

SHORT COMMUNICATION

Behavioural Development of Howling Monkey
Twins (*Alouatta palliata*) in Santa Rosa
National Park, Costa Rica

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ABSTRACT. Twins born to a young female howling monkey in Santa Rosa National Park, Costa Rica were observed during the first 96 days of their life. The comparison of their development to that of single infants and the comparison of the behaviour of the mother of the twins to that of mothers of single infants revealed few differences. However, qualitative observations suggests that high costs are associated with maternal care of infant twins. The mother had difficulty carrying both infants and was the only female observed to become sick during the study. Increased costs of lactation were not compensated for by an increase in foraging time. It would seem that howling monkey mothers possess a maternal care system which is capable of providing suitable care to twins. However, the costs on the mother of raising twins is suggested as a factor selecting for a litter size of one.

Key Words: Twins; Maternal care; Howler; *Alouatta palliata*.

INTRODUCTION

In a small number of primate species multiple births are the norm or commonly occur (various callitrichids: LEUTENEGGER, 1973; KLEIMAN, 1977, 1985; ROTHE, 1974; *Varecia variegata*: FOERG, 1982; KRESS et al., 1978; *Galago crassicaudatus*: Ehrlich, 1974; *Galago senegalensis*: DOYLE et al., 1967). However, the females of most primate species have single infant births. Twinning occurs in a number of those species where single infant births are characteristic (*Microcebus*: SCHULTZ, 1956; *Cebus fatuellus*: STOTT, 1953; *Alouatta palliata*: HENDRICKX & NELSON, 1971; *Presbytis melalophos*: BENNETT, 1982; *Macaca mulatta*: KOFORD et al., 1966; SPENCER-BOOTH, 1968; DEET & HARLOW, 1974; *Macaca fuscata*: NAKAMICHI, 1983; *Pongo pygmaeus*: HEINRICHES & DILLINGHAM, 1970); but it is a rare event. For instance, in rhesus macaques, twins are born in 1 out of every 437 births; and in humans, twins occur in 1 out of every 87 births (KOFORD et al., 1966).

Selective pressures which influence primate litter size could be identified by either comparing species where twins are the norm to species in which twins are rarely born, or by examining the consequences of intraspecific variability in litter size. This investigation examines the behaviour of a young female howling monkey (*Alouatta palliata*) subsequent to her delivery of twins in a wild population. Behavioural observations of the mother with twins were conducted in Santa Rosa National Park, Costa Rica during the first 96 days of the twins' life; and these observations were compared to observations of single infant mothers during the same period.

METHODS

Behavioural observations of a mother and her twins were conducted at Santa Rosa National Park, Costa Rica. Santa Rosa is a 10,800-ha national park situated approximately 35 km northwest of Liberia, Guanacaste adjacent to the Pan American Highway. Rainfall in the park ranges between 900 and 2,400 mm annually, almost all of which falls in the rainy season. The vegetation of the park is a mosaic of grasslands (*Hyparrhenia rufa*), dry deciduous forest, and semi-evergreen forest.

At the time of this study the howling monkey group containing the twins was well habituated to the presence of an observer, since they had been studied for ten months preceding the birth of the twins. The twins were first observed on March 22, 1985. Based on their appearance they were judged to have been born within the past week. The twins were both males, who were very similar in size and appearance. On May 23 the mother was darted, and the infants were individually marked with ear tags and immediately released (see GLANDER et al., in prep. for descriptions of the darting and marking techniques). At this time the mother weighed 6.0 kg and each of the twins weighed 450 g. For her size the mother's weight was close to the average of the females in the groups. One of the twins lost its ear tag prior to the end of the study; but since the other infant retained his, it was possible to distinguish between them.

Behavioural data were collected using a focal animal sampling regime which employed a 10-min session length. During the 96 day study, 172 focal animal sessions were recorded on the subjects. The behavioural sampling was conducted so that approximately an equal number of focal animal sessions were recorded every three weeks and so that the sessions were conducted throughout the day. Comparisons made between the twins were produced from those sessions conducted after they were individually marked. Ad libitum notes were recorded on interactions involving the mother of the twins and relevant interactions involving other members of the group.

RESULTS

The twins and their mother spent the majority of their time (98%) in physical contact. Typically, the twins were observed clinging to either side of their mother's ventrum. However, starting approximately a month and a half after their birth, they started to leave their mother when she was resting. Typically, both infants left their mother at the same time. It was only on 5% of the occasions when one of the twins travelled away from the mother, that the other remained in maternal contact. The twins were observed playing on ten occasions during the focal animal sessions. In the majority of these play bouts (80%) the twins played with each other. On one occasion they were observed playing with their mother and another play bout involved interactions with an old adult male. The play bout with the adult male lasted for 17 min. The male was primarily passive, allowing the twins to crawl over him, but he also gently wrestled with both infants.

When the infants were very young, they were a center of attention for other group members. Females without infants would often follow the mother of the twins in what seemed to be an attempt to get close to the twins. However, the mother of the twins always resisted these approaches by turning her back or moving away, with the exception of the old adult

male whom she allowed to approach closely. The twins were never seen to be carried by a female other than their mother (see GLANDER, 1975 for a description of the baby-sitting of single infant howling monkeys).

There were no significant differences between the twins in the proportion of their time that each spent playing, travelling independent of the mother, nursing, or in contact with the mother (t -test, $p > 0.05$). The only observed behavioural difference between the twins was a definite preference to cling to a particular side. Although the mother carried the twins in a variety of fashions, they were both typically carried on the mothers ventrum. Carried in this manner, each infant had its preferred side. A similar side preference was also noted when the infants were nursing.

The behaviour of the twins was compared to that of three other small clinging infants in the group. Two of the three clinging infants were born just prior to the date when the twins were first seen, while the third was first observed two weeks after this date. No significant differences were found between the single infants and the twins in their time spent playing ($t = 0.54$, $p = 0.613$), travelling independent of the mother ($t = 1.00$, $p = 0.328$) or in contact with their mothers ($t = 0.08$, $p = 0.939$).

The proportion of the observation time that the mother of the twins and the single infant mothers spent engaged in various behaviours was compared, and no significant differences were found (forage $t = 1.36$, $p = 0.190$; rest $t = 1.59$, $p = 0.129$; travel $t = 0.54$, $p = 0.599$; agonism $t = 1.00$, $p = 0.321$; avoidance $t = 1.00$, $p = 0.321$). The only way that these mothers did differ was in the number of animals observed in proximity to them. The mother of the twins tended to have more animals within 10 m of her than the single infant mothers ($t = 2.21$, $p = 0.03$). This relationship is not thought to indicate that the mother of the twins was more central than the single infant mothers; for she was frequently seen on the periphery of the group, and often trailed well behind the group during progressions. Rather, this relationship may be due to a close association between the mother of the twins and an identifiable old adult male. Throughout the study, this male was frequently in close proximity to the mother of the twins, and this was the male observed playing with the twins.

When the mother travelled, she frequently adjusted the position of one or the other of the twins. Also, the mother occasionally appeared to have difficulty carrying both of the infants; and she was repeatedly seen avoiding difficult crossings by travelling around them.

On April 27th, 35 days after the twins were first seen, the mother of the twins showed definite signs of sickness (sniffles, nasal discharge). The nasal discharge resulted in white mucus being caked around the nostrils, a sign easily visible from a distance. This condition lasted throughout the duration of the 96 day study.

The membership of the group was being continuously monitored and these observations revealed that the twins and their mother were still members of the group as of August 1986; over a year following the twins' birth.

DISCUSSION

The examination of the behaviours of howling monkey twins and their mother allows an assessment of selective pressures influencing litter size in this species. Previous studies of twins have been conducted in laboratories or at locations where the animals were provisioned. These tended to be situations where food is readily available and the possibility of predation

is reduced or eliminated. Under these conditions the ability of a mother to care for twins is likely greatly improved, and we might expect a higher probability of twin survival than under more natural conditions.

The observations of the howling monkey mother with the twins in Santa Rosa National Park suggest a considerable cost is associated with the maternal care of the twins. The mother had difficulty carrying the infants and was the only female observed to be sick during the study. In further support, one must consider that milk was being produced for two infants. A lactating female's metabolic rate is 1.5 times higher than that of a non-lactating female (PORTMAN, 1970). Even though the mother of the twins was providing milk for two infants, she did not compensate for this added cost by increasing the amount of time that she spent foraging or by foraging on higher quality foods.

The mother of the twins was capable of performing the appropriate behaviours to look after both of the infants and showed no bias in the care she gave the infants. DEETS and HARLOW (1974) observed that although some captive rhesus macaque mothers (*Macaca mulatta*), which were given two infants to care for, initially rejected one or both of the infants, they tended to eventually accept both infants and provide suitable care. NAKAMICHI (1983) reported that a Japanese macaque mother (*Macaca fuscata*) successfully raised twins for 12 months. For a number of species, cases have been documented of mothers providing care for injured or disabled infants. This suggests that their maternal care system is capable of dealing with many different situations (e.g., experimentally blinded rhesus and crab-eating macaque infants, BERKSON, 1977; Japanese macaque infants born with defects, FURUYA, 1966; FEDIGAN & FEDIGAN, 1977).

In conclusion, observations of the female howler with her twins, suggest that the mother possessed the behavioural potential to care for two infants at one time. This result is in general agreement with past studies of mothers with twins (particularly NAKAMICHI, 1983), or injured, or defective infants. Unlike previous studies of provisioned or captive monkeys, this study suggests that providing care for twins may be costly for the mother. However, costs were difficult to identify quantitatively; there were no differences in time budgets of single mothers and the female with the twins, nor was the mother of the twins lighter in weight than other females of her size. Qualitative data does, however, suggest considerable cost to a female in giving birth to twins. In a howling monkey population at La Pacifica, Costa Rica, only one pair of twins have been observed in 14 years of work in the area, and these twins did not survive a year (GLANDER, pers. comm.). These observations provide support for the idea that the costs associated with twinning in howling monkeys has contributed to selection for single infant births in this species.

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