewhat from those of Baldwin and Baldwin. My subjective impression of the call was

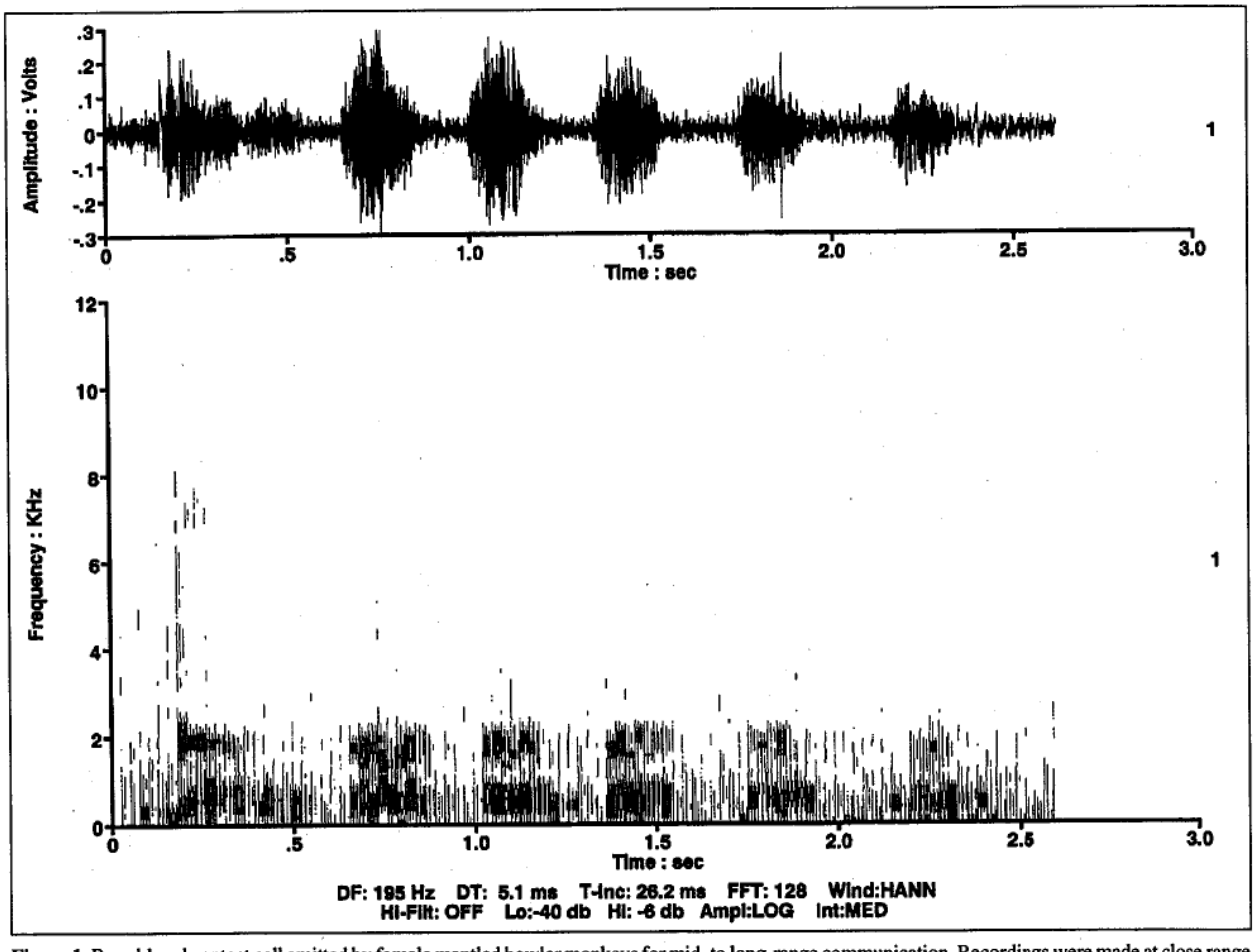

Figure 1. Broad-band contact call emitted by female mantled howler monkeys for mid- to long-range communication. Recordings were made at close range with a portable Panasonic tape recorder and hand-held microphone. Spectrogram digitized at a rate of 22.6 Khz (Gateway 486/33 computer, DT2821 A/D board) using SIGNAL sound analysis software (Engineering Design, Belmont, MA, USA).

that it was a raspy bark audible for >100m. I agree with Baldwin and Baldwin that "there was a moderate amount of variance in the call, in both intonation and intensity. The first syllable was almost always the louder, and the second appeared to be an inhaled tone." (p.100). I heard this call 61 times in >1,000 h of focal and *ad libitum* observation, and censusing of animals and trees at Hacienda La Pacifica, Cañas, Guanacaste, Costa Rica in 1976 and 1977. The forest there is classified as "tropical dry", and two groups were studied in two different habitats, riparian (Group 5, 402 h) and deciduous (the patchier, drier, and presumably more stressful area, Group 12, 114 h). Frankie *et al.* (1974) provided a detailed description of the environment, and Jones (1980) a description of the groups.

The broad-band call shown in Fig. 1 was emitted non-randomly by context. It was given 19 times during group movement, 22 times in sexual contexts, six times in the midst of a female group (including one juvenile vocalizer), five times during foraging and feeding (see note at end of text), and on nine occasions the context was not recorded. Thus, I witnessed the call most often when the group was moving from one location to another (i.e., from one feeding site to another), and in association with reproductive activity. Middle-aged or old females were the most frequent callers, accounting for 28 of the 34 occasions when the vocalizer was identified individually (see Jones, 1996). The call was given at about the same rate in both habitats, 49 times in the riparian forest group (0.12/h), and 0.11/h in the deciduous forest group. In some instances, the call appeared to be responsible for changes in the direction of group movement, and it is interesting to note that on three occasions in the deciduous forest group, two or more females emitted this call in synchrony.

It is my impression that the contact call is intimately associated with food, both during group movements, in sexual contexts, and when females forage independently or in small parties. It is also possible that females employ this call in sexual contexts to "incite" male-male competition during a process of "female choice". Sex, food, and group dispersion are closely linked in mantled howlers because females seem to prefer males who will defend a food source for them (Jones, 1995a), and it is likely that selection has acted upon the vocal repertoire of the species to produce a call with complex utility. Boinski and Mitchell (1977), for example, have demonstrated that "chuck vocalizations" in *Saimiri sciureus* identify the caller and transmit information about food. Vocal signals may supplement visual and chemical signals in the identification of howler individuals in addition to communicating location (and quality?) of food.

What effect will increased deforestation have on the expression of this contact call? In my study, the contact call was emitted at about the same rate in both habitats. This observation is consistent with howlers' resilience under changing conditions (e.g., Jones, 1995b) and suggests that the call has been favored in a variety of physical conditions. Other calls, however, may be less effective with increasing habitat fragmentation. This possibility raises the issue of the role of behavioral, including vocal, adaptations in the conservation of primate species. Species whose repertoires of response are most highly adapted to wet forest conditions may experience fitness deficits in heterogeneous regimes due to an inability to respond genetically, physiologically, and behaviorally in a manner or at a rate necessary to sustain effective population size (N_e). Such species will go extinct or require continued management and husbandry.

Note. On four occasions in the riparian forest I witnessed a delicate, owl-like ("whoooo-whoooo") call, twice emitted by the old female SS (see Jones, 1996) sitting in a small tree. These and other opportunistic sightings of lone females separated from their groups reinforce my impression that females may forage alone for patchy resources. I once observed the group recruited by this call to *Muntingia calabura*, and K. E. Glander and I have discussed the possibility that the use of these small trees may serve as assays for hard times for howlers in riparian forest at La Pacifica (see Fleming *et al.*, 1985).

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Observations on Reproduction and Behavior of the Muriqui, *Brachyteles arachnoides*, in Captivity

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Introduction

Until the 1980's, information on the muriqui, or woolly spider monkey, was restricted to the geographic survey of Aguirre (1971) and observations and reports by Coimbra-Filho (1972). However, discovery of a population at what is now the Caratinga Biological Station by Célio Valle and Ney Carnevalli, then of the Federal University of Minas Gerais, in 1977, resulted in the pioneer work of Nishimura (1979, 1988) and inspired an extraordinary interest in the species. The ecology and behavior of *Brachyteles* has since been the subject of numerous studies of demography, behavior, ecology, and reproduction and reproductive physiology (see, for example, Milton, 1984; Fonseca, 1985, 1986; Strier, 1986, 1991, 1992, 1996, 1997, Nishimura *et al.*, 1988). Strier (1996) discussed specifically the reproductive ecology of muriquis at the Caratinga Biological Station, including seasonal birth peaks and interbirth intervals, and Strier and Ziegler (1997) provided information on ovulatory cycles, the discrete copulation periods observed for females, and gestation lengths from data obtained through fecal steroid analyses, which were validated with urine from females at the CPRJ (Ziegler *et al.*, 1997). Odália-Rímoli and Otta (1997) reported on a study of the development of infant muriquis at the Caratinga Biological Station. All observations to date have been for muriquis in the wild. Only recently have muriquis been bred in captivity (Coimbra-Filho *et al.* 1993; Pissinatti *et al.*, 1994), and here we provide some observations on births and reproductive behavior in *ex situ* conditions: a colony established at the Rio de Janeiro Primate Center (CPRJ-FEEMA). We emphasize that the observations are preliminary, and the conclusions arising should be subject to corroboration, most especially on wild populations.

The Captive Group at CPRJ

The muriquis are maintained in a large cage, especially designed for them, and described in detail in Coimbra-Filho *et al.* (1993). The original group was composed of two adults and a young female from the state of Minas Gerais. Two immature males from São Paulo were introduced shortly afterwards. With the recognition of two distinct forms (Vieira, 1944; Torres de Assumpção, 1983; Coimbra-Filho 1990, 1992a, 1992b; Lemos de Sá *et al.*, 1993; Coimbra-Filho *et al.* 1993), the group was then composed of two male *B. a. arachnoides* (from São Paulo), and three female *B. a. hypoxanthus* (from Minas Gerais). The offspring born into this group are therefore hybrids. For the exact origin of each of these animals see Coimbra-Filho *et al.* (1993), who also described the formation of the group and the births resulting (see also Pissinatti *et al.*, 1994).

The females (CPRJ-850, 891, and 924) were introduced to the cage on 15 May 1989. In the same month, a juvenile male (CPRJ-1012) was obtained, which had been caught in the Serra da Bocaina, in the region of the state boundary between Rio de Janeiro and São Paulo. It was

Table 1: Copulations and births. Male CPRJ-1091 and female CPRJ-924.

Copulations	Births CPRJ-924
09 January 1991	
	10 September 1991 - CPRJ-1245
30 September 1991	
12 November 1991	
	03 June 1992 - CPRJ-1335
20 September 1992	
02 November 1992	
27 April 1993	
16 July 1993*	
	12 October 1993 - CPRJ-1430
	24 June 1994 - CPRJ-1488

* On this day the male CPRJ-1012 also copulated with the female CPRJ-924.

Table 2: Copulations and births. Male CPRJ-1091 and female CPRJ-891.

Copulations	Births CPRJ-891
22 October 1990	
02 May 1991	
30 September 1991	
	30 October 1991 - CPRJ-1286
12 November 1991	
30 December 1991	
08 October 1992	
15 October 1992	
02 November 1992	
10 November 1992	
16 July 1993	
	25 April 1994 - CPRJ-1475

Obs: On 10 August 1989, the female CPRJ-891 attempted mounting the female CPRJ-924. There were no males in the colony at the this time.