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Time budgeting and activity profile of free ranging forest group of Assamese macaque

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Key words: Assamese macaque, *Macaca assamensis,* time budgeting, activity profile.

Abstract

A study was carried out to find out the time budgeting and activity profiles of the forest group of Assamese macaque. For this a free ranging forest group of Assamese macaque was selected from the Jokai reserved forest (RF) of Assam, India. A total of 4800 *scan samples* were recorded covering all four distinct seasons. The study group spent more than one third (40%) of their total annual time for foraging purpose, followed by 25% on locomotion, 13% on resting, 10% on grooming, 9% on monitoring, 1% on play and 2% on sexual and other activities. A distinct seasonal variation in activities has been recorded. The activity profiles of the forest group have revealed that foraging is the most crucial factor responsible for the variation in the activity profiles. In forest, as the food was randomly distributed, the group cost-effectively arranged their total time and spent more time on foraging, locomotion and resting and less time in grooming, monitoring and play activities. These findings clearly demonstrated that nature of distribution of food resource is the guiding force for allocating time to various activities in different habitats.

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Introduction

Activity budget is an analysis of how different species allot their time among various activities, essential to any characterization of their life styles which lays the foundation for interrelating their ecology and behaviour (Struhsaker and Leland, 1979). Allocating time to different activities and distribution of these activities throughout the day is also important to understand how animals adjust to various habitats to optimize resource use for survival and reproduction. This is primarily because, "time" is a hidden constraint which may affect all other behaviour (Dunbar, 1992).

Species-specific studies of the activity budget have been carried out in rhesus macaque (Bernstein and Mason, 1963; Seth and Seth, 1986; Chopra *et al.,* 1992), pig-tail macaque (Bernstein, 1970, 1972) stump-tailed macaque (Bernstein, 1980), lion tailed macaque (Kumar, 1987; Kurup and Kumar, 1993), bonnet macaque (Singh and Vinathe, 1990). On contrary, no study was conducted till date on the ecology and behavior of the forest group of Assamese macaque. So this paper was aimed at a quantitative analysis of time budgeting activity budget of the forest group of Assamese macaque in relation to time allotment and its fluctuations in inter seasonal variability. This variability is important to understand the nature of the adaptive strategy of the Assamese macaque, which in turn is expected to help in species conservation.

Methodology

The study group was selected from the Jokai reserved forest (RF) of Assam. It lies between 27°15'55" E to 27°20'42" E and 94°50'29" N to 94°55'16" N covering an area of 1847 ha. It has an elevation of 100m above MSL. The vegetation profile of this reserved forest is of semi-evergreen type.

The group when studied had a size of 31 individuals comprising of 4 individuals of adult males, 6 adult females, 2 sub-adult males, 8 young females, 4 juvenile-II, 3 juvenile-I and 4 individuals of infants. The group was an inhabitant of closed forest and never visited agricultural land, tea garden and human habitation.

The visibility of the Jokai RF did not permit to follow the Focal Animal Sampling method (Altmann, 1974). However, the *Scan Sampling* (Altmann, 1974) was found to be best suited to study group activity profiles instead of inter-individuals relationships of forest group of Assamese macaque. The 5 minutes scan was adopted depending upon the visibility at the Jokai RF and the purpose of the study. A total of 4800 scan samples were recorded covering all four distinct seasons viz. pre-monsoon (PM), monsoon (M), retreating monsoon (RM) and winter (W). The group was followed dawn to dusk. Observation started half an hour before sunrise and continued half an hour after sunset. A specific cataloguing was followed to record activities like locomotion (travel), grooming, monitory, resting, play, feeding and other activities (including mainly sexual and agonistic interaction).

Locomotion : Any movement except foraging. It includes change in place and position, walking, running, jumping, climbing etc.

Feeding : Any activity related to feeding and drinking. It includes searching, feeding, drinking activities.

Resting : Motionless without eye movement (resting) and eye closed (sleeping).

Monitoring : Motionless with eye and head movement.

Grooming : Activity related to brushing skin to eliminate ecoto-parasites and salt granules.

Play : Any activity related to recreation - may be self directed or may involves two or more individuals.

Other activities : The activities which are less frequent categorized as other activities. It includes activities like agonistic interaction, reproductive activities.

Data analysis was done using Excel 2007 and XLSTAT software. To study whether any differences is there between activity patterns in different seasons, Non Parametric Man- Whitney U test has been used, assuming the samples are independent of each other.

Result

The forest group of Assamese macaque showed a distinct variation in activity profiles. This trend stands true not only in annual variation but also in season.

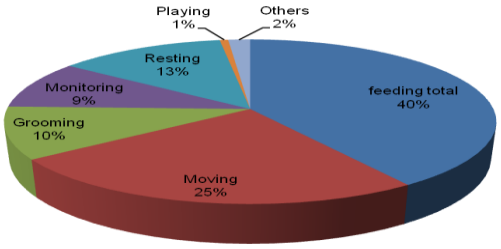

Fig. 1. Annual activity budget.

Annual Activity Budget

In this study it was found that 40% of their total annual time spend on foraging purpose, followed by 25% on locomotion, 13% on resting, 10% on grooming, 9% on monitoring, 1% on play and 2% on sexual and other activities (Fig : 1).

Seasonal Activity Budget

Feeding

The foraging activity has been found as the major activity profile in the forest group of Assamese macaque. They spent about 45% of their total time in feeding activity in pre-monsoon; 38% in monsoon; 39% in retreating monsoon and 38% in winter respectively. These differences of foraging activity have been found statistically significant in pre-monsoon, from retreating monsoon and winter ($Z_{observed} > Z_{critical}$ at 95% significant level). The deviation from average foraging activity showed that the studied group spent more time during pre-monsoon season while spent less time than the average time spent during winter, monsoon and retreating monsoon. However, a highest negative deviation was recorded during monsoon (Fig : 2 a & b).

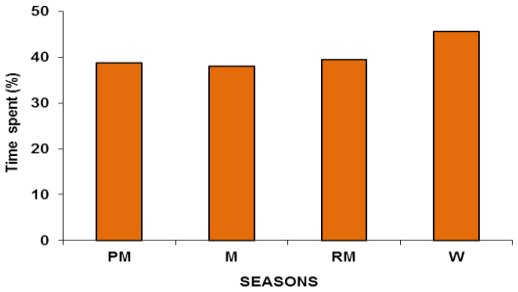

Fig. 2a. Seasonal variation of feeding activity pattern.

Locomotion

The locomotion activity has been identified as the major activity next to foraging. The study group spent 24.76% of their total time in locomotion in pre-monsoon; 25.29% in monsoon, 23.46% in retreating monsoon; and 25.61% in winter. Although the difference in average time spent in locomotion in different season is not statistically significant, the deviation from average locomotion activity indicated that the group spent lowest time than average during retreating monsoon season and more than average (highest) during winter season (Fig : 3 a & b).

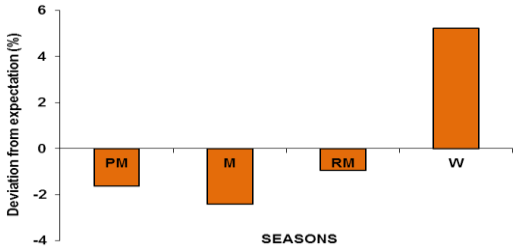

Fig. 2b. Deviation from the expectation of feeding activity.

Resting

The time spent in resting activity depends upon locomotion and foraging activities. The study group spent 10.60% of their total time in resting activity in pre-monsoon, 19.92% in monsoon, 11.58% in retreating monsoon and 7.31% in winter. The differences in time spent in resting are statistically significant in all respective three seasons with

monsoon season. The deviation from expectation indicates that the group spent more time in resting while less than expectation (lowest) in winter (Fig : 4a & b).

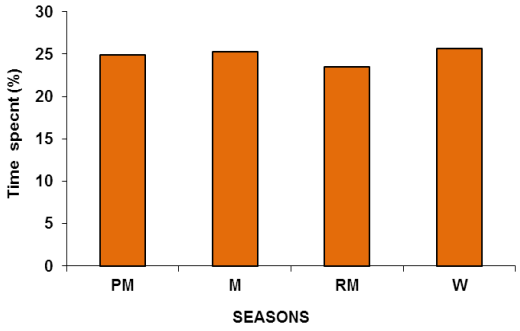

Fig. 3a. Seasonal variation of locomotion activity.

Monitoring

A less time spent in monitoring activity in comparing to resting, locomotion and feeding activities. The group spent 7% of their total time in resting in pre-monsoon, 7% in monsoon, 12% in retreating monsoon and 12% in winter respectively. These differences are statistically significant in all seasons. The deviation from expectation shows that the group spent more time than expectation in retreating monsoon and winter while less than expectation in pre-monsoon and monsoon (Fig : 5 a & b).

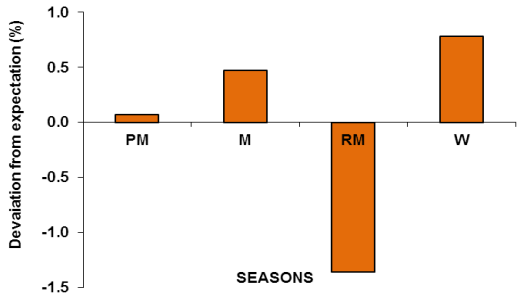

Fig. 3b. Deviation from the expectation of locomotion activity.

Grooming

The time spent in grooming by the forest group was 9% in pre-monsoon, 6% in monsoon, 12% in retreating monsoon and 14% in winter respectively. These differences are statistically significance in all seasons. The deviation from expectation shows that the group spent more time in grooming activity than expectation in retreating monsoon and winter while a less than expectation in pre-monsoon and monsoon (Fig : 6 a & b).

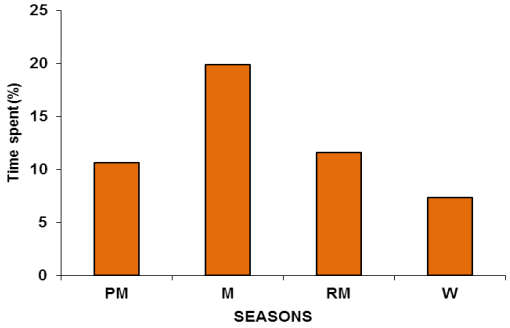

Fig. 4a. Seasonal variation of resting activity pattern.

Play

Play has been identified as one of the least time spending activity in primate. The study group spent less than 1% of their total time in play in all seasons. These differences are statistically significant in retreating monsoon with other seasons (Pre-monsoon, Monsoon and Winter). The deviation from expectation for play activity shows that the group spent less time than expectation in winter (Fig : 7 a & b).

Discussion

Food seems to be the most crucial primary factor that regulates day-to-day activity profiles. The amount of time spent on locomotion is determined primarily by the distribution of food and food plant species in the habitat and by the nature of food items. Individuals of the forest group had to move from one feeding site to another in order to get appropriate quantity of food, which were randomly distributed in Jokai RF. Therefore, the study group had to allot 25% time (range 23-26%) to locomotion. Similar results were earlier obtained in rhesus macaque (Chopra *et al.,* 1992) where the locomotion recorded was the maximum of 22% in the forest habitat and a minimum 12% in pond habitat, 20% in canal habitat, 19% in urban habitat and 16% in temple habitat.

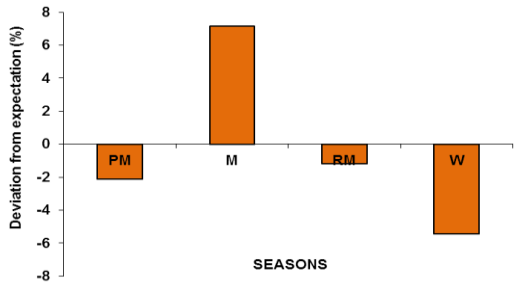

Fig. 4b. Deviation from the expectation of resting activity.

The present studies showed that the forest group spent 40% of their total annual time (range 38-45%) on feeding. Similar result was also found in a number of species. Wild-foraging vervets spent almost 40% of the time on feeding (Brennan *et al.*, 1985; Lee *et al.,* 1986). Malik (1986) and Seth and Seth (1986) also found approximately as high as 40% time spent in the forest monkeys. Chopra *et al.* (1992) while studying the activity profiles of the rhesus macaque in temple, urban, pond, roadside canal side and forest habitats, found out that the forest group spent about 30% of their total time on feeding. This further suggests that the distribution pattern of the food resource guides in reallocation of activity profile for higher time spend of feeding activity in forest group.

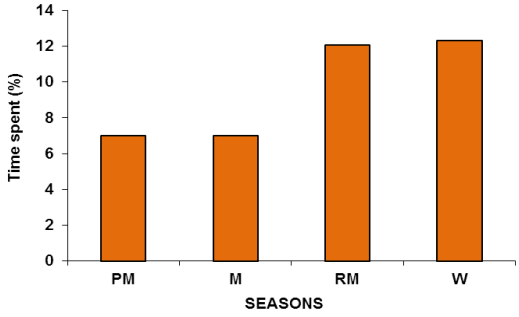

Fig. 5a. Seasonal variation of monitoring activity.

Higher time spent on locomotion, costs higher expenditure of energy. The forest group which spent more time on locomotion, had to spend more time on resting in order to make a balance of energy demand and supply. Hence, the study group spent annually 13% (range 7-20%) of their total time in resting.

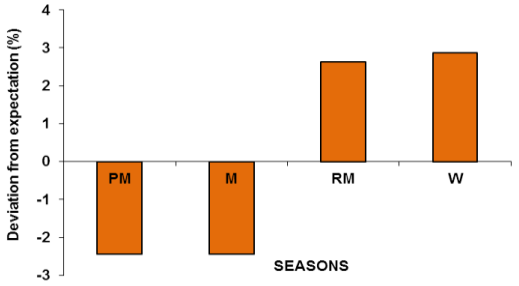

Fig. 5b. Deviation from the expectation of monitoring activity.

The monitoring behaviour has been found to be associated with detection of predator, and inter-and inter-group of the same species interactions for the same identical resources. As the group does not have to spend more time for looking provisioned food beside predator, the time spent in monitoring activity is remarkably less. Hence, the study group spent only 9% (range 7-12%) of time in monitoring.

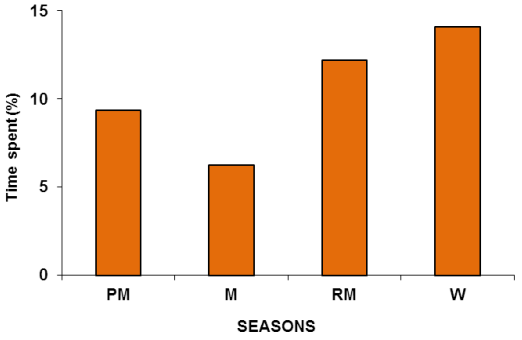

Fig. 6a. Seasonal variation of grooming activity.

As the food is randomly distributed in Jokai RF, individuals of primates do not able to monopolize the resources. Even, the inter-individual distances are more when the food is randomly distributed. Hence, "social tension" due to aggression is comparatively less in the forest group as compared to provisioned/ temple group.

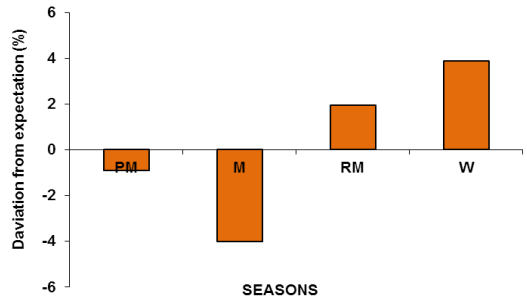

Fig. 6b. Deviation from the expectation of grooming activity.

Grooming behaviour in long term serves the function of reducing "social tension" (Schino *et al.,* 1988) and establishes a social bonding (Carpenter, 1942; Sade, 1965; Karland, 1977) among the individuals within the group. So, the forest group spent only 10% (range 6-14%) of their total time in grooming. Similar results also obtained in rhesus macaque where the forest group spent 4% of their total time in grooming instead of approximately 14% by provisioned group and 14% by urban group (Chopra *et al.*, 1992). Hence, lack of extra social tension in the forest group reduced the time spent on grooming in the forest group, on the basis of the *cost-benefit ratio*.

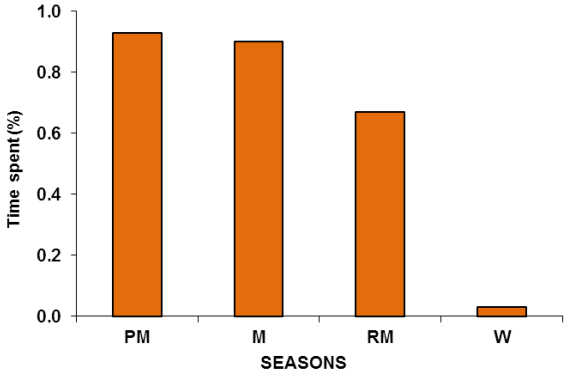

Fig. 7a. Seasonal variation of play activity.

All primates have been reported to perform play activity. The time spent in play activity varies from species to species, event population to population. It also varies from habitat to habitat depending upon quality and quantity of the food availability. Southwick (1967), Baldwin and Baldwin (1972,1976), Muller-Schwarze *et al.* (1982) have found that almost all animals cut down, or even eliminate play when there is a shortage of food. When there is either shortage or the food is randomly distributed, individuals of primates have to spend more time in feeding and locomotion and the time being saved is comparatively less in the forest group. Hence, individuals of the forest group spent only 0.6% (range 0.03-1%) of their total time in play. But, when the food is clumped in distribution either in captivity or in temple habitat, individuals of primates have more time for social activities including play. Studies in the captive colonies have shown that the stump-tail macaque spent as high as 5-13% (Bernstein, 1980; Rhine and Kronenwetter, 1972); pig-tailed macaque 8% (Bernstein, 1972); celebes black apes 8% (Bernstein and Baker, 1988); Sooty Mangabey 9% (Bernstein, 1976) of their time in play. Hence, the distribution of the food resource is the regulatory factor in allocating time for play.

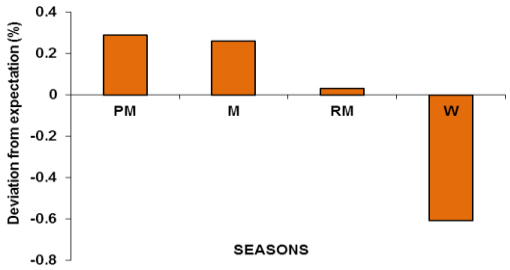

Fig. 7b. Deviation from the expectation of play activity.

The present study has revealed that feeding is the most crucial factor responsible for the variation in the activity profiles. In forest, as the food was randomly distributed, the group cost-effectively arranged their total time and spent more time on feeding, and locomotion. So, the time remains for resting and social activities is less in the forest group. On the other hand, high locomotion and foraging activity cost more energy expenditure and therefore, the group re-allocates the time budgeting for higher resting activity, and allocates a less time for social activities like grooming and play activities. Beside it, as the social tension does not develop much, such strong social net-working is not required when food is not clumped and randomly distributed in the habitat,

and therefore, forest group was devoting less time to grooming, monitoring and play activities. These findings clearly demonstrated that nature of distribution of food resource is the guiding force for allocating time to various activities in different habitats.

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