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Study of Home Range and Daily Activity Pattern in Hanuman Langur, *Semnopithecus entellus* around Jodhpur, Rajasthan (India)

Rashid Ali, Goutam Sharma, Arjun Singh, L.S. Rajpurohit

Animal Behaviour Unit, Department of Zoology, Faculty of Science, J.N.V. University, Jodhpur, Rajasthan, India

ABSTRACT: The ecology and behaviour of langurs have received considerable attention in the last 5 decades, little quantitative information exists concerning the ways langurs distribute their time performing different activities. In present study, data gathered during the systematic focal-animal sampling of study troop Langurs at Jodhpur are studied well for last 5 decades now. For demographic Study of Hanuman langur, females of different age classes in focal groups (i.e. B-7, B-9, B-18 and B-19) were followed regularly. During this all four focal troops were study for remark home range and one focal troop kailana Canal (B-18) observed for daily activity budget. That the langurs of Jodhpur devote about one third of their feeding time in provisioning. And the competition for artificial food is much higher than for natural diet.

KEYWORDS: *Semnopithecus entellus*, Daily activity, Home Range, Jodhpur

I. INTRODUCTION

The Hanuman langur (*Semnopithecus entellus*) a associate of south Asian colobinae is widely distributed. It is a highly flexible species happening in a wide range of habitats (Oppenheimer, 1977; Roonwal & Mohnot, 1977; Mohnot, 1974). The species is the best studied particularly at Jodhpur in the last 50 years.

The species has a variable social organization; the two basic types of social groups are bisexual troops and the all-male bands (Rajpurohit, 1987; Mohnot et al., 1987; Sommer & Rajpurohit, 1989). Social change is a natural process and the resident male replacement is an important and regular phenomenon of social change. The resident males of troops are changed usually after 2.5-3.0 years of tenureships (Rajpurohit, 1987; Sharma, 2007). The large number of data gathered on social behaviour and the ecologies of this species around Jodhpur. The idea of a core area, usually defined as the most frequently used area of the home range (Kaufman, 1962; De Vore and Hall, 1965; Jay, 1965) has a great deal of validity in the field, where it is usually quickly apparent that the group being studied favours one area within its home range. Home-range size can also be inclined by anthropogenic fluctuations to the location and human occurrence. For sample, habitat loss and fragmentation have reduced movements in numerous species worldwide (Sharma, et al, 2010; Rajpurohit, et al 2010).

II. MATERIAL AND METHODS

Hanuman langurs are studied in and around city of Jodhpur, which lies at the eastern fringe of the Great Indian Desert in Rajasthan (altitude about 241 m MSL, latitude 26° 18'N and longitude 73° 08'E). There are about 2500 langurs inhabiting in this isolated population in an area of about 150 sq km (Mohnot and Rajpurohit, 2001; Rajpurohit et al, 2006). The bisexual troops occupy their own home ranges of about 0.5-1.8 sq km with very few exceptions. Females remain life-long in their natal troops, males emigrate usually as juveniles and join unisexual social unit (all male band) whose home ranges can be as long as 15 sq km. Bisexual troops contains 9-154 individuals (average 44.5) and all male bands 2-52, average 12.5 (Mohnot and Rajpurohit, 2001; Rajpurohit et al., 2001).

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The current investigations are the part of a field study on langurs of Jodhpur based on ad libitum and scan sampling (Altman, 1974) during 2015-2017. The habitat used by the langurs contains open scrub forest, farms and orchids (Mohnot, 1974). Water is available to all groups throughout the year from man-made water holes. The diet consists of different parts from approximate 190 plant species (Mohnot, 1974). Jodhpur langurs are well habituated, are considered sacred and are never been hunted. They are easy to observe since animals are not that shy and spend most of the daytime on the ground. Data on different activity pattern in Hanuman langur were by using *ad libitum*, scan and focal animal sampling methods (Altmann, 1974).

III. OBSERVATION AND RESULTS

Hanuman langurs tend to travel as a cohesive group, it is easy to record distance along travel routes and to obtain approximation of range length. These ranges were measured for all the three focal groups and were recorded for a minimum of 6 consecutive days (range 6-8 days). Provisioning is very common in this area, though the intensity of provisioning varies from troop to troop. In general, the provisioning accounts for one-third of the total feeding time which may be more in some highly provisioned troops. A positive correlation was found between provisioning and home range size in this langur study site. And the larger troops had smaller home ranges as they are well fed (artificially).

Table 1. Jodhpur langurs troop size, home range of focal bisexual troops and types of feeding during study period (i.e. 2015-2017)

Troop	Troop size	Home range (sq. km.)	Feeding
B-7	128	0.5 to 0.8	Natural / Provisioned *
B-9	80	0.4 to 0.7	Natural / Provisioned*
B-18	34	0.3 to 0.5	Natural / Provisioned
B-19	26	0.3 to 0.4	Natural / Provisioned

* Highly Provisioned

The observational data of troop size and home range of B-7, B-9, B-18 and B-19 suggest a positive correlation among three parameters (troop size, feeding behaviour and home range). In this study the home range of focal troops was measured by total distance in meters travelled by these troops from dawn to dusk.

Daily agenda and activity design

The demographic structure in the Hanuman langur population of Jodhpur is exciting, in that some single males monopolize harems with, on average, 30 adult females. It has been proposed that extra troop males, which live in all-male bands, inhabit low- quality habitats and suffer from reduced food provisioning and longer daily travel distances.

Langurs are usually more active in the early morning time and evening. And less so at midday and in the afternoon (especially during hot months). Both on the ground and in trees a favourite resting position is to sit on its sub caudal pods, with the tail hanging limp or stretched on the ground behind, the hind legs stretched out in front and raised, resting on some support. In winter, however, they are comparatively more active at midday and in the afternoon.

The flexibility of langur's behavioural responses to fluctuation in resource availability is an essential component of the adaptive strategy. The analysis of the nature and causes of variability in activity proportion can contribute to our understanding of the nature of that adaptive strategy. There are five different categories to observed daily activity pattern. Feeding started when an animal made first contact with any part of a food plant, excluding contacts with the plant as a locomotor's substrate. Dozing includes solitary behaviour during which focal animals slept, rested or were motionless with eyes closed Locomotion category includes all locomotive activities, e.g. walking,

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running, climbing, leaping and jumping, monitoring contains solitary behaviour during which an animal was neither feeding nor sleeping nor involved in communal behaviour and in grooming, the focal animal established contact with other troop member with grooming intent.

Estimates of the proportions of time spent in different activities for all months in study troop B-18 suggest that of the total activity budget, langurs spend one third of the active period in monitoring i.e. 29.11% followed by dozing 21.29%, feeding 21.11%, locomotion 9.30%, grooming 16.19% and sexual and other social activities 3.00% in 2015. In 2016 langurs spend one third of the active period in monitoring i.e. 31.69% followed by dozing 22.90%, feeding 22.11%, locomotion 8.40%, grooming 11.90% and sexual and other social activities 3.00% and in 2017 langurs spend one third of the active period in monitoring i.e. 29.80% followed by dozing 20.10%, feeding 21.90%, locomotion 10.00%, grooming 14.80% and sexual and other social activities 3.40% (see table 2).

Table 2. Annual distribution of main activities in the bisexual study troop Kailana Canal (B-18) of Hanuman langur during 2015-2017

Activities	Percentage of total activity (%), 2015	Percentage of total activity (%), 2016	Percentage of total activity (%), 2017
Feeding	21.11	22.11	21.90
Dozing	21.29	22.90	20.10
Monitoring	29.11	31.69	29.80
Grooming	16.19	11.90	14.80
Locomotion	9.30	8.40	10.00
Sexual and Others	3.00	3.00	3.40

IV. DISCUSSION

Home range in general the home range has been measured as feeding, inactive and sleeping site or animals or troops or herds where animals limit their daily activities. (Mohnot, 1974; Devilal and Rajpurohit, 2009; Burt, 1943; Devilal, 2009; Roonwal and Mohnot, 1977; Srivastava, 1989; Jolly, 1985). Accessibility of food and its distribution is a main factor that regulates home range size of langur troops (Marsh, 1981; Raemaker, 1980; Newton, 1992).

A assessment of the outcomes found in this study with other studies of species is hard because of variances in sampling methods. Langurs in the forested area devote 40 to 60% of their action in feeding (Yoshiba, 1967) of the daily action, feeding at Simla was 40% (Sugiyama, 1976) and at Singer 30% (Oppenheimer, 1977). Rahman and Parthasarthy (1969) observed about 50% of the time being used up in sleeping and grooming, 10% in locomotion and 40 % in feeding activity. Similar results were attained by Post (1981) for yellow baboons. Harding (1976) and Rose (1977) for *Papio anubis*.

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