

**Assessing the feeding ecology of the Bengal slow loris
(*Nycticebus bengalensis*) in Trishna Wildlife Sanctuary,
Tripura**

A Thesis Submitted to

Manipal University

In partial fulfilment for the degree of

Master of Science
in Wildlife Biology and Conservation
2008

By

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Declaration

I declare that the thesis entitled “Assessing the feeding ecology of the Bengal slow loris (*Nycticebus bengalensis*) in Trishna Wildlife sanctuary, Tripura” comprises research work done by me under the guidance of Dr. Sindhu Radhakrishna, and co-guidance of Dr. Atul K. Gupta, IFS. The work is original and has not been done earlier by anyone else. Part of this work, which is related to or similar to work done by other researchers, has been cited in this thesis at appropriate places. The results presented in this thesis have not been submitted previously to this or any other university for an M.Sc. or any other degree.

Signature of the guide

(Dr. Sindhu Radhakrishna)

Signature of the candidate

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Certificate

I declare that the thesis entitled "Assessing the feeding ecology of the Bengal slow loris (*Nycticebus bengalensis*) in Trishna Wildlife sanctuary, Tripura" comprises research work carried out by Swapna N. at the Centre for Wildlife Studies under my guidance, and the co-guidance of Dr. Atul K. Gupta, IFS, during the period 2007-2008, for the Degree of Master of Science in Wildlife Biology & Conservation of the Manipal University. The results presented in this thesis have not been submitted previously to this or any other university for an M.Sc. or any other degree.

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EXECUTIVE SUMMARY

The distribution, biology and behavioral ecology of the Bengal slow loris (*Nycticebus bengalensis*) remain largely unknown. Studies on dietary habits are especially critical not only to determine their nutritional requirements, but also to understand how distribution of food resources could determine density, local distribution and social interactions. The objectives of this study on the Bengal slow loris were to determine the food types and species in the diet, dietary preferences and the effect of seasonal variations on these preferences.

This study was carried out from December 2007 to May 2008, at Trishna Wildlife Sanctuary in the Indian state of Tripura. The study period covered winter (December – February), when a maximum and minimum atmospheric temperature of 33°C and 8°C was recorded and summer (March and April), when a maximum and minimum atmospheric temperature of 37.7°C and 17°C was recorded. The major vegetation in the study site was moist mixed deciduous secondary forest about 4 m in height interspersed with dense bamboo clumps. Dominant tree species included *Holarrhaena antidysenterica*, *Mitragyna rotundifolia*, *Glochidion zeylanicum*, *Dillenia pentagyna* and *Terminalia belerica*. Data on time-activity budgets were collected using instantaneous sampling at an interval of five minutes while continuous focal animal sampling was used to record all instances and duration of feeding, over a total of 177 hours (100 hours in winter and 77 hours in summer). Vegetation (trees, lianas and scandent shrubs) was sampled in seven 50 m x 50 m plots while the phenology of trees was monitored twice a month in four plots.

Feeding comprised $22.25 \pm 2.20\%$ (mean \pm standard error) of the activity budget over the study period, with no difference between summer and winter. Six food types were recorded, with as much as 86.52% of feeding time being spent on exudates (gums and saps) across the two seasons.

Lorises almost exclusively fed on exudates in winter (94.34% of total feeding time). In winter the loris fed mostly on exudates of *Terminalia belerica* (39.79%) which formed 5.72% of all trees counted from the seven plots; however, in terms of preference, the exudates of 4 less abundant species (*Sterculia villosa*, *Albizia stipulacea*, *Albizia procera* and *Spondias pinnata*) rated more highly. In summer insects, fruits and nectar were incorporated into the diet to a larger extent, although exudates still formed the major part of the diet (67%). Lorises preferentially fed on exudates of two species of scandent shrubs - *Acacia pennata* (62.79%) and *Acacia concinna* (7.78%) in summer. These results show that *N. bengalensis* possibly switches to abundant but poorer quality resources (such as *T. belerica*) during periods of resource scarcity, which may play a very essential role in the maintenance of species. However more information on nutritional contents of the food items, especially exudates, is required to test this hypothesis.

This study, although limited to only two seasons, places the Bengal loris as the most exudativorous loris.

ACKNOWLEDGEMENTS

I Thank PCI (Primate Conservation International), for funding the study, (especially Noel Rowe of PCI for showing interest in this project), Centre for Wildlife Studies for logistical support, National Centre for Biological Sciences for academic support and Manipal University for certifying the course.

Many thanks to Ajith sir for the oodles of great advice that helped shape many pages of meaningless rambling into its present form. Most importantly I thank him for his constant encouragement and support throughout the course.

I am grateful to Sindhu for guidance, valuable advice and above all for her patience with me right from the beginning of the project. I thank Dr. Atul Gupta (APCCF & Chief Wildlife Warden, Tripura Forest Department) for granting the required permits, providing valuable information and arranging for logistic support, but most of all I am indebted to him for his generosity and constant encouragement right through my stay at Trishna. I am grateful to the Tripura Forest Department particularly Mr. Animesh Das, Wildlife Warden, Trishna Wildlife Sanctuary for logistic support.

I express heartfelt thanks to Koushik Majumdar from Tripura University for taking time out to visit me in field and help with plant identification. I also wish to thank Dr. B. K. Dutta (Reader, Department of Botany, Tripura University) for helping with plant identification.

I express thanks to Geoff, Dev, Rashid, Karthik and Anish for their valuable inputs while writing my thesis. I thank Vicky Lakshman for letting me use his photograph. I thank Umesh and Sujata (NCBS) for helping with printing of photographs. I thank Sannapa for all his help during the entire course and for helping me procure some very important signatures at the very last minute.

None of this would have ever been possible without the help, support and undying enthusiasm of Suman, Ratan and Nimay. I am especially indebted to them for their patience, for enduring all those nights with hundreds of mosquitoes, for climbing, measuring, counting and identifying thousands of trees without complaints and most of all for enduring me. Mostly I thank them for their wonderful company, delicious Bengali food and movies which made my stay at Trishna all the more memorable. I thank Vimol for his amazing company, sense of humour, for cooking four meals a day without any complaints, trying to teach me Bengali and for all the chai-time conversations.

Thesis writing time would have been insufferable if it wasn't for the company of the fantastic and insane late night gang – Chachi, Diptesh, Doc, Kullu, Kutti, Matha, Nachi, Nandi, Pani and the most recent addition Pizza. I also thank all of them for all their inputs during analysis and thesis writing.

I cannot thank dad, mom, Vicky, Megs and Shireen enough for bearing with me during both my absence and presence. Last but not the least I cannot thank the lorises of Trishna enough for letting me into their secret world.

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INTRODUCTION

Studies on dietary habits are critical not only to determine a species' nutritional requirements, but also to understand how distribution of food resources could determine density, local distribution and social interactions [Oates, 1987]. Studies that investigate the dietary habits and preferences of different species in their natural habitats not only contribute to our understanding of their behavioural ecology but also have significant conservation implications. Further, for animals like the primates, adequate knowledge of nutritional requirements is also essential to maintain healthy, reproductively viable populations in captivity [Sussman, 1978 in Strier, 2003].

While much is known about gregarious diurnal primates the same is not true for nocturnal primate species, even after 70 years of systematic primatological research [Wiens, 2002]. The infraorder lorisiformes, with 34 recognized nocturnal species under three subfamilies Galaginae (galagos), Perodicticinae (pottos and angwantibos) and Lorisidae (lorises) could easily be labeled as the "least known of all primates" [Nekaris & Bearder, 2007]. This suborder is represented by two species in India - *Loris lydekkerianus* (slender loris) and *Nycticebus bengalensis* (Bengal slow loris) [Groves, 2001]. Within the infraorder lorisiformes, slow lorises are among the least studied species.

The slow lorises being predominantly arboreal, nocturnal and cryptic by nature are difficult to observe in their natural habitats as a result of which until recently the slow lorises were considered as a single highly polymorphic species [Nekaris & Bearder, 2007]. However at present at least five species have been recognized based on genetic differences, and differences in dentition and morphology [Roos, 2003; Brandon-Jones et

al., 2004; Chen et al., 2006; Nekaris & Bearder, 2007 in Nekaris & Nijman, 2007]. *N. bengalensis* has the largest geographic range among the slow lorises and has been recorded from northeastern India, Burma, Cambodia, southern China, Laos, Thailand (north of the Isthmus of Kra), and Vietnam [Brandon-Jones et al., 2004]. It is noteworthy that only recently was the Bengal slow loris recognized as a species [Groves, 2001], distinct from *N. coucang* (greater slow loris), which is distributed in Indonesia, Malaysia, and Thailand [Nekaris & Bearder, 2007]. The *N. javanicus* has the most limited distribution among the slow lorises, being found only in Indonesian Java. *N. menagensis* (Bornean slow loris) is distributed in Brunei, Indonesia and Malaysia while the pygmy or lesser slow loris (*N. pygmaeus*) is distributed in Cambodia, China, Laos and Vietnam.

Other than for the limited sporadic information available on the behaviour of slow lorises from preliminary observations there have been only two long-term field studies on *N. coucang* in Malaysia [Weins, 2002] and *N. pygmaeus* in Vietnam [Streicher, 2003; Streicher, 2004 in Nekaris & Bearder, 2007]. Weins et al. (2006) report that *N. coucang* mainly feeds on floral nectar and nectar-producing parts and phloem saps (~ 65 %) while fruits and animal prey constituted a much smaller proportion of the species diet. Although *N. coucang* individuals exploited food resources from a total of 27 plant species, they were largely dependent (~ 70%) on five plant species for their food requirements. More interestingly, 41% of all feeding observations recorded the species to be feeding on nectar from the flowers of *Eugeissona tristis*. The study on *N. pygmaeus* revealed that the species showed a preference for a particular diet type. Results showed that 63% of its diet comprised gums, 33% comprised animal prey while other food types constituted the remaining 4%. Thus both species are shown to exhibit dietary preferences and the

absence of certain highly-preferred plant species could significantly affect the density and distribution of the species.

Apart from scant information on distribution and some preliminary observations on habitat and dietary preferences, the distribution, present status, and ecology of *N. bengalensis* remains virtually unknown across its distributional range. In India Choudhury (1992) mapped the distribution of the species based on information from 43 protected areas in northeastern India. Further, Radhakrishna et al. (2006) carried out surveys in Assam (25 sites) and Meghalaya (4 sites) and reported that Bengal slow lorises were sighted in <20% of the surveyed sites. Preliminary observations suggest that the Bengal slow loris shows a preference for subtropical and tropical evergreen and semi-evergreen rainforests (up to 1300 m ASL) and that its diet comprises shoots, fruit, insects, reptiles and birds [Gupta, 2001]. Thus it is evident that the dietary habits of *N. bengalensis* are practically unknown.

N. bengalensis appears to be fast declining in many areas across its distributional range [Srivastava, 1999]. A survey carried out by the Indo-US Primate Project between 1994 and 1999 reported the presence of the species only in a few isolated pockets [Srivastava, 1999]. In addition local extinction of the species has already been reported from the Rowa Wildlife Sanctuary, Tripura, India [Choudhury, 2001]. Several studies have recorded that *N. bengalensis* faces a multitude of threats across its known range in India. Gupta (2001) has cited habitat destruction as a result of shifting cultivation to be a primary threat to populations of this species, while Radhakrishna et al. (2006) point out that disturbances such as tree felling, road kills by vehicles, trapping and hunting are detrimental to the survival of the species [Radhakrishna et al., 2006]. Molur et al. (2003) report that habitat

loss due to the construction of roads, dams, power lines, fragmentation, deliberate fires and use in traditional medicine pose significant threats to the species. Thus the need for better information on distribution, abundance, ecology and conservation status of this species has been repeatedly emphasized by many authors [Gupta, 2001; Radhakrishna et. al., 2006].

The goal of the present study was to understand the feeding ecology of *N. bengalensis*. The study was carried out in Trishna Wildlife Sanctuary, Tripura, from December 2007 to April 2008.

In the manuscript titled “Feeding ecology of the Bengal slow loris (*Nycticebus bengalensis*) in Trishna Wildlife Sanctuary, Tripura” targeted for the *American Journal of Primatology*, I provide the first ever information on the components (food types and species) that comprised the diet of the species, the dietary preferences and the effects of seasonal variations on these preferences at Trishna Wildlife Sanctuary.

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Feeding ecology of the Bengal slow loris (*Nycticebus bengalensis*) in Trishna Wildlife
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ABSTRACT

I studied the feeding ecology of *Nycticebus bengalensis* (Bengal slow loris) in Trishna Wildlife Sanctuary, Tripura, northeast India, for five months spanning across two seasons (winter – December to February and summer – March and April). I collected data on time-activity budgets using instantaneous sampling with 5 minute intervals and used continuous focal animal sampling to record all instances and duration of feeding, over a total of 177 hours (100 hours in winter and 77 hours in summer). I recorded 329 bouts of feeding that accounted for $22.25 \pm 2.20\%$ of the activity budget over the study period. Six food types were recorded for the species – exudates (gums and saps), nectar, fruit, bark, insects and avian eggs. The study, although limited to two seasons, identifies *N. bengalensis* as the most exudativorous loris with 86.52% of total feeding time being expended on exudates. Methods used to extract exudates were similar to those used by *N. coucang* and *N. pygmaeus* in Asia, *Cebuella* and *Callithrix* in South America and *Phaner* in Madagascar. In winter lorises almost exclusively fed on exudates (94.34% of total feeding time in winter) while in summer, more feeding time was spent on insects, fruits and nectar, although exudates still dominated the diet (67% of total feeding time in summer). Though exudativory in winter was most prevalent on *Terminalia* (39.79%), one among the five most abundant trees in the study area, they preferentially fed on exudates of four other less abundant species. In summer this preference changed to two species of *Acacia* scandent shrubs. *N. bengalensis* possibly switches to abundant but poorer quality resources (such as *T. belerica*) during periods of resource scarcity, and such species may play a very essential role in the maintenance of the population. However more information on nutritional contents of the food items, especially exudates, is required to test this hypothesis.

INTRODUCTION

The diet of a species is one of the most fundamental aspects of its ecology and needs to be understood not only to determine the species' nutritional requirements, but also to understand how distribution of food resources could determine density, local distribution and social interactions [Oates, 1987]. Animals exhibiting extreme selectivity in diet maybe particularly vulnerable to problems associated with nutritional deficiencies [Garber, 1987] and to environmental stressors and anthropogenic disturbances that impact their specific food requirements [Strier, 2003]. In contrast, generalist species that are able to exploit a wider range of food components may adapt better by adjusting their diets or shifting their ranging patterns [Channell & Lomolino, 2000; Cowlshaw & Dunbar, 2000 in Strier, 2003]. As a consequence, studies investigating the dietary habits and preferences of different species in their natural habitats not only contribute to our understanding of their behavioural ecology but also have significant conservation implications. Further, adequate knowledge of primate nutritional requirements is also essential to maintain healthy, reproductively viable populations of primates in captivity [Sussman, 1978 in Strier, 2003].

Primates consume a variety of food types such as leaves, corms, grasses, insects, fruit, flowers, plant exudates and vertebrate prey, thus exhibiting an omnivorous dietary pattern [Garber, 1987]. Nevertheless, many members of this order depend on relatively specialized diets, leading them to be classified as belonging to the following feeding guilds – faunivores, frugivores, folivores and less commonly gummivores [Nash, 1989].

Owing to difficulties associated with the quantification of diet in nocturnal primates [Chivers, 1998], relatively few studies have been carried out in their natural habitats. The lacuna of information on diet and the feeding ecology of nocturnal primates is most keenly felt in the Infraorder lorisiformes, which includes the galagos, pottos and lorises [Groves, 2001]. In spite of including some of the most specialized of primates, this group has

received relatively less attention and is regarded as the least known of all primate groups [Nekaris & Bearder 2007]. In their recent review of the behaviour and ecology of this Infraorder, Nekaris & Bearder (2007), state that only seven studies have focused in detail on the diet of members of this group.

Available information shows that lorisiforme primates are not only highly varied in their dietary choices, but also show distinct preferences for one or a few food types such as gum, fruit and animal prey [Nash, 1989; Chivers, 1998; Nekaris & Rasmussen, 2003; Nekaris & Bearder 2007]. Slender lorises are extremely specialized in their feeding ecology, with more than 90% of their diet composed of insects and animal prey [Nekaris & Rasmussen, 2003; Nekaris & Jayawardene 2003]. Weins et al. (2006) report that the greater slow loris *Nycticebus coucang* feeds primarily on phloem saps (34.9%), floral nectar and nectar-producing parts (31.7%) while fruits and animal prey constitute a much smaller proportion of the diet of the species. The pygmy slow loris *Nycticebus pygmaeus* appears to specialize on one food type – results from a long term study in Vietnam show that a major proportion of its diet was composed of gums (63%) followed by animal prey (33%), while other dietary types constituted a minimal proportion [Streitcher, 2004].

Bengal slow loris *Nycticebus bengalensis* inhabit the forests of northeastern India, Burma, Cambodia, southern China, Laos, Thailand (north of the Isthmus of Kra), and Vietnam [Brandon-Jones et al., 2004]. Largest and most widely distributed among the slow lorises the Bengal slow loris remains unknown in terms of its behaviour, diet and feeding ecology due to the absence of any quantitative study on the species in its natural habitat [Groves, 2001; Radhakrishna et al., 2006].

In this study I provide information on the dietary components, preferences in diet and effect of seasonal variations on the diet of *N. bengalensis* from the first systematic study on the species. This data presents a fresh and sorely-required perspective on the

behavioral ecology of the species and is critical in assessing its long-term conservation needs.

METHODS

Study area

I carried out field observations between December 2007 and May 2008 at the Trishna Wildlife Sanctuary located in southern Tripura (23°12' N to 23°32' N and 91°15' E to 91°30' E), India (Fig. 1). The Sanctuary spans an area of 194.8 km² and encompasses four different vegetation types – tropical semi-evergreen, East Himalayan lower *bhabar sal*, moist mixed deciduous forest and savannah woodland [Tripura Forest Department, unpubl. data]. I recorded a maximum and a minimum temperature of 33°C and 8°C in winter (December to February) and 37.7°C and 17°C in summer (March and April). The area receives a maximum rainfall of 508.2 mm in July and a minimum of 3.6 mm in December [Tripura Forest Department, unpubl. data].

During a preliminary survey of the distribution and status of the Bengal slow loris between June 2007 and July 2007 I had identified a potential study population within the core area of the Sanctuary [Swapna et al., 2008]. I selected a pre-existing trail within the core area, along which I walked after sunset to locate lorises. The major vegetation in the study site was moist mixed deciduous secondary forest (refer to Appendix 4 for species composition) about $4.2 \pm 0.024\text{m}$ (mean \pm SE; $n = 1809$) in height and interspersed with dense bamboo clumps. Altitude along the trail ranged from 48 m to 76 m above sea level.

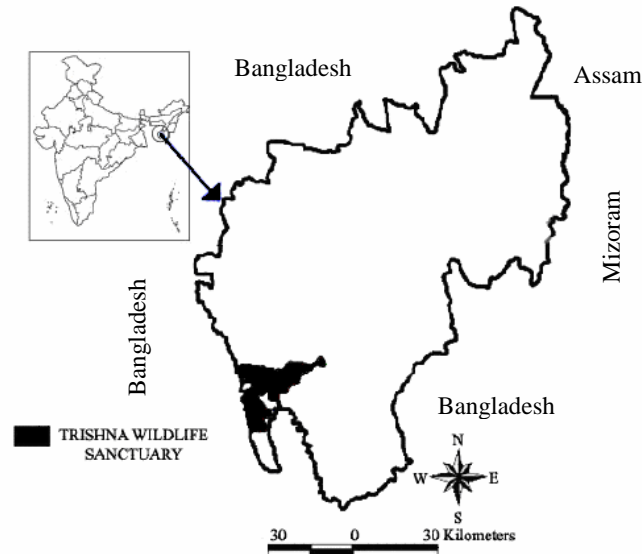


Fig. 1: Map of Tripura showing Trishna Wildlife Sanctuary
 (Reproduced from - http://www.wii.gov.in/enviis/hoolock_gibbon/tripura.htm
 [accessed on 1-7-2008]

Field methods

I detected lorises using Petzl headlamps, after which I followed them for as long as possible. In case the individual being followed was lost for thirty minutes I continued along the trail to locate another individual. As I was unable to individually identify lorises I regarded every subsequent sighting as a different individual.

Activity budget: I used instantaneous sampling [Altmann, 1974] at five minute intervals to record activity. I broadly classified activities into locomotion [Rasmussen, 1986], foraging [Nekaris, 2001], feeding [Nekaris, 2001], grooming [Rasmussen, 1986], resting (all inactive behaviours including sitting, standing and sleeping) and socializing (all behaviours directed towards conspecifics). If the individual was feeding on a plant part, I recorded the species and part being consumed, or else the food item was recorded.

Feeding behaviour: Whenever an animal was located, I used continuous focal animal sampling [Altmann, 1974] till the animal was lost, to record all instances and

duration of feeding, along with the food type (e.g. exudates, fruit, nectar, bark, invertebrates) and the associated plant species.

Vegetation and Phenology monitoring: I sampled the abundance of trees (>10 cm GBH) and liana species from seven 50 m × 50 m plots located along the trail, separated by at least 500 m. I also recorded the presence of buds, flowers and fruits on all trees and liana in four of these plots twice a month.

Analytical methods

Based on differences in minimum day temperatures I divided the study period into two seasons; winter (January to February) and summer (March to April). I divided the night into four quarters (I: 1700 to 2000h, II: 2001 to 2300h, III: 2301 to 0200h and IV: 0201 to 0500h).

Activity budgets: I included data only from individuals with 12 or more instantaneous scans in the estimation of activity budget. I estimated the percentage time spent on each activity per quarter per individual from instantaneous scans using the formula:

$$T_{aqi} = (n_{aqi} / N_{qi}) \times 100$$

where, T_{aqi} = Percentage time spent on activity a in quarter q by individual i ,

n_{aqi} = number of records of activity a in quarter q for individual i , and

N_{qi} = number of records of all activities in quarter q for individual i .

I used the Wilcoxon rank sum test using the statistical software R (version 2.6.1) [R Development Core Team 2007] to test for significant differences in activities between the two seasons, treating seasons as independent samples. In order to test differences between males and females in the frequencies of different activities, I used the Chi-Squared test (χ^2). As the number of records for females was fewer in comparison to

males, I picked a random sample of equivalent size (from the same months and time quarters) for males for comparison between the sexes.

Diet: I estimated the percentage time spent feeding on different plant species and food types for each season from focal animal continuous sampling using the formula:

$$P_a = (n_a / N) * 100$$

where, n_a is the total amount of time spent feeding on species or type a , and

N is the total feeding time observed for that season.

To estimate preference for or avoidance of plant species in diet, I used the Vanderploeg and Scavia Relativized Electivity Index (E_i^*) [Lechowicz, 1982], given as:

$$E_i^* = [W_i - (1/n)] / [W_i + (1/n)]$$

where, $W_i = E_i' / \sum E_i'$ and

$$E_i' = r_i / p_i,$$

Where, r_i is the percentage time spent feeding on species i , p_i is the percentage availability of species i and n is the total number of species in diet. The Vanderploeg and Scavia Relativized Electivity Index (E_i^*) is based on the selectivity coefficient (W_i). It ranges from -1 to +1, where a zero value indicates random feeding, 1 indicates maximum preference and -1 indicates maximum avoidance [Lechowicz, 1982].

All analyses were carried out using R (version 2.6.1) [R Development Core Team 2007].

RESULTS

Lorises were observed for 100 hours in winter and 77 hours in summer amounting to a total of 177 hours across 78 days (winter – 48 and summer – 30). I encountered lorises 159 times over the study period and obtained 80 hours of observations on males, 20.5 hours on females while the remaining time was spent observing unidentified individuals. The earliest record of activity was at 1603h in the month of February while the latest record of activity was at 0515h in March.

Activity pattern

Feeding comprised 22.25% of the activity budget over the study period. It comprised 23.7% and 20.27% of the time in winter and summer respectively (Fig. 2). There was no significant difference between the two seasons in feeding (Wilcoxon rank sum test, $W = 1435.5$, $p = 0.44$) and foraging ($W = 1260$, $p = 0.66$). The times spent on locomotion, grooming and resting were also very similar in winter and summer (Fig. 2).

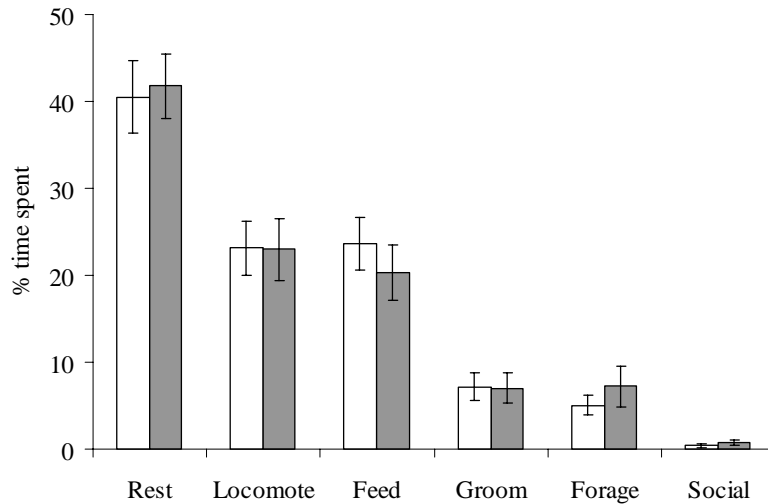


Fig. 2: Percentage time spent on different activities in winter (open) and summer (shaded)

While males moved (40.4%) and foraged (10.8%) more, females fed (18.7%) and rested (44.5%) more (Appendix 1). The frequency of different activities differed significantly between the males and females ($\chi^2 = 11.29$, $df = 5$, $p = 0.05$).

Diet

I recorded 329 bouts of feeding over the study period. Individuals consumed parts of seven species of trees, two scandent shrubs and one woody climber (Table 2). I recorded six food types – plant exudates (gum and sap), nectar, fruits, bark, invertebrates and bird eggs. Over the study period, exudates dominated the diet with 86.52% of the total feeding time expended on exudativory, with little feeding time spent on nectar (3.8%), insects (2.9%), bark (1.9%), fruits (0.3%) and others (4.6%).

There was a seasonal variation in the percentage of time spent feeding on different food types (Fig. 3). Individuals fed almost exclusively on exudates in winter (94.34% of total feeding time), while in summer relatively more time was expended on invertebrates (5.07%) and nectar (13.2%), although exudates (67%) still dominated the diet.

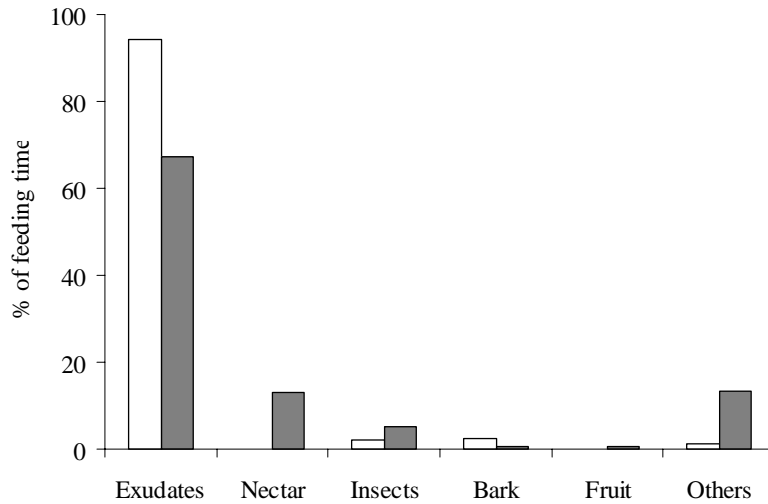


Fig. 3: The percentage feeding time spent on different dietary types, in winter (open) and summer (shaded)

Exudates: A total of 183 bouts of exudativory were observed, accounting for 86.51% of total feeding time. Individuals depended on ten species of trees for their exudates in winter and six in summer, with six species common to both seasons (Fig. 4). Out of total feeding time on exudativory in winter, 39.79% was spent on *Terminalia belerica* and 31.80% on *Sterculia villosa*. However in summer, exudates of the scandent shrub *Acacia pennata* accounted for 85.97% of the total feeding time on exudativory. While some species were only scraped to collect gum (*Terminalia belerica*, *Albizia procera*, *Careya arborea* and *Firmiana colorata*) the rest were gouged into to elicit exudate flow. Lorises obtained exudates from tree trunks and relatively less frequently from branches as well. Time spent on bouts of exudativory was highly variable with a mean \pm SE of 178.82 ± 17.33 seconds. Average time spent on bouts of exudativory on different plant species varied as well (Appendix 2).

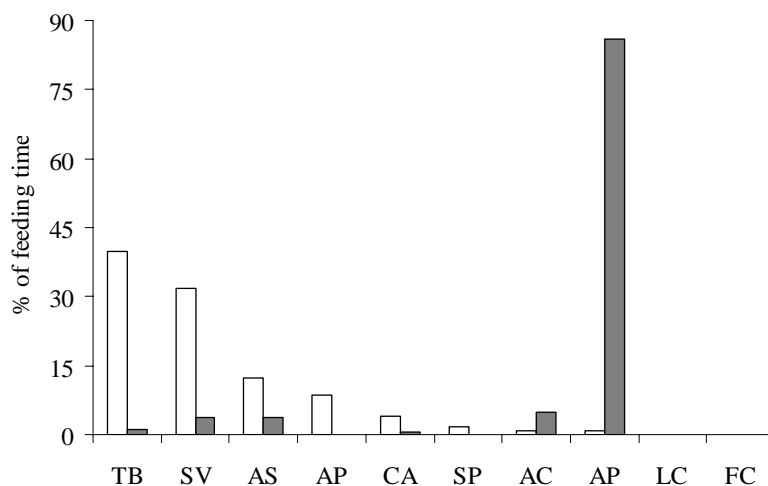


Fig. 4: The percentage feeding time on exudativory spent on different plant species, in winter (open) and summer (shaded) where TB–*Terminalia belerica*, SV–*Sterculia villosa*, AS–*Albizia stipulacea*, AP–*Albizia procera*, CA– *Careya arborea*, SP–*Spondias pinnata*, AC–*Acacia concinna*, AP–*Acacia pennata*, LC–*Lannea coromandelica* and FC–*Firmiana colorata*.

Invertebrates: A total of 101 instances of feeding on invertebrates were recorded, accounting for 2.91% of the total feeding time. Invertebrates accounted for 2.03% of total feeding time in winter and 5.07% in summer (Fig. 3). I saw individuals feed on species from at least five orders - Blattaria (cockroaches; 2 occasions), Lepidoptera (moths; 5 occasions), Isoptera (termites; 2 occasions), Coleoptera (beetles; 1 occasion) and Hymenoptera (ants; 4 occasions) - though I was unable to ascertain the species. Because feeding on invertebrates was usually an event rather than a state, and was cryptic, it was difficult to capture all instances of insect feeding, and it is likely that time spent on insects out of total feeding time has been underestimated. Insects were obtained most often from bark followed by flowers and least often from leaf litter. Foraging and feeding on invertebrates was mostly opportunistic and time spent on each bout was highly variable (mean \pm SE - 615.79 \pm 61.27 seconds). On occasion, invertebrates were also consumed for short periods of time between a bout of exudativory.

Lorises foraged and fed on invertebrates from at least 20 plant species in winter and 17 plant species in summer (Appendix 3). In winter, a substantial percentage of total feeding time on invertebrates was spent on *Terminalia belerica* (38.07%) and *Dillenia pentagyna* (23.08%) while in summer a major percentage was spent on *Terminalia belerica* alone (62.23%) (Appendix 3).

Nectarivory comprised 3.79% of the total feeding time. A total of 16 bouts of nectarivory were recorded on flower buds and flowers of *Careya arborea* (Lecythidaceae) in April when trees of this species began to flower. Individuals vigorously licked around buds and flowers and within flowers for nectar.

An estimated 1.89% of the total feeding time was spent on scraping and chewing of bark of six species of trees (*Terminalia belerica*, *Stereospermum personatum*, *Careya arborea*, *Schima wallichii*, *Dalbergia thomsonii* and *Firmiana colorata*). 2.41% of total feeding time in winter was spent on bark while this percentage dropped to 0.64% in summer (Fig. 3).

Only two episodes of frugivory were recorded, accounting for 0.26% of total feeding time. Berries of the tree *Breynia vitis-idaea* (Euphorbiaceae) were eaten in January. In April ripe fruits of *Dillenia pentagyna* (Dilleniaceae) were chewed before the pulp was discarded.

I observed 7 bouts of leaf-licking of at least 6 plant species accounting for 0.81% of total feeding time. I also observed a single instance of feeding on two bird eggs in April, accounting for 1.16% of total feeding. Further 2.72% of the total feeding time was spent on unidentifiable items.

Major food plant species

Time spent feeding on plant parts and animal prey on different plant species varied between winter and summer (Table 1). In winter, maximum feeding time was spent on *Terminalia belerica* (39.51%) followed by *Sterculia villosa* (30.01%), while in summer it was spent on *Acacia pennata* (62.79%) (Table 1).

Species	% feeding time		
	Winter	Summer	Together
<i>Terminalia belerica</i>	39.51	3.56	30.11
<i>Sterculia villosa</i>	30.01	3.04	22.96
<i>Albizia stipulacea</i>	11.69	2.95	9.4
<i>Albizia procera</i>	8.11	0.00	5.99
<i>Careya arborea</i>	4.09	16.27	7.27
<i>Acacia pennata</i>	0.79	62.79	17
<i>Acacia concinna</i>	0.99	7.78	2.77
<i>Spondias pinnata</i>	1.65	0.00	1.22
Others	3.16	3.62	3.28

Table 1: The percentage feeding time spent on different plant species in each season and together

Most species were used for only one food type while a few were used for more than one, such as *Careya arborea* (exudates 2.9%, nectar 4.1%, and bark 0.2%) (Table 2).

Plant species	Exudates (%)	Nectar (%)	Fruit (%)	Bark (%)	Total (%)	Availability (% of trees)
<i>Terminalia belerica</i>	29.10	0.00	0.00	0.56	29.66	5.72
<i>Sterculia villosa</i>	23.82	0.00	0.00	0.00	23.82	1.81
<i>Acacia pennata</i>	17.58	0.00	0.00	0.00	17.58	0.72
<i>Albizia stipulacea</i>	9.77	0.00	0.00	0.00	9.77	0.22
<i>Careya arborea</i>	2.93	4.10	0.00	0.23	7.26	4.46
<i>Albizia procera</i>	6.23	0.00	0.00	0.00	6.23	0.20
<i>Acacia concinna</i>	2.68	0.00	0.00	0.00	2.68	0.20
<i>Spondias pinnata</i>	1.25	0.00	0.00	0.00	1.25	0.07
<i>Schima wallichii</i>	0.00	0.00	0.00	0.62	0.62	1.76
<i>Stereospermum personatum</i>	0.00	0.00	0.00	0.41	0.41	1.12
<i>Firmiana colorata</i>	0.10	0.00	0.00	0.20	0.30	0.87
<i>Dillenia pentagyna</i>	0.00	0.00	0.21	0.00	0.21	5.85
<i>Lannea coromandelica</i>	0.10	0.00	0.00	0.00	0.10	0.20
<i>Breynia vitis-idaea</i>	0.00	0.00	0.08	0.00	0.08	2.30
<i>Dalbergia thomsonii</i>	0.00	0.00	0.00	0.03	0.03	0.69

Table 2: The percentage feeding time spent on different plant parts of different plant species

Vegetation and Phenology

On the whole 73 plant species (6 climbers, 3 scandent shrubs and the rest trees) were recorded from seven 50 m x 50 m plots (Appendix 4). The most abundant species was *Holarrhaena antidysenterica* which was not a food plant species. Thirteen species accounted for 75% of the total number of trees (n = 4035) in the seven plots. Tree species that were utilized for feeding (excluding insectivory) comprised 26.19% of the total number.

Percentages of trees with ripe fruit, unripe fruit, buds and flowers were all higher in summer than in winter (Fig. 5A). However, there was no significant difference ($\chi^2 = 0.63$, $df = 5$, $p = 0.99$) in the number of species with floral and fruiting parts between the two seasons (Fig. 5B).

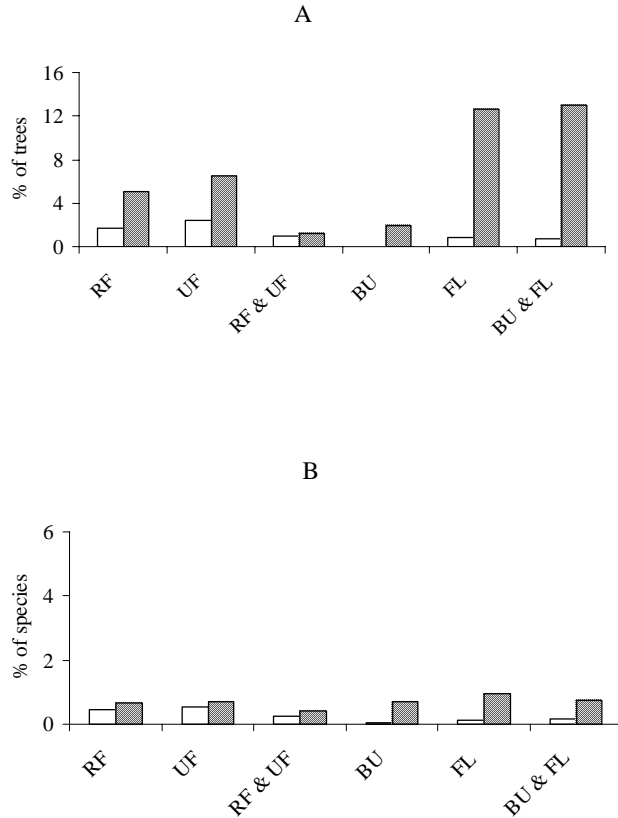


Fig. 5: Percentage of (A) plants and (B) species with different plant parts in winter (open) and summer (shaded), where RF-ripe fruit, UF-unripe fruit, RF&UF-ripe fruit and unripe fruit, BU-buds, FL-flowers and BU&FL-buds and flowers

Although maximum feeding time was spent on *Terminalia belerica* in winter (39.5%), the Vanderploeg and Scavia Relativized Electivity Index (E_i^*) indicated that it was not a preferred species while *Albizia stipulacea* and *Albizia procera*, on which 11.69% and 8.11% of total feeding time was spent were the most preferred (Fig. 6A).

In summer, the preference changed to two species of scandent shrubs of the Fabaceae family, *Acacia pennata* and *Acacia concinna* which accounted for 62.79% and 7.78% of the total feeding time, respectively (Fig. 6B).

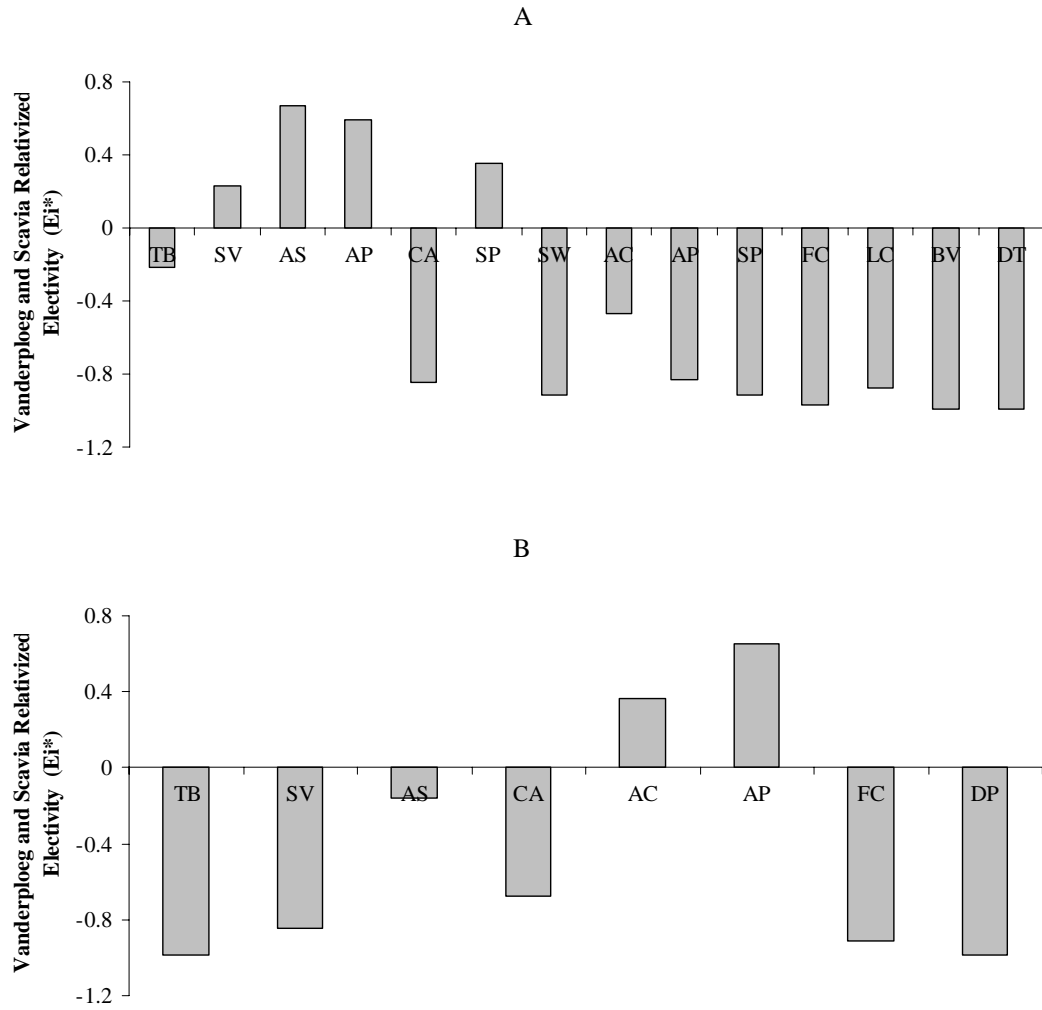


Fig. 6: Electivity indices of plant species using Vanderploeg and Scavia Relativized Electivity (E_i^*), where TB–*Terminalia belerica*, SV–*Sterculia villosa*, AS–*Albizia stipulacea*, AP–*Albizia procera*, CA–*Careya arborea*, SP–*Spondias pinnata*, SC–*Schima wallichii*, AC–*Acacia concinna*, AP–*Acacia pennata*, SP–*Stereospermum personatum*, FC–*Firmiana colorata*, LC–*Lannea coromandelica*, BV–*Breynia vitis-idaea*, DT–*Dalbergia thomsonii* and DP–*Dillenia pentagyna*

DISCUSSION

Activity budget of the slow loris: seasonal and sexual variations

Feeding formed $22.25 \pm 2.20\%$ (mean \pm standard error) of the activity budget of *N. bengalensis*. Interestingly, no significant difference was observed in the time spent feeding between the two seasons. Weins et al., (2006) reported that feeding comprised $20.5 \pm 12.1\%$ of the activity budget of *N. coucang* in Malaysia. Time spent feeding from both these studies is comparable, and this is potentially related to the similar body sizes and types of food resources consumed.

Females spent a greater percentage of time feeding and resting whereas males spent more time locomoting. In many primate species, adult females are known to feed for longer periods in comparison to males [Hiraiwa-Hasegawa, 1997 in Key & Ross, 1999]. This can possibly be explained by the theory that “male reproductive success is often limited by access to females,..., whilst females are limited by resources” [Krebs & Davis, 1993]. As a result, females are expected to spend more time tracking resources while males track females, and these results are consistent with this expectation.

Types and species of food consumed: seasonal variations

N. bengalensis consumed a variety of food types including both plant material (exudates, nectar, bark and fruit) and animal prey (invertebrates and avian eggs). However the salient feature in the diet of the species was plant exudates, accounting for 86.5% of the total feeding time. This places *N. bengalensis* among other highly specialized primates that belong to the relatively uncommon exudate-feeding guild [Nash, 1986]. It has already been reported that exudates are important components of *N. coucang* (43.3%) and *N. pygmaeus* (63%) diets [Weins, 2002; Streicher, 2004]. However, in the

case of the highly faunivorous slender lorises only *Loris lydekkerianus lydekkerianus* has been observed consuming gum which comprises only 2.8% of its total diet [Nekaris & Rasmussen, 2003]. A comparable dependence on exudates has previously been observed in the case of African lorisiformes belonging to the family Galagonidae - *Otolemur crassicaudatus* [Harcourt, 1986] and *Euoticus elegantulus* [Charles-Dominique, 1977 in Nash 1986].

N. bengalensis not only depends on natural gum formations on tree barks, but also actively elicits exudate flow by gouging holes into trees. While several members of the exudate-feeding guild are known to feed on exudates released either naturally from trees or as a result of insect damage, few (*Cebuella*, *Callithrix*, *Phaner*) are known to perforate tree bark to stimulate exudate flow [Bearder & Martin, 1980]. Interestingly, this behavior has been recently reported in the case of both *N. coucang* [Weins, 2002] and *N. pygmaeus* [Tan & Drake, 2001; Streicher, 2004]. Thus interestingly slow lorises seem to exhibit characteristics previously observed only among some species of lemurs and marmosets, in the method used to obtain exudates.

Invertebrates comprised the second most prominent feature of the diet of this species. Species from at least five orders were consumed by *N. bengalensis*. Three of these orders (Coleoptera, Lepidoptera and Hymenoptera) have been recorded as dietary components of *N. coucang* as well [Weins, 2002]. Feeding on moths and ants has also been recorded in the case of *N. pygmaeus* [Streicher, 2004]. Ants and termites are the predominant components in the diet of the *L. l. lydekkerianus* [Nekaris & Rasmussen, 2003]. It had been hypothesized previously that lorises are specialized to feed on toxic insect prey [Charles-Dominique, 1977; Jewell & Oates, 1969; Rasmussen & Izard, 1987; Rasmussen & Nekaris, 1997 in Nekaris & Rasmussen, 2003]. At least three of the orders (Blattaria, Isoptera and Hymenoptera) noted for *N. bengalensis* are known to include

toxic species [Nekaris & Rasmussen, 2003]. However as it was not possible to identify the species consumed by *N. bengalensis*, it was impossible to ascertain if any of the species being consumed were toxic. Thus these findings do not directly address the existing hypothesis.

Feeding on invertebrates was opportunistic and on occasion it was interspersed with bouts of exudativory. These findings could putatively be explained by the fact that it may be advantageous for animals to intersperse exudativory with insectivory, as separate ingestion of proteins without carbohydrates may result in nitrogen loss [Monte, 1981 in Nash, 1986].

The intake of different food types may be influenced by seasonal availability. In this regard, exudates are considered to be a relatively stable dietary resource [Stewart et al., 1973, in Weins, 2002]. Thus, exudativory may be a permanent feature in the diet of *N. bengalensis* though results from a long-term study are required to support this. However, seasonal availability of other dietary types could dictate the time spent on exudativory. I noted a seasonal variation in the utilization of various food types in the case of *N. bengalensis*. In winter, exudativory comprised 94.3% of total feeding time. Comparatively, a greater percentage of total feeding time was expended on other food types in the summer months, though a major proportion of time was still expended on exudates. On the contrary, Weins (2002) did not record any seasonal variation in the proportional intake of different food types for *N. coucang*. This may be explained by the year-round availability of high energy food types such as floral nectar, plant exudates and fruit in the primary forest where *N. coucang* was studied. By contrast, our study was conducted in a secondary forest where tree species diversity was low and plant food parts availability was scarce in winter.

Nectar was added to the dietary repertoire of the species in summer when *Careya arborea* began flowering, and time spent on nectarivory accounted for 13.1% of total feeding time. Floral nectar is a high energy resource and lacks the digestibility constraints associated with gums [Nash, 1986]. Nectar was available year round in the case of *N. coucang* where it accounted for about 31% of total feeding time [Weins et al., 2006]. However, in my study area, the flowering of *Careya arborea* was not only seasonal, but also occurred only for a short period of time.

Feeding time on insects doubled in summer, though it did not account for a major proportion of the species diet. This is understandable, as *N. bengalensis*, being the largest of the lorises [Nekaris & Bearder, 2007], may not be able to sustain itself merely on invertebrate prey as the energy expended in locating such a resource may exceed the benefits attained from it [Streicher, 2004]. Thus, like other primates of this size it might, only utilize this resource to meet its basic protein requirements, and would depend more on fruit, seeds or gums as a principal component of its diet [Hladik, 1979 in Harcourt, 1980]. This could explain the continued dependence on exudates even in summer.

Similar seasonal variations in diet have been observed in other lorisiformes. Extensive dependence on plant exudates during winter has been reported for the *N. pygmaeus* in Vietnam where the season is characterized by lower insect abundance and water shortage, as a result of which trees are known not to provide essential food parts during these months [Streicher, 2004]. *Otolemur crassicaudatus* and *Galagoides moholi* increased their gum intake in winter when insect abundance and diversity was lower [Harcourt, 1986; Bearder & Martin, 1980].

A seasonal variation was further observed in the plant species utilized for exudativory. While *T. belerica* was utilized the most in summer, it was replaced by *A. pennata* in winter. Though Weins (2002) does not discuss seasonal variation in terms of

plant species used for exudativory, Streicher (2004) found a shift in percentage of time spent feeding on different trees for *N. pygmaeus* in different seasons in Vietnam. Though exudates are known to be available year round they are known to vary in chemical composition [Stewart et al., 1973 in Weins, 2002] and moisture content [Nash, 1986] in different seasons. This could, in turn, influence the choice of species.

Primates living in seasonal environments may react to periods of low resource availability by switching to alternative, poorer quality food resources and incorporating them into their diets in unusually high quantities [Hladik, 1977; Crompton, 1984; Richard, 1985; Harcourt, 1986 in Gursky, 2000]. In the present study *T. belerica* was the most prevalent plant species, used in winter for exudativory but was replaced by *A. pennata* in summer. Interestingly, *T. belerica* which was one among the more abundant plant species in this area, was not one of the preferred species in winter according to the Vanderploeg and Scavia Relativized Electivity Index (E_i^*). Instead the preferred species in winter were *S. villosa*, *A. stipulacea*, *A. prosera* and *S. pinnata* all of which are less abundant than *T. belerica*. Thus, this difference in abundances could explain the higher time spent on *T. belerica* despite it not being one among the preferred species. In summer two species of *Acacia* scandent shrubs were preferred. Though a substantial amount of time was spent on nectar from *Careya arborea* in summer it still failed to feature as one among the preferred species. Once again, the preferred species were comparatively less abundant than the non-preferred species. This further supports the hypothesis that high usage may not translate to preference but in turn could just be a strategy employed to survive environments with low resource abundance. However, the E_i^* index provides the single best, but not necessarily the perfect, electivity index [Lechowicz, 1982] and thus more information is required on the nutritional content of and seasonal changes in the composition of exudates and the other utilized resources of the plant species.

Conservation implications

It is fairly evident that in an environment where high quality resources are usually limited, resources that are less preferred may play a very important role in the maintenance of a species. For instance, if total feeding time on plant parts is considered, the time spent on *T. belerica* was the highest. Further *T. belerica* is also seen to be the most important tree for insectivory across both the seasons indicating that *N. bengalensis* depends on it indirectly in order to meet its protein requirements. Similarly *Careya arborea* is equally important as it is utilized for the most number of dietary types. Hence, it is evident that these two species form a significant component of the loris' diet. Thus, conservation efforts at such locales should not only focus on the scarce but highly preferred resources of a species but must also take into account buffer species which play a far more important role in helping species maintain themselves in unrewarding environments.

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APPENDICES

Appendix 1: Percentage time spent on different activities by females (open) and males (shaded)

Activity	Males (% time spent)		Females (% time spent)	
	Average	SE	Average	SE
Rest	44.53	8.53	28.00	6.49
Locomote	26.97	6.38	40.43	8.74
Feed	18.72	5.31	14.77	5.81
Groom	4.61	1.68	5.98	4.43
Forage	4.06	1.91	10.82	7.24
Social	1.12	0.76	0.00	0.00

Appendix 2: The percentage time spent on bouts of exudativory on different plant species

Species	Total number of bouts	Max	Min	Average	SD
<i>Acacia concinna</i>	101	48	3	9.28	7.19
<i>Acacia pennata</i>	554	180	2	11.09	10.87
<i>Albizia procera</i>	297	55	2	7.33	4.66
<i>Albizia stipulacea</i>	109	290	2	31.33	42.27
<i>Careya arborea</i>	131	49	2	7.82	5.95
<i>Firmiana colorata</i>	4	18	5	9.00	6.16
<i>Lannea coromandelica</i>	2	22	22	18.00	5.66
<i>Spondias pinnata</i>	21	56	4	20.86	16.38
<i>Sterculia villosa</i>	477	188	2	17.46	18.34
<i>Terminalia belerica</i>	623	529	2	16.29	39.80

Appendix 3: The percentage feeding time on insectivory spent on different plant species
in (A) winter & (B) summer

Winter		Summer	
Species	% time of total feeding spent on insectivory	Species	% time of total feeding spent on insectivory
<i>Terminalia belerica</i>	38.08	<i>Terminalia belerica</i>	62.23
<i>Dillenia pentagyna</i>	23.08	<i>Vitex pubescens</i>	12.69
<i>Ficus hispida</i>	9.96	<i>Syzygium sp.</i>	9.32
<i>Breynia vitis-idaea</i>	9.29	<i>Zizyphus rugosa</i>	4.51
<i>Acacia pennata</i>	5.29	<i>Careya arborea</i>	2.75
Others	14.30	Others	8.51

Appendix 4: Percentage abundance of different species of trees, scandant shrubs and lianas in seven 50 m x 50 m plots

Sl. No.	Species	Family	Plot 1	Plot 2	Plot 3	Plot 4	Plot 5	Plot 6	Plot 7	% Abundance
1	<i>Holarrhaena antidysenterica</i>	Apocynaceae	13.49	22.55	18.36	13.43	23.95	22.03	13.30	19.28
2	<i>Mitragyna rotundifolia</i>	Rubiaceae	4.37	20.56	15.51	7.21	6.03	13.05	7.60	12.59
3	<i>Glochidion zeylanicum</i> (♀)	Euphorbiaceae	4.37	8.79	3.74	5.22	4.94	5.76	8.12	6.39
4	<i>Dillenia pentagyna</i>	Dilleniaceae	2.38	4.80	11.41	5.47	6.03	8.31	1.55	5.85
5	<i>Terminalia belerica</i>	Combretaceae	7.54	1.72	8.38	6.47	11.33	4.41	5.53	5.72
6	<i>Careya arborea</i>	Lecythidaceae	3.97	1.81	6.24	7.46	5.30	5.59	3.97	4.46
7	<i>Callicarpa arborea</i>	Verbenaceae	7.94	5.34	0.18	1.00	0.73	0.85	9.84	3.72
8	<i>Microcos paniculata</i>	Euphorbiaceae	5.56	4.08	1.25	5.97	0.37	4.07	4.66	3.54
9	<i>Lagerstroemia speciosa</i>	Lythraceae	3.17	0.18	1.96	1.49	9.87	4.41	0.69	2.75
10	<i>Vitex pubescens</i>	Verbenaceae	3.57	2.72	1.78	2.74	3.66	2.20	2.42	2.65
11	<i>Emblica officinalis</i>	Euphorbiaceae	2.38	4.17	1.07	1.24	4.20	2.03	1.21	2.60
12	<i>Syzygium cerasoides</i>	Myrtaceae	3.57	4.35	0.36	1.99	0.18	3.22	3.11	2.60
13	<i>Glochidion zeylanicum</i> (♂)	Euphorbiaceae	2.78	1.36	1.43	3.48	1.10	5.93	2.76	2.50
14	<i>Breynia vitis-idaea</i>	Euphorbiaceae	2.78	2.08	1.43	0.75	2.56	1.86	4.66	2.30
15	<i>Grewia sp.</i>	Tiliaceae	2.78	0.63	2.50	1.24	4.02	2.20	0.86	1.81
16	<i>Sterculia villosa</i>	Sterculiaceae	0.79	1.00	2.50	4.23	2.74	2.03	0.35	1.81
17	<i>Schima wallichii</i>	Theaceae	3.97	0.09	5.70	5.22	0.18	0.85	0.17	1.76
18	<i>Combretum sp.</i>	Combretaceae	1.59	3.17	0.00	4.73	0.18	0.68	1.21	1.73
19	<i>Antidesma acidum</i>	Euphorbiaceae	0.40	1.72	1.96	2.49	0.73	0.34	1.38	1.36

Sl. No.	Species	Family	Plot 1	Plot 2	Plot 3	Plot 4	Plot 5	Plot 6	Plot 7	% Abundance
20	<i>Mallotus philippensis</i>	Euphorbiaceae	3.17	0.09	0.36	1.00	0.73	1.19	4.32	1.26
21	<i>Stereospermum personatum</i>	Bignoniaceae	3.57	0.18	1.25	1.99	1.65	0.85	1.55	1.21
22	<i>Syzygium sp.</i>	Myrtaceae	2.78	0.27	0.18	0.50	0.73	2.37	0.86	0.89
23	<i>Firmiana colorata</i>	Sterculiaceae	0.00	0.72	0.36	1.00	0.00	0.68	2.94	0.87
24	<i>Zizyphus rugosa</i>	Rhamnaceae	1.19	1.18	0.71	0.25	2.01	0.17	0.35	0.87
25	<i>Acacia pennata</i> (scandent shrub)	Mimosaceae	0.40	0.00	2.85	0.00	0.37	0.34	1.38	0.72
26	<i>Dalbergia thomsonii</i> (liana)	Papilionaceae	1.19	1.09	0.53	0.50	0.91	0.34	0.17	0.69
27	<i>Mallotus tetraococcus</i>	Euphorbiaceae	0.00	0.00	0.36	4.98	0.37	0.34	0.00	0.64
28	<i>Dalbergia volubilis</i> (liana)	Papilionaceae	0.00	0.45	0.00	0.00	0.00	0.00	3.28	0.59
29	<i>Glochidion multiloculare</i>	Euphorbiaceae	0.00	0.63	0.00	0.75	0.37	0.34	1.38	0.55
30	<i>Artocarpus chaplasha</i>	Moraceae	0.00	0.00	0.71	1.24	0.55	0.51	0.69	0.47
31	Unidentified	Meliaceae	0.40	0.45	0.71	0.25	0.73	0.00	0.52	0.45
32	<i>Derris robusta</i>	Papilionaceae	1.59	0.27	0.71	1.00	0.18	0.00	0.17	0.42
33	<i>Putranjiva sp.</i>	Euphorbiaceae	1.59	0.45	0.00	0.00	0.37	0.34	0.17	0.35
34	<i>Pterospermum semisagittatum</i>	Sterculiaceae	0.79	0.63	0.18	0.25	0.00	0.00	0.52	0.35
35	<i>Oroxylum indicum</i>	Bignoniaceae	1.19	0.00	0.18	1.00	0.37	0.34	0.17	0.32
36	<i>Croton sp.</i>	Euphorbiaceae	0.79	0.09	0.53	0.00	0.18	0.17	0.86	0.32
37	<i>Garcinia cowa</i>	Clusiaceae	0.00	0.09	0.36	0.00	0.18	0.85	0.52	0.30
38	<i>Albizia stipulacea</i>	Mimosaceae	0.00	0.09	0.36	0.25	0.37	0.34	0.17	0.22
39	<i>Litsea glutinosa</i>	Lauraceae	0.00	0.18	0.00	0.25	0.55	0.17	0.17	0.20
40	<i>Lannea coromandelica</i>	Anacardiaceae	0.40	0.18	0.18	0.25	0.18	0.00	0.35	0.20
41	<i>Erioglossum edule</i>	Sapindaceae	0.40	0.09	0.36	0.25	0.00	0.00	0.52	0.20
42	<i>Albizia procera</i>	Mimosaceae	0.40	0.00	0.53	0.00	0.18	0.00	0.52	0.20

Sl. No.	Species	Family	Plot 1	Plot 2	Plot 3	Plot 4	Plot 5	Plot 6	Plot 7	% Abundance
43	<i>Acacia concinna</i> (scandent shrub)	Mimosaceae	0.00	0.00	0.36	0.50	0.18	0.00	0.52	0.20
44	<i>Erythrina sp.</i>	Papilionaceae	0.00	0.00	0.00	0.50	0.00	0.00	0.86	0.17
45	<i>Dalbergia sp.</i> (liana)	Papilionaceae	0.00	0.00	0.53	0.50	0.18	0.00	0.00	0.15
46	<i>Garuga pinnata</i>	Burseraceae	0.40	0.09	0.18	0.25	0.18	0.00	0.17	0.15
47	<i>Maesa ramentacea</i>	Myrsinaceae	0.79	0.36	0.00	0.00	0.00	0.00	0.00	0.15
48	<i>Ficus hispida</i>	Moraceae	0.40	0.09	0.18	0.25	0.00	0.17	0.17	0.15
49	<i>Randia fasciculata</i>	Rubiaceae	0.00	0.27	0.18	0.00	0.00	0.00	0.00	0.10
50	<i>Bridelia stipularis</i> (climber)	Euphorbiaceae	0.00	0.00	0.18	0.25	0.00	0.00	0.35	0.10
51	<i>Litsea sp. 1</i>	Lauraceae	0.00	0.36	0.00	0.00	0.00	0.00	0.00	0.10
52	<i>Hymenodictylon excelsum</i>	Rubiaceae	0.00	0.00	0.00	0.00	0.00	0.17	0.52	0.10
53	<i>Xantolis sp.</i>	Rubiaceae	0.00	0.09	0.00	0.00	0.37	0.00	0.00	0.07
54	<i>Bombax ceiba</i>	Bombacaceae	0.40	0.00	0.00	0.00	0.00	0.34	0.00	0.07
55	<i>Streblus asper</i>	Moraceae	0.00	0.09	0.00	0.00	0.00	0.00	0.35	0.07
56	<i>Spondias pinnata</i>	Anacardiaceae	0.00	0.00	0.36	0.00	0.00	0.00	0.17	0.07
57	<i>Cassia nodosa</i>	Caesalpinaceae	0.00	0.00	0.53	0.00	0.00	0.00	0.00	0.07
58	Unidentified	Unidentified	0.40	0.00	0.18	0.00	0.00	0.00	0.00	0.05
59	<i>Litsea cubeba</i>	Lauraceae	0.00	0.09	0.00	0.00	0.00	0.00	0.17	0.05
60	<i>Litsea laeta</i>	Lauraceae	0.00	0.00	0.18	0.00	0.00	0.00	0.17	0.05
61	Unidentified	Unidentified	0.00	0.00	0.00	0.00	0.00	0.00	0.35	0.05
62	<i>Ficus sp. 2</i>	Moraceae	0.00	0.00	0.00	0.00	0.00	0.00	0.35	0.05
63	<i>Willoughbyia edulis</i>	Rubiaceae	0.40	0.00	0.00	0.00	0.00	0.00	0.00	0.02
64	Unidentified	Unidentified	0.00	0.09	0.00	0.00	0.00	0.00	0.00	0.02
65	<i>Markhamia stipulata</i>	Bignoniaceae	0.00	0.09	0.00	0.00	0.00	0.00	0.00	0.02
66	<i>Ficus sp. 1</i>	Moraceae	0.00	0.09	0.00	0.00	0.00	0.00	0.00	0.02
67	<i>Cinnamomum obtusifolium</i>	Lauraceae	0.00	0.00	0.00	0.25	0.00	0.00	0.00	0.02
68	Unidentified	Magnoliaceae	0.00	0.00	0.00	0.00	0.00	0.17	0.00	0.02

Sl. No.	Species	Family	Plot 1	Plot 2	Plot 3	Plot 4	Plot 5	Plot 6	Plot 7	% Abundance
69	<i>Acacia sp.</i> (scandent shrub)	Mimosaceae	0.00	0.00	0.00	0.00	0.00	0.00	0.17	0.02
70	<i>Grewia microphylla</i>	Tiliaceae	0.00	0.00	0.00	0.00	0.00	0.00	0.17	0.02
71	<i>Unidentified</i>	Rutaceae	0.00	0.00	0.00	0.00	0.00	0.00	0.17	0.02
72	<i>Combretum sp.1</i> (climber)	Combretaceae	0.00	0.00	0.00	0.00	0.00	0.00	0.17	0.02
73	<i>Combretum sp.2</i> (climber)	Combretaceae	0.00	0.00	0.00	0.00	0.00	0.00	0.17	0.02



Picture 1: Bengal slow loris (*Nycticebus bengalensis*)

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Picture 2: Gouges on *Sterculia villosa* to elicit gum flow

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Picture 3: A sub-adult male scrapping gum from *Albizia procera*

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