

data), a seasonal effect should have resulted in a constant increase or decrease, respectively, of the parameters examined here, rather than in the observed fluctuation.

Modification of resource use (increased number of repeated visits to the same feeding site) may incur costs in terms of increased risk of cueing-in a predator and reduced dietary variability. Since the genetic relationships of the group members are not known (although F-j most likely is the daughter of the adult pair and the sister of the subadult and juvenile group members), it is not clear whether benefits obtained through kin selection or other benefits balanced these costs. An additional cost factor may have been represented by F-j lagging behind the group when entering a sleeping site. Rapid retirement to a sleeping site within 1-2 min is highly consistent between different groups (Table 1), and probably represents an anti-predator strategy (Caine, 1987; Heymann, 1995). Lagging behind could potentially increase the risk of being detected by, or cueing-in, a predator.

Whether or not F-j would have survived without the modification in the group's behaviour cannot be answered. Our observations provide evidence that wild tamarins modify their behaviour in response to an injured member.

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References

- Caine, N. G. 1987. Vigilance, vocalizations, and cryptic behavior at retirement in captive groups of red-bellied tamarins *Saguinus labiatus*. *Am. J. Primatol.* 12: 241-250.
- Caine, N. G. 1993. Flexibility and co-operation as unifying themes in *Saguinus* social organization and behaviour: The role of predation pressure. In: *Marmosets and Tamarins: Systematics, Behaviour, and Ecology*, A. B. Rylands (ed.), pp. 200-219. Oxford University Press, Oxford.
- Chapman, C. A. and Chapman, L. J. 1987. Social responses to the traumatic injury of a juvenile spider monkey (*Ateles geoffroyi*). *Primates* 28: 271-275.
- Dittus, W. P. J. and Ratnayeke, S. M. 1989. Individual and social behavioral responses to injury in wild toque macaques (*Macaca sinica*). *Int. J. Primatol.* 10: 215-234.
- Dunbar, R. I. M. 1988. *Primate Social Systems*. Croom Helm, London.
- Goldizen, A. W. 1987. Tamarins and marmosets: Communal care of offspring. In: *Primate Societies*, B. B. Smuts, D. L. Cheney, R. M. Seyfarth, R. W. Wrangham and T. T. Struhsaker (eds.), pp. 34-43. The University of Chicago Press, Chicago.
- Gould, L. 1997. Intermale affiliative behavior in ringtailed lemurs (*Lemur catta*) at the Beza-Mahafaly Reserve, Madagascar. *Primates* 38: 15-30.
- Heymann, E. W. 1995. Sleeping habits of tamarins, *Saguinus mystax* and *Saguinus fuscicollis* (Mammalia; Primates; Callitrichidae), in north-eastern Peru. *J. Zool., Lond.* 237: 211-226.
- Lovell, N. C. 1991. An evolutionary framework for assessing illness and injury in nonhuman primates. *Yearb. Phys. Anthropol.* 34: 117-155.
- Schultz, A. H. 1939. Notes on diseases and healed fractures of wild apes. *Bull. Hist. Med.* 7: 571-782.
- Shahuano Tello, N., Huck, M. and Heymann, E. W. 2002. *Boa constrictor* attack and group defense in moustached tamarins (*Saguinus mystax*). *Folia Primatol.* 73: 146-148.
- Zihlman, A. L., Morbeck, M. E. and Goodall, J. 1990. Skeletal biology and individual life history of Gombe chimpanzees. *J. Zool., Lond.* 221: 37-61.

DIURNAL BIRTH OF A WILD RED TITI MONKEY, *CALLICEBUS CUPREUS*, AT THE ESTACIÓN BIOLÓGICA QUEBRADA BLANCO

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In most diurnal primates, births take place during the night (Jolly, 1972, 1973), which may relate to ecological, behavioural or physiological factors (Timmermans *et al.*, 1998). The circumstances surrounding a birth are therefore usually not observed. Such observations might be particularly interesting in species where offspring are carried mostly by individuals other than the mother – such as in titi monkeys, night monkeys, the marmosets and tamarins – to see how soon the newborn may be transferred to a helper. Here we report unusual circumstances surrounding the birth of a red titi monkey, *Callicebus cupreus*, observed at the Estación Biológica Quebrada Blanco (EBQB) in north-eastern Peruvian Amazonia (04°21'S, 73°09'W; for details of EBQB see Heymann, 1995).

The titi monkey group was composed of the adult pair, a subadult male and an as-yet unsexed juvenile. This well-habituated group had been under regular monthly observation between October 2002 and September 2003 as part of a thesis project (Perez Yamacita, in prep.). The group was monitored by two of us (CFA and EWH) on 10-13 October 2003, and quantitative data were collected by the first two authors with the help of CFA on 16-18 October 2003 as part of a field course. Instantaneous scan sampling at 10-minute intervals was employed for data collection (Martin and Bateson, 1993). While monitoring the group, we noted the swollen abdomen of the female titi monkey, suggesting that she might be pregnant. She copulated with her mate on 11 October 2002.

On 18 October the group left its sleeping tree at 0530 h and moved into a neighbouring tree, where the titi rested until 0600 h. They then moved, fed, and rested intermittently until 0940 h. During this period, all were in the lower forest levels and clearly visible for much of the time. No infant was present. At 0950 h the group moved into a vine tangle at a height of about 22 m. The two adults remained there for the next two hours, while the subadult and the juvenile foraged and fed nearby, occasionally approaching the adults.

At 1300 h, we saw the neonate for the first time. It was carried by the juvenile, who had climbed down and was moving at a height of about 7 m. The neonate had dark grey skin and was very sparsely haired. Head-body length was estimated to be about 12-13 cm. The juvenile was not moving particularly slowly or carefully, and at one point the juvenile rubbed his back, and the neonate, against a trunk. When the neonate screamed, the other group members looked towards the juvenile and the neonate, but did not interfere.

The juvenile continued to carry the neonate until between 1440 h and 1450 h. We did not notice the transfer, but from 1450 h it was carried by the adult male, who stayed mostly in the upper canopy, while the others used different levels of the forest during foraging, moving and resting. At 1530 h, the adult male climbed down and approached the female. They rested together at a height of 4 m. We heard the neonate vocalizing, and at 1600 h it moved from the male's back to his ventrum. At 1610 h the female climbed up into the canopy, followed by the male with the neonate. They remained out of sight until 1640 h, when the male, still with the neonate, entered a sleeping site, immediately followed by the female. The subadult and the juvenile entered at 1650 h and 1659 h, respectively.

The quantitative data collected during a 3-day observation period do not allow for a statistical comparison of activity budgets. However, it may be no coincidence that the time spent resting by the female on the day of the birth was 41%, compared to 24% on the two days preceding the birth. Furthermore, she was much more vigilant (12% of time) compared to 6% and 3%, respectively, the two days before.

While we could not determine the exact time of birth, it is clear that it took place after 0950 h, most likely during the prolonged resting period of the male and the female. In captivity, birth in titi monkeys occurs during the night (Meritt, 1980), but no information is available from the field. In wild New World monkeys, diurnal births have been reported from *Saguinus labiatus* and *S. imperator* (Nascimento Bezerra and Porter, 1999; Windfelder, 2000). It is difficult to estimate how common diurnal births may be as opposed to nocturnal, due to the rarity of any reports on births in the wild.

In titi monkeys, the father is the principal infant carrier from the first week of life (Jantschke *et al.*, 1995; Wright,

1984), and it would seem to be quite unusual that this newborn was carried by the juvenile for some time after its birth. The juvenile was born in November 2002 and had, therefore, never seen a younger sibling before. It was inexperienced in this sense, and showed inappropriate behaviours, such as trying to rub off the neonate. The parents did not interfere, and the newborn was apparently unharmed. When the group was followed again on 21 and 23 October, the male was carrying the infant. By September 2004, it had become a juvenile.

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References

- Heymann, E. W. 1995. Sleeping habits of tamarins, *Saguinus mystax* and *Saguinus fuscicollis* (Mammalia; Primates; Callitrichidae), in northeastern Peru. *J. Zool., Lond.* 237: 211-226.
- Jantschke, B., Welker, C. and Klaiber-Schuh, A. 1995. Notes on breeding of the titi monkey *Callicebus cupreus*. *Folia Primatol.* 65: 210-213.
- Jolly, A. 1972. Hour of birth in primates and man. *Folia Primatol.* 18: 108-121.
- Jolly, A. 1973. Primate birth hour. *Int. Zoo Yearb.* 13: 391-397.
- Martin, P. and Bateson, P. 1993. *Measuring Behaviour*. Second edition. Cambridge University Press, Cambridge.
- Meritt Jr., D. A. 1980. Captive reproduction and husbandry of the douroucoulis *Aotus trivirgatus* and the titi monkey *Callicebus* spp. *Int. Zoo Yearb.* 20: 52-59.
- Nascimento Bezerra, E. and Porter, L. M. 1999. Birth of *Saguinus labiatus* twins observed in their natural habitat. *Neotrop. Primates* 7: 27-28.
- Timmermans, P. J. A., van Beersum, A. C. and Vossen, J. H. M. 1998. Giving birth in primates: Connection between ecological, behavioural and organismic variables and time and place of delivery? *Folia Primatol.* 69: 223.
- Windfelder, T. L. 2000. Observations on the birth and subsequent care of twin offspring by a lone pair of wild emperor tamarins (*Saguinus imperator*). *Am. J. Primatol.* 52: 107-113.
- Wright, P. 1984. Biparental care in *Aotus trivirgatus* and *Callicebus moloch*. In: *Female Primates: Studies by Women Primatologists*, M. Small (ed.), pp. 59-75. Alan R. Liss, New York.