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## SOCIAL STRUCTURE OF *ALOUATTA GUARIBA CLAMITANS*: A GROUP WITH A DOMINANT FEMALE

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### Introduction

The social group of the brown howler monkey, *Alouatta guariba clamitans* Cabrera, 1940 is typically small (2–12 individuals), with one or two adult males, and more females than males (Silva Jr., 1981; Neville *et al.*, 1988; Mendes, 1989; Steinmetz, 2000, 2001; Treves, 2001; Miranda and Passos, 2005). In primates where males outnumber females, males compete for both females and food, which normally results in groups with dominant males (Clutton-Brock and Harvey, 1977; Dunbar, 1988; Mittermeier *et al.*, 1999). As in all howler monkeys, *A. g. clamitans* is sexually dimorphic; adult males are larger than females and are dominant to them (von Ihering, 1914; Altmann, 1959; Neville *et al.*, 1988; Bonvicino, 1989; Mendes, 1989; Chiarello, 1995; Mittermeier *et al.*, 1999; Treves, 2001). Although howler monkeys are the most studied of the Neotropical primates, most of the research has been concentrated on a few species, in particular *A. palliata* and *A. seniculus*, and only more recently *A. caraya*, *A. pigra* and *A. guariba* (Neville *et al.*, 1988; Bicca-Marques, 2003). Field studies on the composition, social structure and hierarchy of *A. g. clamitans* are rare (Miranda, 2004; Jardim, 2005; Miranda and Passos, 2005), and long-term investigation will be necessary to obtain more detailed information on their social patterns. Here we describe a particular case of an *A. g. clamitans* group in which the dominant animal was an adult female—in effect, a matriarchal group.

### Methods

#### Study area

The study area is a forest fragment of approximately 700 ha in the Chácara Payquerê, a component of the Área de Proteção Ambiental da Escarpa Devoniana, in the municipality of Balsa Nova, Paraná, Brazil (25°29'52"S, 49°39'24"W). This remnant forest is within the Floresta Ombrófila Mista (*Araucaria* Pine Forest biome) and consists mainly of disturbed primary forest, broken by patches of secondary forest.

#### Methods

Observations of the behavior and ecology of brown howler monkeys in the study area have been continuous since February 2002 (Miranda, 2004; Miranda and Passos, 2004, 2005; Miranda *et al.*, 2005; Miranda *et al.*, in press). The study group, the Forninho Group, was the best known in the area while its members remained together. Our observations here were recorded *ad libitum* (Altmann, 1974). We used the system of age-sex classification proposed by Mendes (1989) and used by Miranda and Passos (2005).

## Results

In February 2002, the Forninho Group included two adult males (AM), three adult females (AF), and a juvenile I (JI). After four births through two years of study (two births in 2003 and two in 2004), the group consisted of two AM, a sub-adult male (SAM), three AF, two juveniles II (JII), one male and one female, and two JI (both males). In January 2004 the dominant adult male (AM1) disappeared, which apparently disrupted the social structure of the group. This resulted in the Forninho Group splitting into two: the Carrano Group with one AM, one AF and one JII (female), and the Vavá Group with one SAM, two AF (AF1 and AF2), one JII (male), two JI (males) and one infant (INF) born one month after the disappearance and presumed death of AM1 (Table 1). Another birth occurred in July of 2004, this time to an AF2 in the Vavá Group. Miranda and Passos (2005) give the details of the dynamics of this group.

AF1 of the Vavá Group was the mother of the SAM, as well as the JII, one of the JI and the older INF. AF1 may also have been the mother of AF2, but we could not confirm this because AF2 was already an adult at the beginning of our study. If AF1 was indeed the mother of AF2, then every member of the Vavá Group would have been the progeny of this single adult female.

In confrontations with neighboring groups, AF1 vocalized the most (bark and howl *sensu* Oliveira, 2002) and challenged the dominant AM of Carrano Group, forcing him away from the confrontation. This female behaved in the same way toward humans when one of the investigators accidentally startled the animals, alarming the group and provoking AF1 to come their defense. On two occasions, AF1 challenged the subadult male over food. The male retreated both times.

## Discussion

The breakup of the original Forninho Group may have been prompted by AM2, who was possibly the son of AF1, and, as such, leaving the group to avoid endogamy. Following

**Table 1.** Composition of the Forninho social group and of the resulting (Vavá and Carrano) groups which were formed after it split up, coincident with the disappearance of the adult male AM1.

Before splitting	January 2004	After splitting
<b>Forninho Group</b>	Disappearance of AM1	<b>Vavá Group</b>
2 AM		2 AF
3 AF		1 SAM
1 SAM		1 JII
2 JII		2 JI
2 JI		1 INF (born Feb 2004)
Total = 10		Total = 7
		<b>Carrano Group</b>
		1 AM
		1 AF
		1 JII
		Total = 3

his departure, AM2 became the nucleus of the new Carrano Group. However, given the occurrence of infanticide in howler monkeys (Clarke, 1983; Zunino *et al.*, 1986; Rumiz, 1990; Clarke *et al.*, 1994; Galetti *et al.*, 1994; Calegario-Marques and Bicca-Marques, 1996; Palacios, 2000; Aguiar *et al.*, in press), it is also possible that AF1 may have forced AM2 out of the group, since AF1 was pregnant by AM1, who had been the dominant male until his disappearance. AF1, therefore, may have been trying to protect her infant from possible infanticide by AM2. Mendes (1989) observed a similar case in which an AM drove out the dominant male of his study group. Although successful in his ouster of the dominant male, the AM in Mendes' study group was forced out by the two adult females of the group, primarily by the adult female who was pregnant. This behavior on the part of the female ended only when her infant disappeared, and she finally accepted the presence of the new male. Mendes (1989) interpreted these events as an attempt by the pregnant female to avoid infanticide.

The AF1 was followed by her offspring with AM1 who had disappeared—INF, JI, JII and SAM, and possibly AF2—which gave rise to a group dominated by a female rather than a male. AF1 remained dominant despite the presence of the subadult male; she was the one who defended the group against neighboring howlers and the researchers who accidentally startled her group. Hirano (2003), studying *A. guariba*, and Calegario-Marques and Bicca-Marques (1997), studying *A. caraya*, have reported that adult females are dominant to subadult males.

In howler monkeys, individuals of both sexes emigrate, forming new groups or simply integrating with another group (Neville *et al.*, 1988; Mendes, 1989; Bonvicino, 1989; Calegario-Marques and Bicca-Marques, 1996; Giudice, 1997; Brockett *et al.*, 2000; Ostro *et al.*, 2001; Jardim, 2005). Bonvicino (1989) and Mendes (1989) recorded only subadult males as solitary individuals. We saw solitary adults of both sexes in our study area, showing that females emigrate as well as males (Miranda, 2004; Miranda and Passos, 2005). The subadult male of the Vavá Group could have remained in the group to become the dominant adult, or else moved out to avoid endogamy. Groups without adult males may be more susceptible to predation, as well as to infanticide by strange adult males or to an upset in group hierarchy (Zunino *et al.*, 1986; Dunbar, 1988; Clarke *et al.*, 1994; Galetti *et al.*, 1994; Palacios, 2000). We would expect that sooner or later an adult male, either the resident subadult or an immigrant, would take over as the dominant individual in the group.

Groups of *A. g. clamitans* are usually dominated by males, but they may be adaptable enough to change this pattern in certain cases. We believe that this is evident in the case of our original focal group, the Forninho Group, in which an adult female left in order to avoid imminent infanticide, establishing, at least temporarily, a female-dominated group.

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#### SUBSTRATE MANIPULATION BY *ALOUATTA GUARIBA CLAMITANS* IN SOLVING A LOCOMOTOR PROBLEM

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Primates are distinguished from other groups of animals by having large brains, enhanced manipulative abilities, and more complex cognitive skills (Garber, 2004). These traits allow nonhuman primates to perform complex behaviors such as tool use, a behavior previously considered to be limited to humans (Panger, 1998). Most instances of manipulating objects as tools have been recorded in apes (Beck, 1975; Goodall, 1964). There are some records for Old World monkeys, including baboons (*Papio*) and macaques (*Macaca*) (Van Lawick-Goodall *et al.*, 1973; Tomasello and Call, 1997; Westergaard, 1992); in New World monkeys, tool use has been observed in capuchin monkeys (*Cebus*) (Beck, 1972, 1975; Chevalier-Skolnikoff, 1989; Fragaszy *et al.*, 2004; Ottoni and Mannu, 2001; Phillips, 1998; Struhaker, 1977; Vaclair and Anderson, 1994; Visalberghi, 1990; Westergaard, 1988).

Beck (1975) defined tool use as “the manipulation of an unattached environmental object, the tool (not part of the user's body), to alter more efficiently the form or position of a separate object, when the user holds or carries the tool *in toto* during or just prior to use and is responsible for the critical connection between tool and incentive” (p.414). Urbani and Garber (2002), however, warned that several

reports of tool use cited in the scientific literature are better classified as “proto tool-use or object manipulation.” True tool use involves the detachment and manipulation of both the object of change and the agent of change (the tool), whereas in proto tool-use, only the object of change is detached and manipulated (Panger, 1998; Parker and Gibson, 1977).

Here we report a case of substrate manipulation by a brown howler monkey (*Alouatta guariba clamitans* Cabrera, 1940). It was recorded by F. Koch during a study of the ecology and behavior of a group of brown howlers at the Morro da Extrema (30°12'S, 51°04'W), Porto Alegre, Rio Grande do Sul, Brazil. On 16 October 2002, around 15:00 h, the sky became overcast and the wind picked up, signaling an approaching rainstorm. The study group began moving away. At 15:20 h, the group came to a gap in the canopy of about 2 m. All successfully leaped across the gap to the next tree except an infant (in the process of becoming independent from its mother). The branches were blowing about vigorously because of the high winds, and the infant stopped and vocalized (cried) while holding onto the end of the branch. The group members did not return to help the infant, which made no attempt to jump but continued vocalizing loudly, until eventually its mother went back to rescue it. In order to help her infant, the mother manipulated a nearby branch (without detaching it) of the tree she was in until it was positioned close to the infant. The infant immediately used this branch as a bridge to traverse the gap. Once safely across, it quickly climbed onto its mother's back. Given the configuration of the arboreal canopy, the only way for group members to cross the gap was by leaping from one tree to the other. A similar situation involving the same mother-infant pair was observed on a second occasion when there was a strong wind but a clear sky.

This note reports the observation of a complex behavior performed by a howler monkey to solve a problem commonly faced by arboreal primates. This is the first record of the manipulation of an object to help an infant howler monkey travel across a gap in the canopy. Previous reports indicate that adult howler monkeys may use their bodies to form a “bridge” in order to help immatures cross such gaps. According to the definition proposed by Beck (1975), this behavior cannot be considered as true tool use because the animal (mother) did not detach the branch used as a bridge from the tree. This use of the substrate as an object, however, can be classified as proto-tool-use or object substrate manipulation (*sensu* Parker and Gibson, 1977).

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