

**Zu/Preem:** primate diet, manufactured by Premium Nutritional Products, Inc., Topeka, KS 66606, USA.

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## Parental behaviour in Maned wolf

*Chrysocyon brachyurus*

### at Belo Horizonte Zoo

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There is limited information on the reproductive behaviour of the Maned wolf *Chrysocyon brachyurus*. Although it is a monogamous species, little is known about the ♂'s role in the rearing of pups. In 1994 a comparative study of the behaviour of two ♀♀ with new-born pups was carried out at Belo Horizonte Zoo to try to establish the ♂'s role in rearing: one ♀ was housed alone with her pups throughout the observation period; the other ♀ was housed with the ♂ and pups for the first month and alone with the pups for the second month of observation. The applied methodology for behaviour evaluation was instantaneous sampling (scan). The behaviour of each adult was recorded at one-minute intervals. Location in the enclosure and spatial proximity were also recorded. The results suggest that Maned wolves are inactive for large parts of the day and that they prefer secluded areas within an enclosure. The results also suggest that only the ♀ is directly involved in rearing the offspring and that ♂ participation is

limited to protection only. The time that the ♀ stays with the pups is at a maximum on the days immediately following birth, but this time decreases considerably as the pups grow. At around day 50, when lactation has ceased, contact between the ♀ and pups is minimal and the pups have their own resting places within the enclosure. These resting places, inside the burrows or thick vegetation, are rarely shared with others.

*Key-words:* behaviour, maned wolf, parental behaviour, reproduction, reproductive behaviour, scent marking, territory

The Maned wolf *Chrysocyon brachyurus* is the largest endemic, nocturnal and crepuscular canid in South America. Although common in some regions, it is classified as Vulnerable throughout its

GROUP	1	2
♀ (stdbk ID)	Luana (1207 Belo 33)	Xuxa (1454 Belo 51)
♂ (stdbk ID)	Capixaba (524 Belo 57)	Carandai (1299 Belo 47)
Birth of pups	13 Jun 1994	5 Jul 1994
Number born	2.1	2.2
Enclosure	off-exhibit	exhibit
Date sire separated	13 Jun 1994	2 Aug 1994
Date pups separated	28 Aug 1994	9 Sep 1994

**Table 1.** Details of Maned wolves *Chrysocyon brachyurus* in the study of parental behaviour at Belo Horizonte Zoo (Matern, 1995).

range because of the indiscriminate loss of natural habitat and persecution by farmers (Carvalho, 1976; Thornback & Jenkins, 1982; Nowak & Paradiso, 1983; Bernardes *et al.*, 1990; Groombridge, 1993; Fonseca *et al.*, 1994). As at December 1994 208.201 Maned wolves were reported to the international stud-book (Matern, 1995).

Until the mid-1970s maintenance of Maned wolves in captivity was problematic and animals often died prematurely because of inadequate diet, disease and stress (Dennler de la Tour, 1968; Meritt, 1973; Brady & Ditton, 1979). More recently zoos have maintained and bred this species with improved success, although the survival rate of pups remains low at a little more than 50% per year (Velloso, 1991). In Brazilian zoos, between 1962 and 1990, 75 Maned wolves were born of which only nine reached adulthood (Velloso, 1991). Until the 1990s injury inflicted by the adults was the main cause of infant mortality (Velloso, 1991), although more recently hand-rearing has improved survival rates (Rosenthal & Dunn, 1995). This is not a totally satisfactory solution, however, because wild canids are susceptible to diseases usually found in domestic dogs, such as canine distemper, parvovirus and coronavirus, when they are taken for hand-rearing before they have received passive immunity from the dam's colostrum (Velloso, 1991). A vaccination protocol has not yet been established for these diseases at Belo Horizonte Zoo.

High infant mortality may reflect a lack of knowledge about the reproductive behaviour of Maned wolves (Acosta, 1972; Carvalho, 1976; Brady & Ditton, 1979; Dietz, 1984; Velloso, 1991). The ♂'s role in rearing pups is almost unknown and although this is a monogamous species there is no certainty about the ♂'s importance in rearing the litters (Carvalho, 1976; Brady & Ditton, 1979; Biben, 1983; Dietz, 1984). In most collections the ♂ is separated from the ♀ either before or immediately after the birth to avoid injury to the pups (Brady & Ditton, 1979; Biben, 1983; Velloso, 1991). The aim of this report is to examine the ♂'s role in rearing by comparing the behaviour of two ♀♀ with new-born pups, one housed alone with the pups and one housed with the ♂ and pups. The study was carried out at Belo Horizonte Zoo and the observation period was from 6 July to 6 September 1994.

#### SUBJECTS

Two ♀♀ with new-born pups were observed (Table 1). On 13 June 1994 'Luana' gave birth to 2.1 pups. The sire 'Capixaba' was separated immediately after the birth and the pups remained with the ♀ until they were 2.5 months old. On 5 July 1994 'Xuxa' gave birth to 2.2 pups. The sire 'Carandai' remained in the family group for the first month, after which he was removed and Xuxa was observed alone with the pups until they were 2 months and 4 days old.

ENCLOSURES

Luana and her litter were housed in an enclosure (c. 1100 m<sup>2</sup>) with restricted public access and with natural vegetation and thick grass tufts at the corners. A wooden shelter and large termite mounds provided shelter but there was no holding area. A dividing screen between the adjoining enclosure, where the ♂ was housed, did not restrict visibility between the two adults (Fig. 1). Xuxa and Carandaí were housed in an enclosure (c. 338 m<sup>2</sup>) with thin vegetation, no thickets and a few trees. This enclosure had a 4 m<sup>2</sup> holding area and two round concrete shelters, one with two entrances and one with a single entrance. While the ♀ was rearing the pups the exhibition corridor was screened so that visitors did not disturb the group (Fig. 2).

HUSBANDRY

The enclosures were cleaned each morning and the animals were fed in the afternoon. Three times a week meat (chicken and beef) was fed. On other days the Maned wolves received a mixture of rations for wild dogs (Special Crock), a variety of fruits and minced meat.

SAMPLING AND NOTE TAKING

Each ♀ was observed for 3 hours daily. Luana was observed for a total of 66 hours (22 observations) and Xuxa observed with Carandaí for 42 hours (14 observations) and alone with the pups for more than 42 hours (14 observations). A total of 150 hours of observations over 50 sampling periods was recorded. Instantaneous sampling was used to record the behaviour, proximity of individuals and pattern of enclosure use, with one-minute intervals between scans. The results were analysed in percentage values with the total time spent on the activity related to the total time of observation. Behavioural events were recorded as they occurred. The results are presented as analyses of frequency (number of occurrences) in a 3 hour period. The terminology applied for the recording of behaviours is given in Table 2. Codes were used to record proximity of individuals (Table 3). In order to record enclosure use the area was divided into squares of approximately equal size and each section was given an identification letter (Figs 1 and 2).

RESULTS AND DISCUSSION

*Nest moving* In captivity a ♀ Maned wolf will only rear her litter if the enclosure

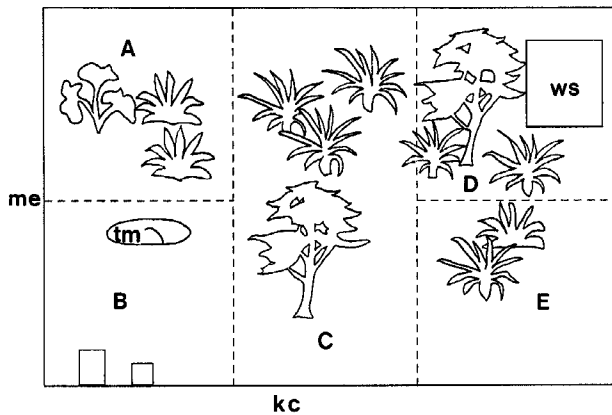


Fig. 1. Enclosure for ♀ Maned wolf *Chrysocyon brachyurus* at Belo Horizonte Zoo. In order to record enclosure use the area was divided into hypothetical sections each identified with a letter (A, B, C, D, E): kc. keeper corridor; ws. wooden shelter; tm. termite mound; me. ♂ enclosure.

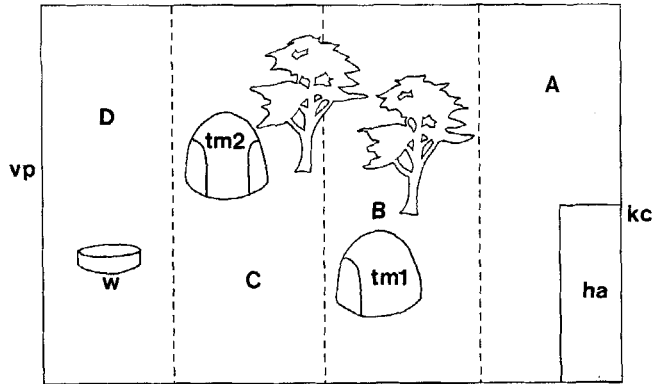


Fig. 2. Enclosure for a pair of Maned wolves. In order to record enclosure use the area was divided into hypothetical sections each identified with a letter (A, B, C, D): ha. holding area; kc. keeper corridor; tm1. one-entrance concrete shelter; tm2. two-entrance concrete shelter; w. water-hole; vp. visitor pathway.

offers a safe environment for the pups. The ♀ may move the pups to a different shelter within the enclosure but if a suitable secure area is not available she may neglect or even kill her offspring (Faust & Scherpner, 1967; da Silveira, 1968; Brady & Ditton, 1979). In general, it is necessary to offer quiet breeding areas which are free from disturbance because visitor noise, keeper activity and veterinary procedures can all unsettle the ♀ and litter.

Luana gave birth in a thicket in D (Fig. 1). After several days she moved the litter to a larger and denser thicket, also in D and several days later she put the pups inside an abandoned termite *Cornitermes bequaerti* mound in B. The observation period began when Luana's pups were 23 days old and were already ensconced in the termite mound. Here they remained until day 40, by which time they were more independent and had begun to explore their surroundings by themselves and choose their own rest places.

Luana moved her pups three times. It is impossible to know whether Luana kept the pups in the termite mound because it provided the most suitable burrow or because this was the only secluded area within the enclosure.

Xuxa gave birth in the single entrance shelter (tm1) and the pups remained there until the end of the observation period (Fig. 2). It is likely that Xuxa did not move her litter because there were no other suitable nest areas in the enclosure. The other shelter, which had two entrances, did not offer any security and there was no adequate vegetation in the enclosure for nesting in.

*Behaviour and enclosure use* The three adult Maned wolves usually stayed in their rest places in the morning and became more active during the afternoon. Luana rested in the thickets in D (Fig. 1) and Carandaí in the two entrance shelter (tm2) (Fig. 2). Xuxa, however, did not appear to have a preferred resting place; sometimes she was observed with the pups in tm1 or with Carandaí in tm2 or lying elsewhere in the enclosure.

The wolves started to become active just before feeding at about 1430 and 1500 hours. Luana and Carandaí displayed similar behaviours during the feeding period, especially on days when they were offered meat. As soon as they saw the keeper, Luana and Carandaí would begin walking around their whole enclosures and they were constantly alert,

BEHAVIOUR	CODE	DESCRIPTION
eat/drink	CB	
social eat/drink	SCB	
locomotion	LO	
observation/locomotion	LOO	walking for long periods around enclosure quickly and on the same paths
locomotion/fur bristled	AE	agonistic/threatening behaviour where the fur on the neck is bristled showing the distal part of black fur
accompanied locomotion	LOCAC	seclusion, approach or accompanied locomotion
active	ATV	watchful, sitting, standing or lying, head up
	SATV	watchful, in close proximity to one another
inactive	INV	full lying down (including neck), eyes open or closed
	SINV	relaxed and in close proximity to one another
self-grooming	ATI	
not visible	NV	
	SNV	animals not visible, but in close proximity to each other
lactation	AM	
pups lick/sniffing	LCF	
play	BR	arched tail approach, paw pushing, amicable neck or muzzle bites
naso-anal contact	CNA	
naso-nasal contact	CNN	
scent marking	PL	urinating with rear leg raised
	UA	urinating in squat position
	US	urinating over other urine
	CHU	sniffing another individual's urine
	APE	rubbing genital region over substrate
	DEF	defecation
vocalization	CR	whining
	ROS	snarling
	LT	short barks
	UI	prolonged barking/howling

**Table 2.** Solitary and social behaviours recorded during the study of parental behaviour in Maned wolves.

even when standing still. After feeding they would try to hide any remaining meat in ready-dug holes in the enclosures. Luana and Carandaí remained active for between 1 and 2 hours, walking around the enclosures, observing and stopping often to rest and scent mark.

Xuxa had a more varied activity pattern and no routine in her behaviour was observed. She was more active than Carandaí both in the morning and in the afternoon but no territorial observation, locomotion or meat hiding was recorded.

These results differ from those of Veloso (1991). In a study of captive Maned wolves at Sorocaba Zoo, the animals were more active in the morning than in the afternoon. This difference may be related

to the time of feeding at each zoo: at Sorocaba the wolves were fed in the morning, while at Belo Horizonte they are fed in the afternoon at 1500 hours. Altmann (1972) observed that captive Maned wolves and other species showed behaviour patterns in response to the husbandry routine at a zoo (Brady & Ditton, 1979). A relationship has also been observed between levels of activity and feeding at Washington NZP, where the Maned wolves were most active at the end of the afternoon just before feeding (Brady & Ditton, 1979).

Two locomotion types, 'LO' and 'LOO' (Table 2), were the behaviours associated with feeding that were observed most frequently. After feeding and apparently

satiated, Luana and Carandaí hid all the remaining food in holes in the ground. There is no information about what animal dug these holes. Although Maned wolves are not typically diggers, Brady & Ditton (1979) have observed them digging at Washington NZP. Because this behaviour was usually observed on the days that the wolves were fed meat, we assumed that they were probably hiding the remains to eat the next day, when they would be fed on a mixture of rations for wild dogs (Special Crock) and fruit. However, this behaviour may be a response to cultures that frequently scavenge in the enclosures.

Once the meat was hidden, both Luana and Carandaí would walk around the enclosure for up to 2 hours. This journey around the enclosure, with brief stops for rest and scent marking, appears to be a territorial 'patrol'. Dietz (1984) found territorial defence to be a ♂ behaviour. In the wild, up to 20 km can be walked during sunset and at night, and this is related to both foraging and territorial defence (Carvalho, 1976). Because captive Maned wolves do not need to forage, this activity is possibly solely defensive. Because only Carandaí and Luana were observed in this activity it is possible that Luana was performing the ♂ role of defending the territory. If this assumption is correct then the presence of a ♂ may provide the ♀ with the security she requires for rearing pups. If a ♀ has to spend time and energy defending the ter-

ritory she might be neglecting some maternal functions and this could increase stress levels.

*Social activities and proximity* The intensity of social interaction between ♀♀ and pups varies according to the age of the litters. Immediately after parturition the ♀♀ stayed with the pups inside the nest and out of sight, but as the pups grew the time spent with them decreased. From 1 month old contact between the ♀ and young took place outside the nest and was less frequent, shorter in duration and usually only occurred when the pups were suckling. Luana was more attentive to her pups than Xuxa. When Luana called the pups out of the nest, she would inspect them by circling and sniffing and licking them (naso-nasal and naso-anal contacts), before suckling. After suckling, which lasted for about 5 minutes, she played with the pups or let them explore the surroundings. Xuxa did not stay or play with the pups and interaction was limited to 3-4 minutes for suckling. From day 50 contact between Luana and the pups decreased considerably and she even started to avoid them. By this time the young had begun to eat solid food and they did not stay inside the nest.

Interactions between Xuxa and Carandaí were infrequent; only a few brief instances of naso-nasal and naso-anal contact were observed and a few short periods of accompanied locomotion were recorded. For the majority of the study the pair were either apart (A) or far apart (FA) from each other.

There was no record of interaction between Carandaí and the pups, and they mostly stayed far apart from each other.

Maned wolves are essentially solitary animals (Langguth, 1975; Carvalho, 1976; Brady & Ditton, 1979; Biben, 1983; Dietz, 1984). Velloso (1991) observed that small enclosures and the lack of secluded rest areas often caused an increase in social interaction. Xuxa and Carandaí often shared the two-entrance shelter but when

CODE	PROXIMITY
C	contact
P	proximity up to 0.5 m; without contact, or where contact can not be determined
A	over 2 m apart
FA	over 5 m apart

Table 3. Codes used to record proximity of individual Maned wolves during the comparative study at Belo Horizonte Zoo.

we checked inside the ♂ would be on one side and the ♀ on the other. There was no apparent social contact and the pair only shared the same space. Any social interactions that were observed were brief. Even in small spaces the ♂ and ♀ kept themselves apart or far apart from each other.

Interactions between the ♀♀ and their pups also demonstrated the solitary behaviour of Maned wolves. The ♀ remains with the pups only during the time of greatest dependence; that is, immediately after birth when the pups were suckling frequently. At this time the interactions were mostly naso-anal and naso-nasal, with pups sniffing and licking and the ♀ acknowledging the young. Once lactation is less important the interactions between the ♀ and pups decrease until the ♀ avoids her young. By this time the pups are independent and each has its own rest place. It is important that enclosures for Maned wolves enable individuals to have spatial distance, particularly when pups are becoming independent.

*Behaviour* Luana and Carandaí frequently scent marked the territory, especially during the afternoon. Carandaí preferred a raised rear leg posture for urine marking and used anal gland secretion marking. Luana used the squatting position more often than the raised leg posture and anal gland secretion marking. Xuxa was not observed scent marking.

Scent marking occurred in specific places inside the enclosure. Carandaí preferred to urinate near the visitor screen and in one corner of the holding area. Anal gland marking occurred only on a small tree next to the holding area. According to the keepers, Carandaí defecated into a hole beside the visitor screen. Luana frequently urinated next to a small elevation in C (Fig. 1), using the squatting position. She always dug in the foliage before urinating directly onto the earth. She also urinated, using the raised leg position, on the stakes supporting the

dividing screen adjoining Capixaba's enclosure. Her preferred location for defecation was an elevation in A.

According to Dietz (1984), scent assists in territory defence by showing conspecifics that the area is occupied. This suggests that observation locomotion (LOO) is closely related to territory defence, because it was only during LOO that scent marking was observed. As in the wild, the captive Maned wolves urinated and defecated on elevations. Dietz (1984) reported that 65% of faeces were found on rocks or termite mounds, always above ground level, probably for defence or to cause alarm. There is little available information relating to urine marking but its persistent smell suggests that it might also be used for defence or to cause alarm. Posture for urination largely depends on the circumstances and animals which are intimidated will squat rather than use the raised leg posture (Brady & Ditton, 1979).

There is little information available concerning Maned wolf vocalization. Vocalizations at Belo Horizonte occurred in two situations, either when there were strangers inside the enclosure or to call the pups. Loud, fierce snarls were used to intimidate strangers and Carandaí snarled more intensively than either Xuxa or Luana. Agonistic vocalizations, such as loud barking or snarling, were used by the ♂. These vocalizations indicated stress situations and they were not included in the study. Luana made a weak whining to call the pups and she used repeated howls to round them together when they were scattered around the enclosure. Whining and howling were used only by this ♀. The results of this study suggest that the ♀'s role is rearing the pups while the ♂ defends the territory and protects the litter.

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PRODUCT MENTIONED IN THE TEXT

**Special Crock:** rations for wild dogs, manufactured by Royal Canin, R. Lima Duarte, 81 30710-470, Belo Horizonte MG, Brazil.

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