

Scent-Marking of Giant Otter in the Southern Pantanal, Brazil

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Abstract

Giant otters live in social groups, consisting of a mating pair and one or two litters. Groups are territorial and mark their territories often with scent-marks. Our objectives were to evaluate the frequencies of marking and over-marking according to the social status of the individuals and to define the different postures used during the marking. We observed four groups, totaling 25 individuals (five alpha males, four alpha females, seven adult females, one adult male and eight juveniles) with group size ranging between four and 13 individuals. The study was conducted between July 2006 and July 2007 in the Vermelho River and in a stretch of the Miranda River, in the Southern Pantanal. We observed the groups for a total of 2006 min and recorded 95 events of marking totaling 84.9 min. Time spent marking varied between groups and ranged from 4.3 to 44.7 min. The alpha males marked more frequently (62% of marking events, 55 min) than the alpha females (17% of marking events, 13.6 min). Of the 59 events of scent-marking by the alpha males, 32 over-marked the marks of other individuals from the group. Of the 16 events of scent-marking of the alpha females, five over-marked that of other females from the same group. When scent-marking, alpha males used the 'stepping' posture most frequently (63%), then 'fore-paw rubbing' (24%), 'latrine use' (7%), and 'body rubbing' (6%). Alpha females used the 'stepping' posture most frequently (65%), then 'latrine use' (19%) and 'fore-paw rubbing' (12%), with only one event of 'body rubbing' observed during marking. Subordinate females used the 'stepping' posture (76%) and 'latrine use' (24%) during marking. Scent-marking can play many roles in mammals and for giant otters, and the main roles appear to be communication of social and sexual status and territorial defense.

Introduction

Scent-marking is the behavior by which chemical secretions that provide information are deposited in the environment by an animal (Johnson 1973; Dunbar 1978; Hutchings & White 2000). The sources of these chemicals can include various glands as well as excrement. The variable composition of the secretions deposited during scent-marking can transmit different kinds of information even in the physical

absence of the animal, providing a sophisticated means of communication between individuals. Some Mustelids and other carnivores deposit the contents of their anal glands as well as urine and feces in latrines, which serve as scent-marks and play an important role in communication and social interactions of these species (Erlinge 1968, 1995; Duplaix 1980; Revilla & Palomares 2002; Rostain et al. 2004; Jordan et al. 2007). The main roles of scent-marking involve territory defense (Luque-Larena et al. 2001),

communication of sexual and/or social status (Herrera & Macdonald 1994; Gould & Overdorff 2002; Stewart et al. 2002; Rostain et al. 2004).

Some studies of social mammals report differences in marking frequency between individuals. In the majority of these species, dominant males mark more often than individuals from other sex and age categories (Herrera & Macdonald 1994; Gould & Overdorff 2002; Revilla & Palomares 2002; Stewart et al. 2002). Furthermore, in some species of mammals, dominant males use different postures for scent-marking than do females or other members of the social group (Gese & Ruff 1997; Sillero-Zubiri & Macdonald 1998). Some authors suggest that different marking postures communicate different messages, for example, that postures used by female canids convey information about food availability and fertility, while the postures of males relate to reproductive status and fighting ability (Wells & Bekoff 1981). According to Johnson (1973), the development and use of the scent glands by mammals are associated with sexual maturity and the production of gonadal hormones, so some of the differences in postures or frequency of marking between individuals may be related to sexual status and dominance hierarchy.

Over-marks can play different roles between species. This may reflect different tactics that males and females use to attract individuals of the opposite sex or to compete with individuals of the same sex (Ferkin 1999). Scent over-marking is common in some species of carnivores such as coyotes (Gese & Ruff 1997) and hyenas (Woodmansee et al. 1991), and is associated with the social and reproductive status of the individual (Ferkin 1999). Recent studies support the hypothesis that over-marks and adjacent marks are competitive tactics, as the individuals that over-mark gain advantages by masking the chemical information left by other individuals (Ferkin & Pierce 2007).

Giant otters (*Pteronura brasiliensis*) live in social groups, consisting of a mating pair and adult and juvenile offspring of one or two litters (Duplaix 1980). The groups maintain various sites within their territory, along the rivers or lake banks, where they clear the vegetation and leave tracks, scent-marks and sometimes create communal latrines (Duplaix 1980; Carter & Rosas 1997). The aim of this study was to determine if the frequency of scent-marking, the frequency of over-marking behavior, and the postures used during marking behavior are related to an individual's status within the social hierarchy of the group. We predicted that dominant

males would tend to mark more often than other individuals of the group, followed by the dominant females, and that the dominant pair would tend to over-mark the scent-marks of other individuals. We also predicted that dominant males would use more varied postures during the marking behavior than the other individuals of the group.

Methods

The study area was located in the Pantanal, a 160 000 km² wetland located approximately at the center of South America (Junk & Nunes da Cunha 2005). The weather is characterized by dry (April–September) and rainy (October–March) seasons (Cadavid 1984; Soriano 1997). Between October and March, 82.4% of the average annual precipitation of 1262 mm falls during the rainy season (Cadavid 1984). Highest mean precipitation occurs in January, with 216.7 mm, and the lowest, in July, with 11.6 mm (Soriano 1997). However, due to the flatness of the area, there is a delay between the start of the rains and the floods, so that the high-water season occurs from December to March and the low-water season, between April and November.

We conducted the study between July 2006 and July 2007, with 5-d trip per month, surveying the Vermelho River and a section of the Miranda River, for a total of 75.8 km (19°36'S, 56°44'W; Fig. 1). We used a 5-m aluminum boat, with a 15-hp outboard motor, to search for giant otter groups along the study area. Our surveys were during daytime hours, as the species is diurnal (Duplaix 1980; Carter & Rosas 1997). Every time we located an individual or a group, we recorded behavior with a Sony 8 DCR-TRV340 camcorder, resulting in a total of 2006 min of video-monitoring.

We identified individual otters by the characteristic markings on the throat and chest. When possible, we also identified sex of individuals and inferred their hierarchy status within the group, according to their behavior and other cues. We considered the alpha male as the adult which was typically prominent in the defense of the group, remaining often at the front of a defense line. The alpha female was considered the adult female that also was outstanding in the defense of the group, which was lactating during the reproductive season, and that manifested more attachment to the cubs.

We classified the different postures used during marking as: (1) 'stepping' (when the animal rubs its paws on the ground), (2) 'fore-paw rubbing' (when the animal rubs its fore paws vertically on the

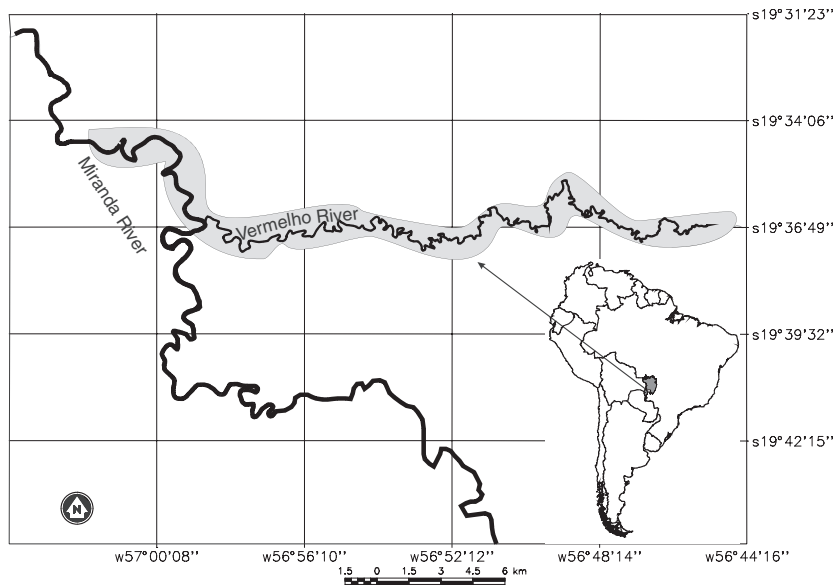


Fig. 1: Map of the study area showing the stretches of the Miranda River and Vermelho River (dashed) where groups of giant otters were surveyed from July 2006 to July 2007, on the Southern Pantanal of Brazil.

vegetation, tree trunks or shrubs), (3) 'body rubbing' (when the animal rubs its body on the ground or on other objects in the environment), and (4) 'latrine use' (feces and/or urine elimination). We measured the time spent during marking by each individual and the number of events of each posture used by the individual.

Results

We monitored the behaviors of four giant otter groups, with a total of 25 individuals (five alpha males, four alpha females, seven adult females, one adult male and eight juveniles) and a group size of 4–13 individuals. We observed the groups for a total of 2006 min and recorded marking behavior during 84.9 min. Time spent marking varied between groups and ranged from 4.3 to 44.7 min.

Scent-Marking

During the study period, we recorded 95 episodes of marking behavior. The alpha males scent-marked more often, followed by the alpha females and non-alpha females (Table 1). We observed a young male marking on only one circumstance (after an agonistic encounter).

Alpha males over-marked the markings of other individuals from the same group. Of 59 marking events of alpha males, 32 were deposited over the scent-marks of other individuals or after latrine use by other individuals of their group. Alpha males over-marked 16 scent-marks of non-alpha females,

Table 1: Time and frequency of marking behavior according to the social status and sex of giant otters in the Vermelho River, Pantanal of Brazil, from July/2006 to July/2007

| Hierarchy status | Number of individuals | Time (min) | Number of events | Frequency (%) |
|------------------|-----------------------|------------|------------------|---------------|
| Alpha male | 5 | 55 | 59 | 62 |
| Alpha female | 4 | 13.6 | 16 | 17 |
| Females | 7 | 16.2 | 19 | 20 |
| Males | 1 | 0.1 | 1 | 1 |
| Total | 17 | 84.9 | 95 | 100 |

15 scent-marks of alpha females, and the only scent-mark deposited by a young male. Of 16 marking events by alpha females, five over-marked previous scent-marks of other females of the same group. In contrast, of 19 marking events by non-alpha females, only two were over scent-marks deposited by alpha females. In both cases, the same subordinate female was responsible for these over-marks, and this specific female was seen lactating few months before. We could not determine if any of the six young then present belonged to this female.

In April 2007, we observed an agonistic encounter between two neighboring groups. Group 1, comprising one alpha male, one alpha female and two adult females, trespassed the boundary of the territory of group 3, with one alpha male, one alpha female, two adult females, one young male and six cubs, located 3.5 km upriver from the mouth of the Vermelho River. After a short confrontation, group 1 was expelled, and the resident group (3) scent-marked the place where the conflict had begun.

During this episode, all individuals of the group, with exception of the juveniles, spent 3.3 min scent-marking. The alpha male continued marking for an additional 3.6 min, and then the entire group swam upriver to the central area of their territory.

On one occasion, we observed a group scent-marking by rubbing their bodies on the sand and their fore paws on the vegetation. After the group swam upriver, we collected leaves of the plants that had been used in rubbing, to examine them, but we did not find any sign of secretions, even under ultra-violet light. A few hours later, when the group returned to the site, they seemed to realize our disturbance to their marking site. Two animals appeared to follow the smell of our tracks on the sand and produced a sound that resembled the 'hum-growl' vocalization described by Duplaix (1980), but differed in tone and by being in pulses, separated by 1–2 s (Fig. 2). Soon after, the entire group left the area.

Marking Postures

We observed the stepping posture 97 times, fore-paw rubbing 26 times, latrine use 18 times and there were seven instances of body rubbing (Table 2, Fig. 3). Alpha males used all of the marking postures, with stepping (63%) being most frequent, followed by fore-paw rubbing (24%), latrine use (7%) and body rubbing (6%). Alpha females used the stepping posture most often (65%), followed by

Table 2: Number of marking posture events according to the hierarchy

| Posture | Hierarchy status | | | | Total |
|---------|------------------|----|----|---|-------|
| | AM | AF | F | M | |
| ST | 60 | 17 | 19 | 1 | 97 |
| BR | 6 | 1 | 0 | 0 | 7 |
| FP | 23 | 3 | 0 | 0 | 26 |
| LU | 7 | 5 | 6 | 0 | 18 |

ST, stepping; BR, body rubbing; FP, fore-paw rubbing; LU, latrine use (feces and/or urine elimination); AM, alpha male (n = 5); AF, alpha female (n = 4); F, female (n = 7) e M, young male (n = 1), in Vermelho River, Pantanal, Brazil, from July/2006 to July/2007.

latrine use (19%) and fore-paw rubbing (12%), and with only one event of body rubbing observed during their marking behavior. Subordinate females used only the stepping posture (76%) and latrine use (24%) during the marking events.

Discussion

Alpha males marked more often than other individuals of the group. According to Gosling (1982), dominant individuals must defend and reinforce their status in order to maintain access to resources, and consequently mark more frequently. Studies with other social mammals also report a higher frequency of marking by the dominant individuals and suggest that the alpha animals mark their territory to inform their dominant (Herrera & Macdonald 1994; Rostain

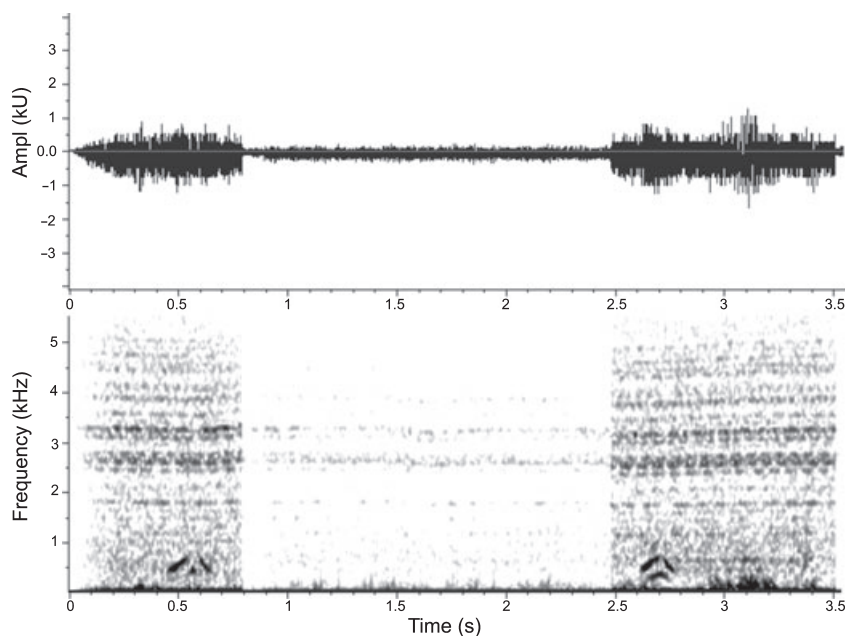


Fig. 2: Sonogram of a Giant otter sound. This sound was produced when the animals noticed disturbance (human tracks) in a newly marked locale, Vermelho River, Pantanal, Brazil, 2006.



Fig. 3: Postures used by Giant otters (*Pteronura brasiliensis*) during marking behavior [a – stepping; b – fore-paw rubbing; c – body rubbing at scent-marking sites; d – latrine use (feces and/or urine elimination in communal latrines)] in the Vermelho River, 2007.

et al. 2004), reproductive status (Gould & Overdorff 2002; Stewart et al. 2002), or to defend resources (Revilla & Palomares 2002).

Many animals have the capacity to distinguish between the top and the bottom scent-marks and, usually, respond selectively to the mark of the top-scent donor (Johnston et al. 1994). In our study, alpha males usually over-marked the scent-mark of other members of the group, possibly to prove their reproductive dominance over the other members of the group and to inform potential intruders of their presence and stability of the group. Alpha females in some episodes over-marked the scents of subordinate females of the same group. This behavior could be just a means to provide information about their reproductive status and their willingness to mate, as reported for other social mammals as *Microtus pennsylvanicus* (Ferkin 1999), or to be involved in more complex interactions. Reproductive suppression is likely to occur in giant otters, as only the dominant couple breeds (Duplaix 1980). We do not know whether the over-marking behavior could be related

with hormonal mechanisms to inhibit reproduction in subordinate females. However, it is interesting that the few cases in which a subordinate female over-marked scents of the dominant female occurred in a group where both were lactating. Two lactating females belonging to the same group were already observed among giant otters (Rosas & Mattos 2003) and were also reported to happen albeit in low frequency, in dwarf mongooses, for which reproductive suppression is well-known (Creel & Waser 1991).

In giant otters, adjacent groups as well solitary individuals can threaten the resident group with infanticide and cannibalism (Mourão & Carvalho 2001), loss of territory (Ribas & Mourão 2004; this study) or even the death of the dominant male (Schweizer 1992). Ribas & Mourão (2004) suggested that intra-specific aggressiveness and sociability can possibly be associated in Lutrinae. Following the agonistic encounter observed in this study, marking lasted longer than the other marking events that we observed, strongly suggesting that scent-marks are critical in the establishment and defense of giant

otter territories. In addition, scent-marks may also function in inter-specific communication, as giant otters responded to disturbance produced by humans in this study.

Different marking postures were used in scent-marking. The stepping posture was used more frequently by all individuals, while the other postures were used in different frequencies by males and females. According to Duplaix (1980), giant otters eliminate secretions from anal glands along with feces and urine, possibly eliminating a complex mixture of volatile and non-volatile components binding to proteins found in the urine, as it is known in other mammals (Hurst et al. 1998). Usually, giant otters use the fore paws to rub and scatter the latrine content on vertical substrates, but sometimes we observed individuals rubbing their fore paws on substrate soon after they came out the water, without apparent eliminations, suggesting that this posture maybe just a means to produce a visual signal and not a chemical advertisement of individual dominance/sexual status. Interdigital glands for this species have only been mentioned by one author (Kruuk 2006) and it is odd that they have not been mentioned by others authors (e.g., Duplaix 1980; Carter & Rosas 1997). It is likely that fore-paw rubbing provides a visual signal through the trampling of the vegetation rather than a scent signal.

According to Munn & Munn (1988) giant otters in the Peruvian Amazon live in groups to avoid predation by larger predators, especially black caimans (*Melanosuchus niger*). In the Pantanal, a single giant otter can easily defend itself against adult yacare caiman (*Caiman yacare*), which are much smaller than black caimans. In the Pantanal, the main threat to a group of giant otters appears to be adjacent groups and/or solitary conspecifics, as a number of studies have reported intraspecific aggression (Schweizer 1992; Mourão & Carvalho 2001; Ribas & Mourão 2004; this study), sometimes resulting in the death of adults or cubs. Therefore scent-marking, as well as the still poorly documented vocal communication, can play an important role in reducing conflicts.

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