

OBSERVATIONS ON THE SEXUAL BEHAVIOUR AND BIRTH SEASONALITY OF PROBOSCIS MONKEY (*Nasalis larvatus*) ALONG THE LOWER KINABATANGAN RIVER, NORTHERN BORNEO

Ramesh Boonratana

Mahidol University International College, 999, Buddhamonthon 4 Road, Salaya, Nakhon Pathom 73170, Thailand.

E-mail: icramesh@mahidol.ac.th

ABSTRACT

Sexual behaviour of Proboscis Monkey *Nasalis larvatus* was observed along the Lower Kinabatangan River in eastern Sabah, Bornean Malaysia, during a two-year field study. Eight sexual mounts and two non-sexual mounts in one-male groups were recorded using scan sampling and event sampling. All observed copulations comprised single mounts, with copulatory bouts averaging 25 seconds. The adult female was the solicitor when solicitations were observed with certainty. Sexual harassment by older infants and young juveniles of copulating pairs was also observed. *Nasalis larvatus* infants were observed almost throughout the study. No correlation could be established between birth dates and environmental parameters, although there appeared to be more births during the wet season.

Keywords: mating behaviour, sexual behaviour, sexual harassment

INTRODUCTION

Proboscis Monkey *Nasalis larvatus* (Wurmb) is a large, sexually dimorphic, monotypic arboreal 'odd-nosed' colobine, endemic to the island of Borneo, where it is largely restricted to riverine, peat swamp, and mangrove forests of the coastal lowlands. The social structure of *N. larvatus* in the Lower Kinabatangan is flexible, comprising relatively stable one-male, all-male, and non-breeding groups. A non-breeding group refers to a loosely bonded predominantly male group with at least one female member (Boonratana, 1993, 2002). They further exhibit inter-group associations that show a secondary level of social organization, the band, with fission-fusion of stable one-male groups within bands (Boonratana, 1993, 2002).

A two-year field study was carried out on the ecology and behaviour of *N. larvatus* at Abai (N5°41', E118°22') and Sukau (N5°30', E118°17') located along the Kinabatangan River in eastern Sabah, Bornean Malaysia. Observations on the sexual behaviour of *N. larvatus* made during the study, carried out from January 1990 to December 1991, are described here. Data could not be collected in July 1990 when the author had viral fever, or in February 1991 due to unfavourable weather conditions.

The Lower Kinabatangan region (N5°20'-5°45', E117°40'-118°30') is generally flat with forests that had been subjected to different degrees of disturbance, with much of the area comprising a mosaic of open water, hills, limestone outcrops, settlements, plantations, and several ox-bow lakes at various stages of infilling (Boonratana, 1993, 2000). Overall, the region has a humid tropical climate whose annual rainfall averaged about 2,600 mm (wet months typically from October to February), and the mean diurnal temperatures from 22°C to 32°C (Scott, 1989). Being just 23 km apart, the climate seasonality was similar for both study sites. Mean temperatures did not vary much between months during the study. The mean monthly minimum for both 1990 and 1991 was 23.7°C, whereas the mean monthly maximum was 32.9°C for 1990, and 33.0°C for 1991 (Boonratana, 1993). The total rainfall was 1,816 mm for 1990, and 2,975 mm for 1991. It rained for a total of 159 days in 1990, and 183 days in 1991, or on average every other day. Dry months, with rainfall less than 50 mm, occurred in February and April 1990, and March 1991.

The principal vegetation at Abai was mangrove forest with extensive stands of *Nypa fruticans* Wurmb (Arecaceae) at the inland edge and the upper tidal limit of the estuaries, and riverine forest and lowland swamp forest beyond the influence of seawater, in the seasonally flood-prone zone. There were also patches of lowland dipterocarp forests on steep hills and flat ground. At Sukau, the vegetation in the flood-prone areas principally comprised riverine forest and freshwater swamp forest, peat swamp forest, and some open reed swamps. Meanwhile cocoa and oil palm plantations, and remnants of pristine lowland dipterocarp forest, logged-over swamp forest, and burnt lowland dipterocarp forest dominated in the flood-free zone. A full description of the botanical composition, structure, and phenology at Sukau and Abai during the study period is provided in Boonratana (1993, 2000).

SEXUAL BEHAVIOUR OF PROBOSCIS MONKEY

No copulation was observed at the Abai study area. The habitat conditions (soft muddy substrate, entangled roots, and tidal inundations) at Abai did not allow observing any single group continuously throughout the day. Using event and scan sampling methods (Altmann, 1974), eight copulatory bouts in different one-male groups were recorded at Sukau throughout the study (Table 1).

For this study, scan samples encompassed all members of the group that could be recorded during a 2-minute period for every 15-minute time block from dawn to dusk on every full day follow. As it was possible to see more animals engaging in conspicuous activities (e.g. travelling) than in other inconspicuous activities (e.g. resting), the number of individuals recorded during each scan was weighted to reduce this bias. Each scan contributed only one point to the dataset, irrespective of how many animals were seen during the scan; all observations made during a scan were thus divided by the total number of observations made during that scan, giving the combined weightings for each scan as one (Kavanagh, 1977; Bennett, 1983; Boonratana, 1993).

Copulation in the focal one-male group, SU1, was recorded four times, twice during scan observations. Weighted scans showed that copulation made up only 0.1% of total scan observations at Sukau ($n=4,966$). All copulations consisted of a single mount, ranging from 10 to 40 seconds and averaging 25 seconds. Murai (2006), at the same site, observed mostly single

mounts and some multiple mounts (up to six mounts per copulation), with the mounts averaging 27 seconds (ranging 7 to 58 seconds). At Tanjung Puting National Park, Yeager (1990) reported two instances of multiple mounts, one occurring in the context of harassment, and one during intergroup displays.

Typically in the present study, the adult female approached the adult male, presented her hindquarters in a quadrupedal position with slightly flexed legs and arms, and tail to one side. The male rested his feet on the supporting tree branch, grasped her midsection with his hands, and mounted and penetrated the female from the rear. This was followed by repeated thrusting movements by the male. During copulation, the female maintained a pouted face and pursed lips, and occasionally looked back at the male. A brief pause marked the end of the copulatory bout. The pair separated to at least a meter away after the male dismounted. After separation, both the male and female shuddered briefly. Similar observations were documented at Tanjung Puting National Park, with the exception that the male *N. larvatus* there often used a foot to clasp one of the female's hind limbs (Yeager, 1990).

In all five cases when solicitations were observed with certainty, the adult female was the solicitor. In Asian colobines, solicitations are considered almost always initiated by females (Kirkpatrick, 2007). In contrast, Murai (2006) at the same site observed that solicitation for copulation was initiated frequently by males and occasionally by females. At Tanjung Puting National Park, Yeager (1990) reported that females initiated six out of seven confirmed solicitations, and Gorzitze (1996) reported that copulations were solicited by the females in most instances. Likewise, female solicitations have also been reported for a captive *N. larvatus* group (Hollihn, 1973). Solicitations by the female in the Lower Kinabatangan, made during this study and Murai's (2006), usually began with a sexual gesture, which involved looking at the male with a pouted face, eyelids half closed, chin up and out, lips pursed forward, and occasionally shaking her head from side to side.

Although not observed in this study, Murai (2004a, 2004b, 2006) reported that sexual swelling was often visible in 77% of the mating females, with swelling most distinct in the mating subadult females. At Tanjung Puting National Park, Gorzitze (1996) reported observing reddening of the genitalia in pregnant females that lasted several days after birth of the infants.

Harassment of the mating pairs was seen five times but none were successful in stopping copula-

Table 1. Summary of *Nasalis larvatus* copulatory bouts observed at Sukau (n=8).

Date	Group	No. of mounts	Duration (seconds)	Harasser	Comments
21/05/90	?	1	15	Older infant	Agitated older infant bounced around the mating pair, then grabbed adult male's fur and screeched. Adult male barked at older infant but did not stop copulating.
31/08/90	SU1	1	35	Young juvenile	A young juvenile male pulled adult male's legs and rump, but did not succeed in interfering with the copulation.
28/10/90	?	1	12	Older infant	Older infant pulled the nose of the adult male, but did not stop the copulation.
14/03/91	SU1	1	12	None	Agitated older infant whimpered near the mating pair, but did not harass. Another adult female and older juvenile sat nearby and watched.
10/09/91	SU1	1	40	Young juvenile	Young juvenile pulled the nose of the adult male, but did not stop the copulation.
12/09/91	SU1	1	38	Two older infants	Two screeching older infants came towards the copulating pair. One climbed on the adult male's back, grabbed the adult male's chest and nose, but failed to stop the copulation. After copulation, the mating pair separated to about 0.5 m apart, and shuddered briefly.
18/09/91	?	1	40	None	About four minutes before copulation, adult males of a nearby predominantly male non-breeding group displayed by leaping from branch to branch.
10/11/91	SU5	1	10	None	The adult female of the mating pair was non-sexually mounted by another adult female for about two seconds before being sexually mounted by the adult male of the mating pair (see text).

tion. Older infants and young juveniles were the only age-sex classes observed harassing the mating pairs. Harassment included agitated movements, usually accompanied with 'screech' vocalizations near the mating pairs. Often the protagonists would climb the pair and grab the male's nose or other parts of his body (Table 1). Sexual harassment in *N. larvatus* was also reported at the same site (Murai, 2006), at Samun-sam Wildlife Sanctuary (Bennett, 1988; Rajanathan & Bennett, 1990), and at Tanjung Puting National Park (Yeager, 1990).

Non-sexual mounts in *N. larvatus* were observed once at Abai and once at Sukau (Table 1). A non-sexual mount is defined as either homosexual or heterosexual mounting with no penile penetration. At Abai, during a play session, a young juvenile of indeterminate sex briefly mounted an older male infant. At Sukau, an adult female from SU5, another one-male group, bounced

from one tree branch to another and then started gesturing as described above. Another adult female of the same group, about four meters away on the same tree, then gestured similarly but did not bounce from branch to branch. The first female proceeded towards the second female and presented her hindquarters. The second female mounted the first, and began thrusting movements that lasted for two seconds. Both the females frequently looked at the resident male on another tree about 13 m away, from the moment the first female started gesturing. The first female proceeded, still gesturing towards the adult male and presented her hindquarters to him. He mounted her and began copulation that lasted for ten seconds.

Murai (2006) likewise observed non-sexual mounts at the same site, and these comprised female-female, female-juvenile/infant, juvenile-juvenile, and juvenile-infant pairs. Murai (2006) further reported observing

female-female mounts occurring shortly after solicitations toward males failed. Two instances of homosexual mounts in *N. larvatus* were observed at the Tanjung Puting National Park (Yeager, 1990). The first involved two adult females, with one of the females copulating with the resident male. In the second instance, an older juvenile mounted a young juvenile while they engaged in play wrestling. The function of non-sexual mounts in *N. larvatus* is still not clear. It could possibly be related to dominance (Altmann, 1962; Hall & DeVore, 1965). It could also be related to social bonding (Fedigan & Gouzoules, 1978; Reinhardt *et al.*, 1986). Conversely, it could assist in soliciting copulation, as in the mounting observed between two adult females. Non-sexual mounts likely have more than one function, apparently depending on the context of the act.

BIRTH SEASONALITY OF PROBOSCIS MONKEY

At birth *N. larvatus* have sparse, blackish hair and dark blue faces with snubby, upturned noses (Napier & Napier, 1967; Bennett, 1987; Bennett & Gombek, 1993). In this study young infants (up to two months old) were distinguished by their dark brown/black hair on the body and head and a dark coloured face, and older infants (two to four months old) were distin-

guished by their brown hair on the body and head but with at least some dark skin on their faces.

Young infants were present at Abai almost throughout the study, with peaks in number observed in September 1990, and to a lesser extent in January, June, and December 1991 (Fig. 1). The ratio of young infants to adult females was as high as 0.65, as observed in September 1990, while no young infants were observed in December 1990. This ratio was determined from the total number of young infants and adult females observed during monthly surveys carried out throughout the study. An August to November 1990 peak in births coincided with a wet period. The peaks in January and December 1991 similarly coincided with peak rains, and the one in June 1991 was during another wet period. No significant correlations, however, were detected between births and monthly rainfall (Spearman rank correlation, $r_s = 0.17$, $n=21$, $p>0.05$). Nevertheless, birth peaks for 1991 were observed to coincide with the young leaf production of trees in Abai, and there was a positive correlation between young leaf production and rainfall ($r_s=0.491$, $n=21$, $p<0.05$). There was also a significant positive correlation between fruit production and rainfall ($r_s=0.513$, $n=21$, $p<0.05$), with the birth peaks coinciding with peak fruit production in January, September and December 1991. In addition, birth peaks in June and September 1991 were

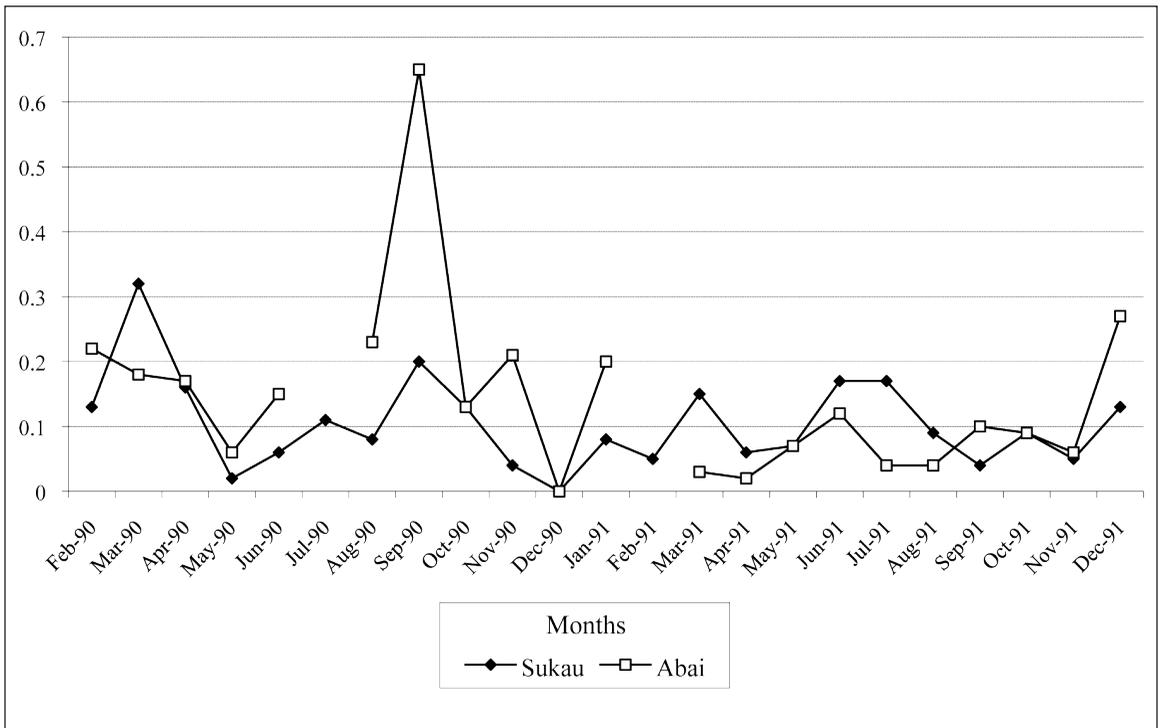


Fig. 1. Ratio of young infants per adult female observed each month.

observed to coincide with peaks in adult females' time spent feeding. This most likely relates to the costs of pregnancy and lactation (Clutton-Brock, 1977; Key & Ross, 1999; Dufour & Sauther, 2002).

At Sukau, young infants were similarly present almost throughout the study (Fig. 1), with apparent peaks in births from February to April 1990 and from July to October 1990. The highest ratio of young infants to adult females was 0.32, in March 1990, while no young infants were observed in December 1990. Although not pronounced, peaks in births in 1991 were recorded from January to March and from June to December. Both birth peaks in 1991 began earlier than in 1990; the second birth season of 1991 was prolonged. In contrast to Abai, a birth peak coincided with the only peak in the adult females' feeding time, in December 1991. Other age-sex classes also fed more in this month. No correlation was observed between phenological patterns and rainfall for the same duration, or between the different plant parts eaten and rainfall.

In the Lower Kinabatangan, this study found that *N. larvatus* had birth peaks and the highest ratios of young infants to adult females, in February/March and September 1990, and in March, June/July, and December 1991. In contrast, Murai (2004a) at the same site reported no births in September 2000, or in February, July, and August 2001. Although seasonal weather conditions (Poirier, 1970; Melnick & Pearl, 1987; Struhsaker & Leland, 1987) and rainfall-induced food supply (Lindburg, 1987; Campbell, 2007) are reported to influence birth seasonality in some primates, and a birth peak in *N. larvatus* has been recorded near the end of the rainy season in March-May in Samunsam Wildlife Sanctuary (Rajanathan & Bennett, 1990), data currently available for *N. larvatus* in the Lower Kinabatangan are not sufficient to confirm such an influence. Furthermore, proximate mechanisms influencing birth seasonality might obscure normal patterns.

ACKNOWLEDGMENTS

This study was funded by the Wildlife Conservation Society. John R. Fellowes kindly commented on the manuscript.

REFERENCES

- Altmann, S.A. 1962. A field study of the sociobiology of rhesus monkeys, *Macaca mulatta*. *Annals of the New York Academy of Science* **102**: 338-435.
- Altmann, J. 1974. Observational study of behavior: sampling methods. *Behaviour* **49**: 227-267.
- Bennett, E.L. 1987. Big noses of Borneo. *Animal Kingdom (March/April)*: 9-15.
- Bennett, E.L. 1988. Cyrano of the Swamps. *BBC Wildlife* **6(2)**: 71-75
- Bennett, E.L. and Gombek, F. 1993. *Proboscis Monkeys of Borneo*. Borneo Natural History and Publications, KOKTAS, Kota Kinabalu, Malaysia.
- Boonratana, R. 1993. *The Ecology and Behaviour of the Proboscis Monkey (Nasalis larvatus) in the Lower Kinabatangan*, Sabah. PhD dissertation, Mahidol University, Bangkok, Thailand.
- Boonratana, R. 2002. Social organisation of proboscis monkeys (*Nasalis larvatus*) in the Lower Kinabatangan, Sabah, Malaysia. *Malaysian Nature Journal* **56(1)**: 57-75.
- Boonratana, R. 2003. Feeding ecology of proboscis monkeys (*Nasalis larvatus*) in the Lower Kinabatangan, Sabah, Malaysia. *Sabah Parks Nature Journal* **6**: 1-26.
- Campbell, C.J. 2007. Primate sexuality and reproduction. **In:** *Primates in Perspective*, C.J. Campbell, A. Fuentes, K.C. MacKinnon, M. Panger and S.K. Bearder (eds.), pp. 423-437. Oxford University Press, New York, USA.
- Clutton-Brock, T.H. 1977. Some aspects of intraspecific variation in feeding and ranging behaviour in primates. **In:** *Primate Ecology: Studies of Feeding and Ranging Behaviour in Lemurs, Monkey, and Apes*, T.H. Clutton-Brock (ed.), pp. 539-556. Academic Press, London, UK.
- Dufour, D.L. and Sauther, M.L. 2002. Comparative and evolutionary dimensions of the energetics of human pregnancy and lactation. *American Journal of Human Biology* **14(5)**: 584-602.
- Fedigan, L.M. and Gouzoules, H. 1978. The consort relationship in a troop of Japanese monkeys. **In:** *Recent Advances in Primatology, Volume I: Behaviour*, D. Chivers (ed.), pp. 493-495. Academic Press, London, UK.
- Goritzte, A.B. 1996. Birth-related behavior in wild proboscis monkeys (*Nasalis larvatus*). *Primates* **37(1)**:75-78.
- Hall, K.R.L. and DeVore, I. 1965. Baboon social behaviour. **In:** *Primate Behaviour*, I. DeVore (ed.), pp. 53-110. Holt Rhinehart and Winston, New York, USA.

- Hollihn U. 1973. Remarks on the breeding and maintenance of colobus monkeys (*Colobus guereza*), proboscis monkeys (*Nasalis larvatus*), and douc langurs (*Pygathrix nemaeus*) in zoos. *International Zoo Yearbook* **13**:185-188.
- Key, C. and Ross, C. 1999. Sex differences in energy expenditure in non-human primates. *Proceedings of the Royal Society of London. Series B: Biological Sciences* **266**(1437): 2479-2485.
- Kirkpatrick, R.C. 2007. The Asian colobines: diversity among leaf-eating monkeys. **In:** *Primates in Perspective*, C.J. Campbell, A. Fuentes, K.C. MacKinnon, M. Panger and S.K. Bearder (eds.), pp. 186-199. Oxford University Press, New York, USA.
- Lindburg, D.G. 1987. Seasonality of reproduction in primates. **In:** *Comparative Primate Biology Volume 2B: Behavior, Cognition, and Motivation*, G. Mitchell and J. Erwin (eds.), pp. 167-218. Alan R. Liss, New York, USA.
- Melnick, D.J. and Pearl, M.C. 1987. Cercopithecines in multimale groups: genetic diversity and population structure. **In:** *Primate Societies*, B.B. Smuts, D.L. Cheney, R.M. Seyfarth, R.W. Wrangham and T.T. Struhsaker (eds.), pp. 121-134. University of Chicago Press, Chicago, USA.
- Murai, T. 2004a. *Social Structure and Mating Behavior of Proboscis Monkey Nasalis larvatus (Primates; Colobinae)*. PhD dissertation, Hokkaido University, Japan.
- Murai, T. 2004b. Social behaviors of all-male proboscis monkeys when joined by females. *Ecological Research* **19**(4):451-454.
- Murai, T. 2006. Mating behaviors of the proboscis monkey (*Nasalis larvatus*). *American Journal of Primatology* **68**(8): 832-837.
- Napier, J.R. and Napier, P.H. 1967. *A Handbook of Living Primates*. Academic Press, London, UK.
- Poirier, F.E. 1970. The Nilgiri langur (*Presbytis johnii*) of South India. **In:** *Primate Behaviour: Developments in Field and Laboratory Research*, L.A. Rosenblum (ed.), pp. 251-383. Academic Press, New York, USA.
- Rajanathan, R. and Bennett, E.L. 1990. Notes on the social behaviour of proboscis monkeys (*Nasalis larvatus*). *Malayan Nature Journal* **44**: 35-44.
- Reinhardt, V., Reinhardt, A., Bercovitch, F.B. and Goy, R.W. 1986. Does intermale mounting function as dominance demonstration in rhesus monkeys? *Folia Primatologica* **47**: 55-60.
- Struhsaker, T.T. and Leland, L. 1987. Colobines: infanticide by adult males. **In:** *Primate Societies*, B.B. Smuts, D.L. Cheney, R.M. Seyfarth, R.W. Wrangham and T.T. Struhsaker (eds.), pp. 281-324. University of Chicago Press, Chicago, USA.
- Yeager, C.P. 1990. Notes on the sexual behavior of the proboscis monkey (*Nasalis larvatus*). *American Journal of Primatology* **21**: 223-227.
-
-