

# RANGING PATTERN, FEEDING AND TIME BUDGET OF LANGURS (*Semnopithecus entellus*) IN A RECENTLY ESTABLISHED HOME RANGE AT EASTERN UNIVERSITY CAMPUS, BATTICALOA, SRILANKA

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## Abstract

Ranging pattern, feeding activity and time budget were studied in a troop of langurs in the Eastern University campus. Locations, feeding preference and activities of members of the troop were recorded for a period of five months. The troop consists of 16 individuals. The home range was 8.3 ha; the core area was 0.063 ha. The leaves, fruits of a variety of plants were taken as feed. The preferred feed in the descending order for the pooled data include: *Azadirachta indica* leaves, *Terminalia catappa* leaves, *Poinciana* sp leaves, *Albizia* spp leaves, gum of *Anacardium occidentale*, *Mangifera indica* fruits, *Psidium* fruit, *Ficus* shoot and fruit, *Anacardium* fruit, *Samania saman* leaves, *Pongamia* shoot, *Tridax* spp leaves, *Leucaena* sp leaves, *Acacia* sp leaves, *Acacia* fruit and *Azadirachta indica* gum. The feed intake varied seasonally: *Psidium* fruits in March, *Acacia* and *Anacardium* fruits in April and *Mangifera* fruits in May and June. The frequency of feeding and play was higher in the mornings and evenings, whereas resting was observed at noon. Grooming was also observed at noon.

keywords: : *Semnopithecus entellus*, ranging, feeding, time budget, Batticaloa, Sri Lanka.

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## 1 Introduction

The use of space, feeding habits and social organization are important aspects of behavioural ecology. It is often assumed that patterns of movement and habitat selection are designed to maximize nutrient capture rates relative to time and energy costs [1]. Optimality models usually focus on single resource exploitation. In practice however, it will be necessary to take into account a number of variables: requirements for nutrients, water, microclimates and safety from predators etc., [2]. Primates use fixed habitats; they are not nomadic or migratory. In primates, males tend to leave their natal groups and home ranges after sexual maturity. On rare occasions females and entire troops also shift their home range. Habitat destruction is known to cause such shifts of home range of entire groups of Vervet monkeys [3]. Population size, space use and food intake will be affected in a new habitat. When the home range is shifted to a new and unfamiliar area predation was high because of the lack of knowledge about the habitat [3]. A newly established group of Hanuman langurs was sited in the Eastern University campus in the east coast of SriLanka, about three years prior to the study. The troop was largely arboreal making use of patches of trees in the campus. The reason for the shift to the new area of the troop can only be speculative as prior studies are not available. It is also assumed that this troop is not a result of fission [4] as there were no troops in and around the study area. Habitat destruction in the nearby forest area may have caused the shift to the campus, which has a large number of trees to supply the nutritional requirements of the troop.

The Hanuman/Common/Grey langur, *Semnopithecus (Presbytis) entellus* is distributed in South Asian countries: from Afghanistan border to Tibet, northwest of India, Bangladesh and north, east and southeast of SriLanka. These arboreal folivores are naturally found in rainforests and scrublands [5]. They also frequent urban areas. In human habituation encounters occur with man. This can be considered as a disturbed habitat. In a human habituation, the factors that affect the population size, movement and space use will be different from a natural habitat. Langurs in the east coast of SriLanka have not been studied previously. The aim of the study was to observe ranging pattern, feeding habits and time budget in a new home range as well as in a disturbed habitat. This can be considered a preliminary study since data pertaining to changes in group size, composition and home range will be acquired from further studies. This study will also provide preliminary information on the 'campus' troop necessary for further behavioral studies.

## 2 Study area

Eastern University campus (07° 43'N, 81° 42'E) is located on the east coast of SriLanka in the district of Batticaloa (not exceeding 7.62 m above sea level). The

climate is dry with a temperature range of 23.6 to 35.1° C and an annual rainfall of 1626 mm in 1998 [6]. The rains are received during the monsoon from October to March. The campus is bordered on the southeast by mostly uninhabited forests and paddy fields and by the main road on the northwest. Villages are found in the southwest. The campus has mostly single storied buildings and patches of trees. The trees include *Terminalia catappa*, *Anacardium occidentale*, *Azadirachta indica* etc. A small farm belonging to the University is located northeast of the campus.

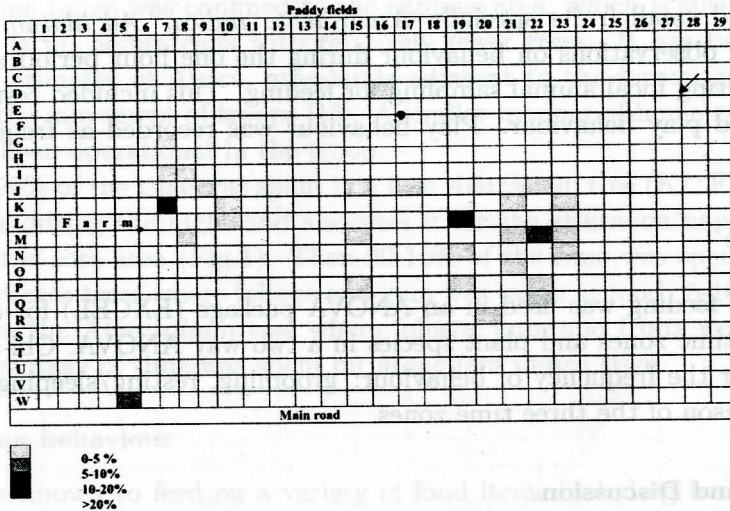


Figure 1: Percentage occupation of the troop in each quadrat

### 3 Methodology

Data was obtained from observations made on a single troop of langurs. Initial observations for about a month were made to become familiar with the troop members and the identification of males, females and juveniles. The study proper was conducted for a period of five months (March to July) in 1998. Even though it was not intended to study the seasonal variation in habitat use, feeding etc., temporal variation in feeding in relation to the fruiting season was observed. This variation is also presented. The troop was followed for two days per week for three hours in three time zones: 7.30 – 8.30, 12.30 – 13.30 and 17.30 to 18.30 hours. Thus a total of 117 hours of observations was made. The time zones were selected for convenience and to identify differences in behaviour during these zones to collect data on time budget. The campus map was marked into grids of 12.5 x 12.5 m. The occupancy of the troop was noted in each quadrat as the landmarks of the study area were already

known to the observer. The frequency of occupation was recorded for the 117 hours of observation. The percentage of occupancy in each quadrat was calculated from the total observations.

Activity of the members and the, types of food utilized were noted during these observations. Feeding was measured as food manipulation, searching for food and ingestion of food but not time spent chewing [7]. Feeding was recorded as frequency of behaviour during a period of 5 minutes per individual (adults) during each time zone as focal sampling. At times it was difficult to differentiate between feeding of foliage and small fruits specially *Azadirachta indica*. *Ad libitum* sampling [8] was done for observations on behaviour during the one hour period as frequencies while conducting focal animal sampling for feeding. This included resting/sleeping, grooming and play behaviour. Play behaviour was recorded as frequency of play bouts [9].

#### 4 Statistics

Frequency of feeding was used in an ANOVA package (EXCEL) for a comparison of the three time zones and plant species in a two way ANOVA. Chi-squared tests were done for the frequency of behaviour: grooming, resting/sleeping and playing for a comparison of the three time zones.

#### 5 Results and Discussion

The composition of the troop

The troop size was 16 individuals: 7 adults, 2 subadults, 4 juveniles and 3 infants. Of the adults, three were males and four were females. The average group size of hanuman langurs is 19 [10]. The mean number of members of troop per month was 20.4 in a study done in Jodhpur in northwest India [11] and 18.3 in a study in south Nepal [12]. The group size is small for a multimale group.

One infant was born during the study and two died due to electrocution from a live wire in the campus. In a natural habitat in a new and unfamiliar home range, the population is affected by predation [3]. In a disturbed human habituation mortality is caused by human related factors.

Hanuman langurs are well known for their social and ecological adaptability. Bisexual groups can exist as one-male or multimale troops. Males emigrate from the natal troops and join one of the all male bands [13]. The troop in the campus was also a multimale-multifemale one as there were three males. Multimale groups are generally larger (mean group size: 20.5; mean female group size: 7.2) than one male group (mean group size is 12.8 and female group size: 4.8) [14]. However, the numbers in the troop that we studied were lower than that of the average size of a multimale group.

### 5.1 Ranging behaviour

The home range of the troop was 8.3 ha; the core area where more than 20% of the time was spent was 0.063 ha. The average home range size of langurs is reported as 340 ha and can range from 5-1300 ha [10]. The home range of Hanuman langur troops in Jodhpur northwest India was 5 –130 ha [11]. The home range of langurs in our study was in the lower range. The troop observed in northwest India had 26 members (12 adults) and the home range was 75 ha [11]. It should be noted that the home range was confined to the campus area, which is surrounded by the main road, farm, homesteads with relatively fewer trees. It has been noted that in arboreal primates of Africa, grasslands adjacent to the forests generally act as barriers to the movement of troops [15]. A similar manner of home range limitation could have been operational in the troop.

More than 20% of the time was spent in a tree *Albizia* sp tree (K7, Fig.1) where the troop roosts during the night and also uses it for the afternoon naps. This can be considered the core area (Fig.1). Then 20-10% of the time was spent in a quadrat with *Azadirachta* trees where foliage and gum was taken as food. 5-10 % of the time was spent in the *Anacardium* tree where foliage, gum and fruits were ingested. A similar percentage of time was spent on *Mangifera indica* trees.

### 5.2 Feeding behaviour

Langurs are known to feed on a variety of food items including fruits, flowers and shoot [10]. During the course of our study the langurs utilized more than 16 plant species (Table.1), which This included foliage, fruits, flowers and gum. The major preferred food plants in the descending order: *Azadirachta indica* (leaves), *Terminalia catappa* (leaves), *Poinciana* sp (leaves), *Albizia* spp (leaves), gum of *Anacardium occidentale*, *Mangifera indica* (fruit), *Psidium* (fruit), *Ficus* (shoot and fruit), *Anacardium* (fruit), *Samania saman* (leaves), *Pongamia* (shoot), *Tridax* spp (leaves), *Leucaena* sp (leaves), *Acacia* sp (leaves), *Acacia* (fruit) and *Azadirachta indica* (gum). Seven of the plant species used to obtain food belonged to the Family Leguminosae. Apart from these shoot of *Azadirachta* and *Terminalia* formed a considerable portion of the diet. Occasionally the langurs also fed on the foliage and fruits of *Vitis vinifera*, foliage and gum of *Chloroxylon* sp. Crops such as bittergourd leaf, pod and foliage of beans, brinjal, manioc, papaw fruit, *Passiflora* fruit, capsicum, *Gliciridia* were also ingested occasionally, by raiding the farm nearby. These were rare and therefore they were not taken into consideration for analysis.

Primates use plant chemicals as drugs in prophylaxis or treatment of infectious disease or stimulants [16]. *Azadirachta* is known to have insecticidal properties. The leaf is used in viral infections and chronic malaria [17]. The gum of the *Azadirachta* tree is used for catarrh and general debility. Thus the langurs in our study may use the foliage and gum of the *Azadirachta* for medicinal purposes. Langurs in India

Table 1: Showing percentage of feed intake of each type of food for five months. Mean frequency (SE) of feeding pooled for all species is provided for each month.

	March	April	May	June	July	Over all %
<b>Family Leguminosae</b>						
Albizzia shoot	3.13	5.52	15.21	0.00	26.07	9.99
Acacia shoot	0.00	2.97	0.00	0.00	0.00	0.59
Pongamia shoot	0.00	4.03	7.82	0.00	0.00	2.37
Sapanea shoot	0.00	8.99	0.00	3.14	0.00	2.43
Leucaena shoot	0.00	3.30	0.00	0.00	0.00	0.66
Poinciana shoot	9.19	11.60	0.00	19.2	23.18	12.6
Acacia fruit	0.00	1.90	0.00	0.00	0.00	0.38
<b>Family Anacardiaceae</b>						
Anacardium fruit	0.00	8.67	0.00	15.02	0.00	4.74
Mangifera fruit	0.00	0.00	30.73	3.32	0.00	6.81
Anacardium gum	26.51	8.07	0.00	0.00	0.00	6.92
<b>Family Meliaceae</b>						
Azadirachta shoot/fruit	34.45	24.94	23.39	0.00	27.90	22.1
Azadirachta gum	0.00	1.48	0.00	0.00	0.00	0.30
<b>Family Combretaceae</b>						
Terminalia catappa shoot	14.20	11.50	0.00	20.18	22.85	13.7
<b>Family Compositae</b>						
Tridax shoot	6.68	2.60	0.00	0.00	0.00	1.86
<b>Family Myrtaceae</b>						
Psidium fruit	5.85	0.00	0.00	27.14	0.00	6.60
<b>Family Moraceae</b>						
Ficus	0.00	4.45	22.85	3.08	0.00	6.08
<b>Family Euphorbiaceae</b>						
Drypetis shoot	0.00	0.00	0.00	8.92	0.00	1.78
Mean frequency	39.9±8.3	75.1±12.6	66.3±11.1	58.0±8.4	74.9±6.4	

have been observed to feed on *Holarrhena antidysenterica* [16].

Feeding was mostly observed in the morning and evening time zones (Table.2) ( $F_{2,2105}=7.20$ ,  $p=0.0008$ ). There was also a significant interaction between the different species of plants used for feeding and the time zone ( $F_{34,2105}=2.65$ ,  $p<0.0001$ ). Even though the aim of the study did not include a seasonal variation in feeding pattern, data on differences mainly caused by the fruiting season is presented here.

Feeding was observed from 7 plants in March. This included the leaves of *Poinciana*, *Terminalia*, *Azadirachta*, *Tridax*, *Albizzia* and *Psidium* fruit. The gum of *Anacardium* was also eaten as an item of preferred food during March. In April the number of plant species used for food had increased to 14. The most preferred food being *Azadirachta* and *Poinciana*. The fruits of *Acacia* and *Anacardium* were also beginning to be eaten. In May the number of plants used decreased to 5 species. While continuing to feed on the foliage of *Terminalia*, *Azadirachta* and *Albizzia* the fruits of *Ficus* and *Mangifera* were also consumed. This trend continued to June,

Table 2: Mean frequency (SE) of feeding for all plant species in the three time zones. Means denoted by the same letter are not significantly different.

Time	Mean frequency of feeding
7.30-8.30 hours	76.66 ± 6.5 <sup>a</sup>
12.20-13.30 hours	34.4 ± 7.94 <sup>b</sup>
17.30-18.30 hours	86.92 ± 7.06 <sup>a</sup>

the fruits of *Mangifera* being consumed to a large extent.

Only foliage was consumed in July. 10.57% of the total frequency of food consumed was fruits in April. This value increased to 30.73% in May and was 45.48% in June. The frequency of fruit consumption in the months of March to June was not significantly different ( $F_{3,93}=1.24$   $p=0.299$ ). Gum of two species *Azadirachta* and *Anacardium* was consumed in April. In a study done in Africa the percentage of fruits consumed by an omnivorous primate Mangabey were also higher during the dry months [18]. A similar observation of maximum percentage of feeding on fruits was also reported from a comparative study of the langur and the purple faced monkey (*Presbytis senex*) conducted in the north central part of SriLanka [19]. In this study it was reported that both species altered their diet with the time of the year. During the rainy season leaves and shoots are eaten. In the dry season both species fed on fruits and flowers.

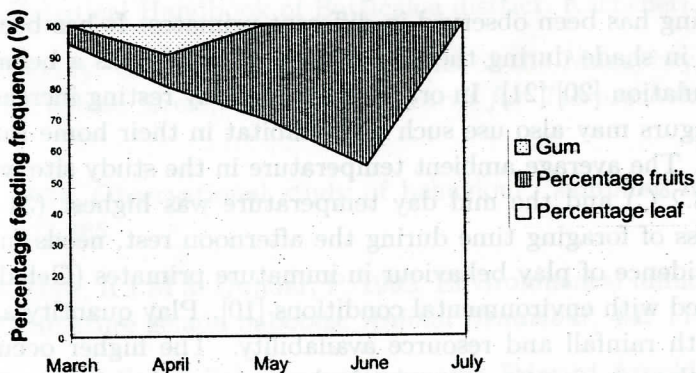


Figure 2: Percentage of feeding on foliage, gum and fruits of plants with months

The frequency of feeding was not significantly different between the months ( $F_{4,117}=1.41$ ,  $p=0.24$ ). A similar observation was also made in mangabeys where the shortage of food during the dry season was compensated by increase in the home

range [17]. The fruiting season being over in July for *Mangifera* and *Ficus* the langurs mainly fed on foliage afterwards. The foliage of four plants: *Poinciana*, *Terminalia*, *Azardirechta* and *Albizia* were the staple supply of food for the troop during the study period. *Anacardium* and *Mangifera* are two species affected by langurs as far as the human interest is concerned.

### 5.3 Time budget

Of the total observation of 117 hours 58.7% of the time budget was spent in feeding activity. Of the total frequency of behaviour 11.0% of the time budget was spent in play behaviour. Play behaviour was more frequent in the morning; 66% of the play behaviour occurred during the morning (play behaviour in the three time zones  $\chi^2$  test,  $p < 0.001$ ). 19.2% of the time budget was spent in resting (Table.3).

Table 3: Time budget (%) of resting, grooming and play behaviour during each time zone.

	6.30-7.30 hours	12.30-13.30 hours	17.30-18.30 hours
Resting (%)	4.8	95.2	0.0
Grooming (%)	12.5	50.0	37.5
Playing (%)	66.7	16.7	16.7

50% of the grooming observed and 95.2% of the resting/afternoon nap occurred during the afternoon (frequency of resting in the three time zones,  $\chi^2$  test,  $p < 0.001$ ). Mid day resting has been observed in different primates. It has been reported that baboons rest in shade during the hottest part of the day as a behavioural method of thermoregulation [20] [21]. In orang-utans mid day resting increased on dry days [22]. The langurs may also use such microhabitat in their home range to optimize energy levels. The average ambient temperature in the study site was lowest in the mornings (28.2°C) and the mid day temperature was highest (31.5°C). The cost benefits of loss of foraging time during the afternoon rest, needs further investigation. The incidence of play behaviour in immature primates (Gelada baboons) has been correlated with environmental conditions [10]. Play quantity and quality were correlated with rainfall and resource availability. The higher occurrences of play behaviour in the morning time zone in the langurs may be also be related to a short term advantage of optimizing energy levels as differences in ambient temperatures occur in the dry zone of SriLanka.

This study of a troop of langurs in the east demonstrates that the ranging behaviour is somewhat limited in a newly established and disturbed site whereas the feeding patterns are essentially similar to those studies done in forest habitats. Feeding, resting, grooming and play behaviour varied between the three time zones.

Postscript: At present the home range of the langur troop has increased (the study



reported here was in 1998). The residential area of the campus, which is across the main road is also inhabited by the troop. This area has a large number of *Anacardium occidentale*, *Ficus benchalenses*, *Cassia* sp. The home range seems to increase with time in a newly established habitat. Further studies are being done to compare the home ranges.

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