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THE POPHAM ARBORETUM: A REFUGE FOR GREY SLENDER LORIS (*Loris lydekkerianus*) IN AN URBANIZED LANDSCAPE IN SRI LANKA

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ABSTRACT : The aim of the present study was to document the population size, distribution and habitat preferences of the Grey Slender Loris (*Loris lydekkerianus*) in the Popham Arboretum in Dambulla, Sri Lanka. The Popham Arboretum is a small and isolated forest patch nestled in an urbanized landscape that serves as a refuge for *L. lydekkerianus*. The study was carried out over 15 nights for a period of ten months from September 2016 to June 2017, with nocturnal searches being conducted between 1900 to 2200 hrs. A total of 55 sightings were made, with the number of sightings per night ranging from one to eight. The sightings suggest that the arboretum supports a population of at least 15 individuals. The loris was more frequently sighted in core areas of the arboretum than towards the edges, with preference shown for areas which were relatively cooler and secluded. Furthermore, the lorises were sighted in areas with greater canopy cover and a higher richness of trees, shrubs and woody creepers. Two species, a tree *Diplodiscus verrucosus* and a woody climber *Derris parviflora*, were selectively used by the lorises. Our findings highlight the possible dangers of urban expansion on this arboreal primate and the need to strengthen its protection within the arboretum.

KEY WORDS : Popham Arboretum, Loris, habitat selection, edge effects

INTRODUCTION

Habitat preference of a species is influenced by its body mass, diet, sex, age, group size, and population density (Chapman *et al*. 2012). Habitat preference is also driven by environmental factors such as seasonality, vegetation characteristics, availability of food and refuge sites, and the presence of predators and competitors (Pliosungnoen *et al*. 2010). Within mosaic landscapes, some species may use multiple habitats (Law and Dickman 1998). This is particularly important for arboreal primates such as the lorises which may traverse large extents of land encompassing a range of different habitats. For instance, a study has shown that the Bengal Slow Loris (*Nycticebus bengalensis*) uses a wide range of habitats – degraded forest, evergreen tropical forest, and forest plantations of different ages (Pliosungnoen *et al*. 2010). Understanding the factors that affect habitat choice is crucial for ensuring the survival of threatened primate populations (Kim and Riondato 2016).

The lorises (Family Lorisidae) are represented in Sri Lanka by two species, *Loris lydekkerianus*, (Grey Slender Loris), also found in southern India, and *Loris tardigradus* (Sri Lanka Red Slender Loris), which is endemic to Sri Lanka. *Loris lydekkerianus* inhabits the dry and intermediate climatic zones, while *L. tardigradus* is restricted to the wet zone. Both these species are further divided into several subspecies. The subspecies of *L. lydekkerianus* recorded in Sri Lanka are *L. l. grandis* in parts of the Knuckles mountain range, *L. l. nordicus* in dry lowlands in the North Central Province,

and *L. l. nycticeboides* at the highest altitudes around Nuwara Eliya (Groves 1998; Perera 2008; De Silva and Hapuarachhi 2012). *L. lydekkerianus* is presently categorized as a Near Threatened (NT) species, and L. tardigradus as Vulnerable (VU) (MOE 2012). No separate assessments have been made of the status of the three subspecies of the Grey Slender Loris.

Multiple demands for agriculture, human settlement and urban development in the dry zone in recent decades have led to the loss of large tracts of natural forest, driving primates into small remnant forest patches. The Dambulla area, in particular, has been classified as a deforestation hot spot (Fernando *et al*. 2015). In this situation a small refugium assumes special importance.

The Popham Arboretum is a small forest patch nestled within an urbanized landscape in Dambulla. This patch has been recognized as an important shelter for the Grey Slender Loris (*Loris lydekkerianus*) (Vitarana and Weerarathna 2008). Based on the distribution ranges as well as pelage colour variations in the three subspecies (Groves, 1998; Perera 2008; De Silva and Hapuarachhi 2012), the subspecies present in the arboretum could be classified as *Loris lydekkerianus grandis* (Figure 1). Although an earlier study had recorded the presence of the loris in this small patch of forest (Vitarana and Weerarathna 2008), no detailed investigations have been conducted on its population size or its habitat ecology. The present study sought to (i) estimate the loris population within the arboretum (ii) document the sex and age composition of this population and (iii) examine the distribution and habitat use of the loris within the arboretum.

FIGURE 01: *L. lydekkerianus* at the Popham Arboretum, Dambulla

Study site: Popham Arboretum

The Popham Arboretum in Dambulla, Sri Lanka (Matale District, 7 51”34 N and 80 40”28 E; 150 amsl), lies 6 km from the Dambulla town along the Dambulla-Bakamuna road (Figure 2). The arboretum is 37.5 ha in area and is bordered by the main road on one side and a stone quarry and buildings on the other borders. A small abandoned plot of land (forested) lies on one side of the arboretum. The arboretum is now jointly managed by the National Institute of Fundamental Studies and Rukrakaganno, a nature conservation society in Sri Lanka. Located within the dry zone, the area is characterized by a typically dry climate with a short, wet season from October to early February, when the northeast monsoon is active, and a prolonged dry season lasting about eight months. In the early 1960s, an overused and degraded land that had been under repeated shifting cultivation (chena cultivation) was acquired by Sam Popham, given protection, and the natural process of plant succession allowed to take place, with some management activities being carried out such as weeding and giving care to selected tree species. At present, after 50 years of regeneration, the land holds a young forest bearing a close resemblance to the dry mixed evergreen forest which is the typical natural forest vegetation found in the dry zone of Sri Lanka. Over 312 plant species belonging to 75 families, which include 12 endemic species, have been recorded here (Cramer 1993; Popham and Hunt 1993). Faunal species richness is also high, with 248 species being recorded; these include 8 dragonflies, 46 butterflies, 6 amphibians, 37 reptiles, 51 birds and 21 mammals, of which 13 species are

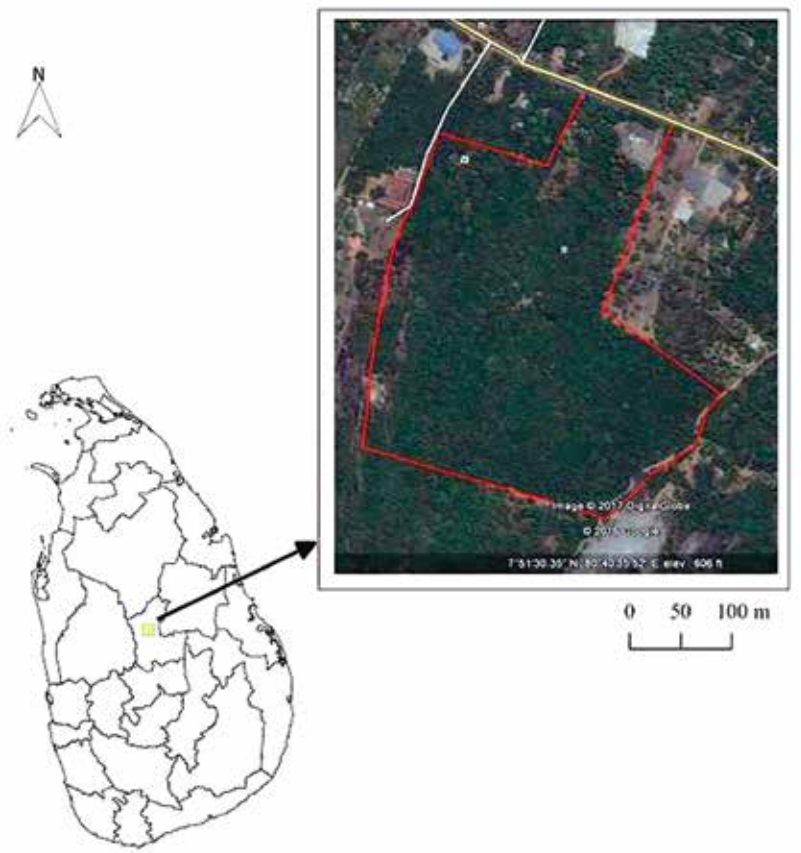

FIGURE 02: Map of Sri Lanka showing the location of the Popham Arboretum, Dambulla. Inset: Google image of the arboretum (boundary demarcated in red)

endemic to Sri Lanka (Vitarana and Weerarathna 2008). One of the most charismatic species recorded within the arboretum is the Grey Slender Loris (*Loris lydekkerianus*) (Vitarana and Weerarathna 2008).

METHODOLOGY

Field surveys were conducted over 15 nights in September, October and November 2016 and March to June 2017. In each of these months, sampling was conducted over two or three consecutive nights. On each night searches were conducted between 1900 to 2200 hrs using halogen headlamps and a red filter to scan at all levels of the vegetation, following Nekaris *et al*. (2008). We moved along four existing nature trails which sufficiently covered the extent of the arboretum. Observations along the same four line transects were repeated on the 15 nights. Once a loris was spotted, the sex (male, female) and age (adult, sub-adult or juvenile) of the animal were recorded (where possible) along with the estimated perch height. The tree on which it was sighted was marked with a coloured tape. On the following day the location of sighting was geo-referenced using Garmin Dell XL portable GPS.

Two approaches were used for investigating habitat preference. In the first, we recorded the plant species on which the animal was sighted and the height at which it was seen. The second approach was meant to determine whether the frequency of use of a plant species is due to 'actual preference' or is driven by the availability of this plant within the arboretum. Hence it was necessary to ascertain the abundance of the tree, shrub, or woody climber (liana) species on which the lorises were sighted. Of the observations made on the 15-day survey, we decided to use the data from no more than one location of sighting per day, haphazardly distributed over the arboretum over 10 days of the survey. At each location a 15m x 15m quadrate was marked out enclosing the sighted location towards its centre. (We call this a used quadrate). In addition, at each of the 10 locations, and at least 20 m away from the quadrate where loris was sighted, another quadrate of the same size was marked out. (We call this an unused quadrate). In each of the quadrates, both used and unused, eight variables were recorded. Atmospheric temperature and relative humidity were recorded the same night at the four corners and the centre of each quadrate using a digital portable temperature and humidity meter (model TA138A/B Thermometer-Hygrometer, China). The other parameters recorded were girth at breast height (GBH) of all plant species over 10cm GBH, species richness and abundance of the same plants, the number of woody climbers among these plants, canopy cover, and the shortest distance from the centre of the quadrate to the boundary of the arboretum (measured on a Google map). Canopy cover was estimated using photographs taken with a camera, by holding it at ground level and pointing vertically upwards (Sony bridge: 20 megapixel camera, Malaysia and Canon 7D lens, Japan). Except for the atmospheric temperature and relative humidity, the other data were recorded on the day following each sighting. At the conclusion of the field survey, it was found that, as the survey progressed, lorises had been sighted in, or in close proximity to, three of what were originally taken as unused quadrates. Hence, including these three, we increased the number of used quadrates to 13 and reduced the number of unused quadrates to seven. The data on the 13 used quadrates and seven unused quadrates were used for the analyses.

Data Analysis

The distribution map based on the geo-references of the loris sightings within the arboretum was generated using Q GIS essence program. The population size of the Grey Slender Loris within the arboretum during the period September 2016 to June 2017 was estimated using the time and location of the sightings on each night (a maximum speed of 1.5 m per second was assumed for the loris as given in Nekaris and Stevens 2006), as well as the age and sex of the observed individuals.

Plant species preference was interpreted using a method adopted by Johnson (1980), where usage is compared with availability.

Percentage utilization (% U) = (number of sightings of the loris on a particular plant species / total number of sightings) x 100. Percentage availability of the plant species (% A) = (number of individuals of a particular plant species within the quadrates / total number of individuals of all tree, shrub and woody climber species in the quadrates) x 100 (n=20 quadrates). The basic premise here is that, if the percentage utilization of a plant species exceeds percentage availability of that species, it would indicate preference for that particular plant species in comparison to the others.

The mean values for the microhabitat variables recorded separately for 'used' and 'unused' quadrates were subject to a series of one-way Anova tests and regression analyses to ascertain whether there were significant differences which would hint at habitat preferences. Additionally, the Principal Component Analyses (PCA) was used to ascertain whether the locations where loris was sighted were different to sites that were not used in terms of the recorded habitat parameters. Since many of these factors are correlated the correlation matrix was used in the PCA. The PC 1 and PC 2 scores were used to make interpretations. All statistical tests were conducted using Minitab version 17.

RESULTS

A total of 55 sightings were made over the 15 days of nocturnal sampling. The mean (± Standard Deviation) number of sightings per day was 3.7 ± 2.4, with the number of sightings being highly variable (minimum one and maximum eight) (Figure 3). It is noteworthy that 93 % of the sightings were of solitary animals, differing from observations made by Beader *et al*. (2002) and Nekaris (2003). Only on two occasions were there more than one animal; in one such instance a group of five individuals was observed, comprising one female, two males and two individuals whose sex was not ascertained. On the other occasion, there were two individuals, a male and a female. Based on the on the analysis of data as set out above, it appears that at least 15 different individuals were observed within the arboretum during the study period.

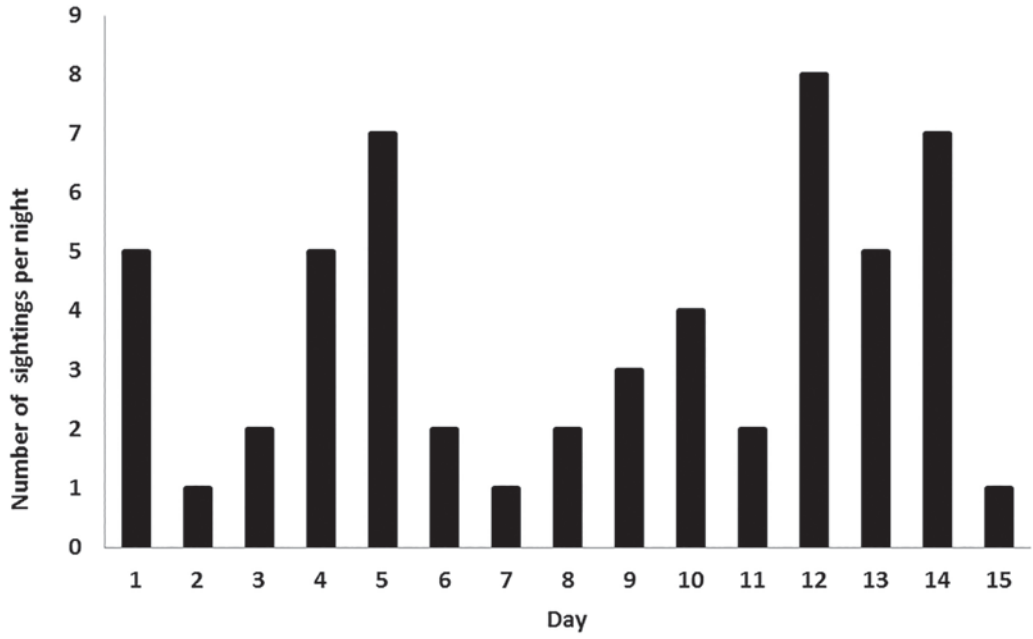

FIGURE 03: Variation in the number of loris sightings per night during the 15-day survey at the Popham Arboretum.

With regard to sex composition, 7 % of those observed were females and 27 % were males, while for the majority (66 %) of sightings determination of the sex was not possible due to low visibility and/or rapid movement of individuals. Of the individuals sighted, over 95 % were subadults/adults – only one was a juvenile. The distribution of the loris sightings within the arboretum is shown in Figure 4. A notable feature was that the edges of the arboretum appear to have been avoided to a large extent, as only a few sightings were recorded close the boundary.

With regard to microhabitat preferences, the 55 loris sightings were made on 24 plant species (16 tree species, 6 shrubs and 2 woody climbers) (Figure 5). The plant species included four endemics, and of the 24 species one is listed as Vulnerable (VU), one as Endangered and three as Near Threatened. Interestingly, our sightings showed that two species, the tree *Diplodiscus verrucosus* (Dikwanna) and the woody climber *Derris parviflora* (Kala wel) were more frequently used than the other plant species. Since usage may reflect availability and not necessarily selection by the animal, the availability of these two species in the arboretum was quantified using data collected from the 20 quadrates. The mean abundance per quadrate of the two species *Diplodiscus verrucosus* and *Derris parviflora* was 11.6 % and 5.2 % respectively. Despite their relatively low abundance, the usage of the species as depicted by the sightings was moderately high - 29.0 % on *D. verrucosus* and 27.3 % on *D. parviflora*. Based on these results percentage usage of these two species far exceeds their availability, indicating selectivity or preference of these two plant species by the loris. A range of heights were used for perching but the majority of sightings (48 %) were recorded between 5.0 to 7 m followed by the 12 % recorded at a much lower height of 2 m (Figure 6).

FIGURE 04: The distribution map of loris sightings within the Popham Arboretum (boundary indicated in red).

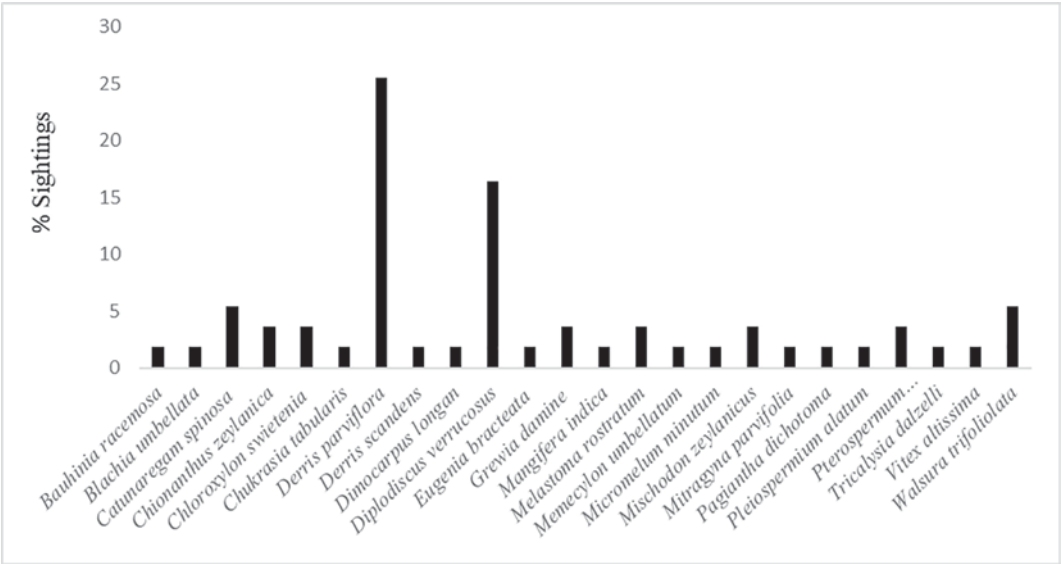

FIGURE 05: The plant species on which lorises were sighted within the Popham Arboretum

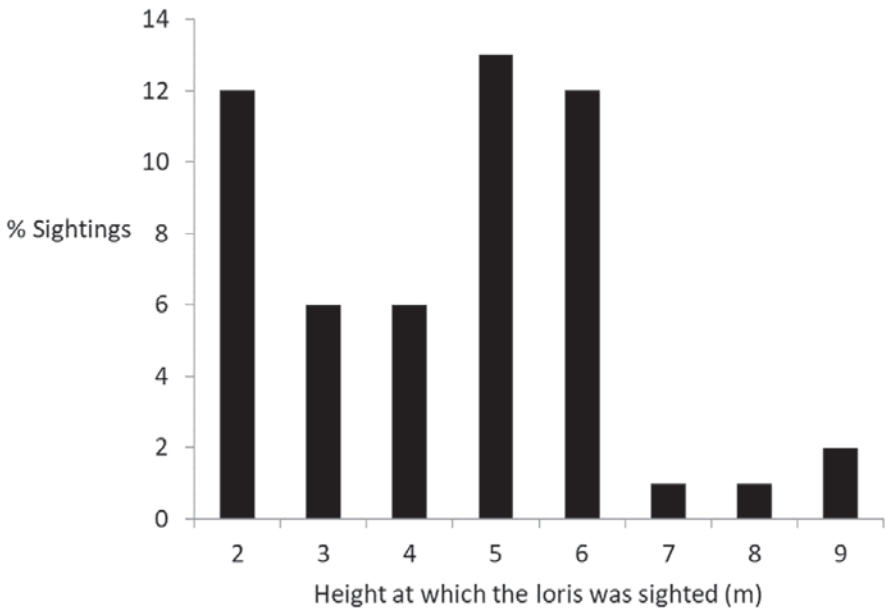

FIGURE 06: Variation in heights of at which lorises were sighted during the survey within the Popham Arboretum.

Habitat preference was also examined using characteristics of the 'used' and 'unused' locations within the arboretum (Table 1). In comparison to the unused locations, the used locations had greater species richness and abundance of trees, shrubs and woody climbers and greater canopy cover. Used sites were also considerably cooler and located further away from the boundary. Differences were significant for canopy cover, relative humidity and distance to the boundary while R^2 suggests a relatively large contribution of these variables in each case.

DISCUSSION

The present study was conducted with the aim of assessing the population of *Loris lydekkerianus* inhabiting the Popham Arboretum and studying aspects of its habitat selection. This was of particular interest as the arboretum is a small isolated dry zone forest patch nestled within an urbanized landscape. It was interesting to note that this small forest supported a moderate population of the loris – a minimum of 15 individuals in 37.5 ha of forest during the period September 2016 to June 2017.

TABLE 01 : Mean values of eight variables recorded in the quadrates where the loris was sighted (used quadrates n=13) and not sighted (not used n=7) during the survey. F and P values are from one-way Anova tests, while R2 is the contribution made by the variable as revealed by regression analyses.

Parameter	Used	Not used	F	P	R2
GBH (trees, shrubs, woody climbers)	21.3 ± 3.8	22.0 ± 3.8	0.15	0.70	0.03
% Canopy cover	60.2 ± 7.3	49.7 ± 10.1	7.10	0.01*	28.39
Abundance (trees, shrubs, woody climbers)	91.4 ± 25.5	71.4 ± 28.9	2.54	0.33	12.40
Species richness (trees, shrubs, woody climbers)	23.4 ± 5.3	20.1 ± 7.9	1.21	0.23	6.31
Number of woody climbers	8.9 ± 8.2	5.7 ± 3.8	0.91	0.35	4.80
Atmospheric temperature	27.2 ± 1.1	27.7 ± 0.5	1.70	0.21	8.40
Relative Humidity	76.5 ± 4.7	69.1 ± 4.7	11.09	0.01*	38.90
Distance from the boundary (m)	93.2 ± 51.0	43.1 ± 33.3	5.43	0.03*	23.17

* $P<0.05$

The PC1 and PC2 scores generated for used and unused quadrates are shown in Table 2 and Figure 6. These two PCs contributed to about 60 % of the variation in the data while the variables species richness and abundance of all flora, abundance of woody climbers and relative humidity rank as the most important habitat parameters (with Eigen values of 0.50 or above) that varied across the quadrates surveyed. As indicated by the polygons in Figure 6, there is a noteworthy difference between microhabitats in areas where the lorises were sighted in comparison to those where no observations were made.

The sighting of eight individuals on one night is remarkable, given the small extent of the forest and its disturbed surroundings. No clear peaks in sightings were noted, suggesting that the lorises in the arboretum is very likely a resident population. Confirmation of this fact would only be possible through further studies by marking individual animals.

No densities were calculated since the forest patch is contiguous with another forested area on one side of its periphery. It is likely that the lorises use both these patches. A study by Nekaris *et al*. (2012) reports densities of

TABLE 02 : The Eigen values generated for the correlation matrix of the PCA using eight habitat variables in loris 'used' and 'unused' quadrates sampled within the arboretum.

Variable	PC1	PC2
Abundance of trees	0.43	-0.25
Eigen values	2.88	1.79
Cumulative proportion explained	36.0 %	58.4 %
GBH	-0.28	-0.48
% Canopy cover	0.43	-0.25
Abundance (trees, shrubs, woody climbers)	0.21	-0.61*
Species richness (trees, shrubs, woody climbers)	0.50*	-0.07
Number of woody climbers	0.30	0.50*
Atmospheric temperature	-0.30	-0.19
Relative Humidity	0.50*	-0.13
Distance from the boundary (m)	0.04	-0.17

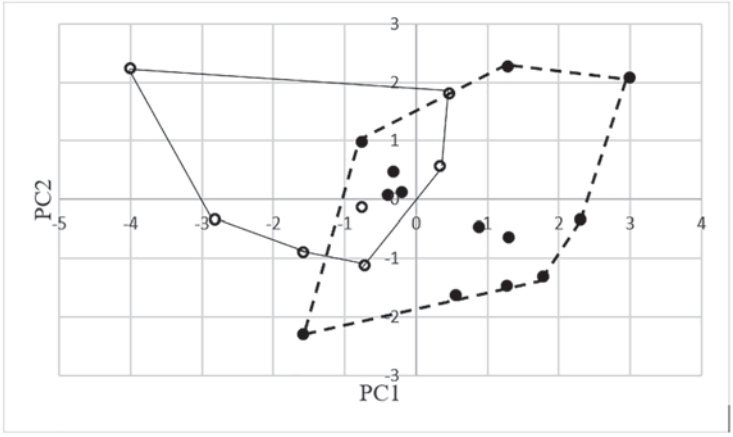

FIGURE 07: The plot between PC1 and PC2 values generated for areas that were used (solid circles) and not used (open circles) by loris within the Popham Arboretum.

between 3.4 to 28 animals per square kilometre for *L. lydekkerianus* in the dry zone of Sri Lanka, with linear encounter rates of between 0.1 and 1.1 per kilometre. In another study a density of 4.9 animals per square kilometre has been reported for the same species in the dry zone by Nekaris and Jayewardene (2004). Interestingly the record of as many as 15 lorises in the Popham Arboretum is possibly due to this forest being, for the most part, separated from other wild areas and hence serving as an isolated habitat island with limited routes of escape.

The scarcity of adjacent forests and the modified built up surroundings makes it even more important to understand aspects of habitat

usage within this small forest. Interestingly, observations conducted by Erdelen (1988) have shown that the loris has the ability to survive near human habitations, which may also explain its abundance in this 'urban' forest. Nekaris and Jayewardene (2004) found *L. l. nordicus* to be associated with disturbed human habitations. They observe that even when lorises were associated with a forest reserve, they were commonly seen in areas bordering human settlements, including on human-built fences. Others have also noted that many species of small arboreal mammals commonly occur at higher abundance in disturbed areas (Lambert *et al*. 2006). This is very likely because edges have the provision of providing a rich food resource for insectivores. Usually increased herbaceous cover at edges, triggered by high light levels, would mean a greater density of insects which would be beneficial for the loris preferentially feeding on insects. In the present study, however, the lorises were sighted more often towards the centre of the forest. The arboretum is bordered by a quarry, a main road and buildings on most of its periphery, which results in high levels of noise, vibration, artificial light and dust emission. This may most likely account for the preferential use of the core forest areas in this instance. In fact Kappeler and Erkert (2003) and Donati and Borgognini-Tarli (2006) have reported that such factors have the potential to adversely impact the survival of the loris.

The used areas of the forest were much cooler and shadier (secluded) than the unused areas. Additionally, the species richness and abundance of plants (tree, shrub and woody climber species) were also greater in used quadrates than in unused ones. This might suggest the need for lorises to stay well hidden from predators or potential prey when foraging at night. High canopy cover and continuity may also allow for quick movement through the forest. It has been documented that canopy continuity is an important factor in determining arboreal mammal abundance (Malcolm and Ray 2000; Lacher and Alho 2001), and that this is so particularly for the Slender Loris (Singh *et al*. 1999). A noteworthy factor observed during the present study was the higher abundance of woody climbers in locations of the nocturnal sightings which may have made traveling through the vegetation easier for the loris. Also, the loris was more commonly observed on the climber *Derris parviflora* and the tree *Diplodiscus verrucosus*. In the wet zone, the Red Slender Loris has been recorded in association with woody climbers and vines (Nekaris *et al*. 2005; Gamage *et al*. 2009). In the present study the most frequently preferred heights were 5 – 7 m. A wide range of usage (3.5 to 9 m) has been reported by Gamage *et al*. (2009) while Nekaris and Jayawardene (2003) state that lorises typically move at approximately 3.5 m off the ground, although they also moved in the undergrowth (0.5 m).

With the possibility of continued urban development in the Dambulla area the population of loris in the Popham Arboretum would be subject to adverse impacts. Based on the present study several recommendations can be made to mitigate such effects. One of the major findings of the present survey was that the loris was less prone to utilize forest edges. Edge conditions in the present study included noise from vehicle traffic, artificial light, vibration due to rock blasting, and human presence. These effects could be reduced if suitable live fences (green boundaries) are put in place. Erecting meshed fences on which a suitable creeper could be grown would be a feasible option. One of the main concerns is that the isolation of this population would threaten its long-term viability. Every effort must therefore be made to increase connectivity of the arboretum with nearby forest patches, particularly the only abandoned land located on its southern border. No development activity should be allowed within the arboretum to ensure that its integrity is maintained, and every effort should be made to retain its tranquility. Monitoring of the loris population regularly is also necessary as it would generate better information on its viability within the arboretum.

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REFERENCES

Bearder, S. K., K. A. Nekaris, and C. A. Buzzell, (2002). Dangers in the dark: Are some nocturnal primates afraid of the dark? *Eat or be Eaten*, 21-43. doi:10.1017/cbo9780511610233.003

Chapman, C. A., J. M. Rothman, and J. E. Lambert, (2012). Primate foraging strategies and nutrition: behavioral and evolutionary implications. In (Eds). J. Mitani, J. Call, P. Kappeler, R. Palombit, J. Silk. The Evolution of Primate Societies, University of Chicago Press, Chicago.

Cramer, L.H. (1993). A Forest Arboretum in the dry zone. Institute of Fundamental Studies, Kandy

De, Silva. M. and N. Hapuarachchi, (2012). Wildlife Conservation Society, Galle, & Nations Trust Bank (Sri Lanka). (2012). *Sri Lankan primates: An enthusiasts' guide.*

Donati, G. and S. M. Borgognini-Tarli, (2006). Influence of abiotic factors on cathemeral activity: the case of Eulemur fulvus collaris in the littoral forest of Madagascar. *Folia Primatol (Basel)*, **77:** 104-122.

Erdelen, W. (1988). Forest ecosystems and nature conservation in Sri Lanka. *Biological Conservation*, **43:** 115-135.

Gamage, S., W. Liyanage, D. Weerakoon and A. Gunwardena, (2009). Habitat quality and availability of the Sri Lanka Red Slender Loris *Loris tardigradus tardigradus* (Mammalia: Primates: Lorisidae) in the Kottawa Arboretum. *Journal of Threatened Taxa*, **1:** 65-71.

Groves, C. (1998). Systematics of tarsiers and lorises. Primates, **39:** 13-27.

Fernando, S., A. Senaratna, N. Pallewatta, E. Lokupitiya, L. Manawadu, U. Imbulana, I. De Silva and S. Ranwala, (2015). Assessment of key policies and measures to address the drivers of deforestation and forest degradation in Sri Lanka. Final report of a consultancy awarded to the Colombo Science and Technology Cell, Faculty of Science, University of Colombo, by The United Nations Development Programme for the Sri Lanka UN-REDD Programme.

Johnson, D.H. (1980). The comparison of usage and availability measurements for evaluating resource preference. *Ecology* **61:**65-71.

Kappeler, P. M. and H. G. Erkert, (2003). On the move around the clock: correlates and determinants of cathemeral activity in wild redfronted lemurs (*Eulemur fulvus rufus*). *Behavioral Ecology and Sociobiology*, **54:** 359-369.

Kim, D. J. and E. Riondato, (2016). The influence of canopy cover and connectivity on the habitat selection of Saguinus geoffroyi in the Parque Natural Metropolitano Mc.Gill University, Panama.

Lacher, T. E., and Alho, C. J. (2001). Terrestrial small mammal richness and habitat associations in an Amazon forest – Cerrado. *Biotropica*, **33:** 171-181.

Lambert, T. D., J. R. Malcolm, and B. L. Zimmerman, (2006). Amazonian Small Mammal Abundances in Relation to Habitat Structure and Resource Abundance. *Journal of Mammalogy*, **87:** 766-776.

Law, B. S. and C. R. Dickman, (1998) The use of habitat mosaics by terrestrial vertebrate fauna: Implications for conservation and management. *Biodiversity and Conservation*, **7:** 323-333

Malcolm, J. R. and J. C. Ray, (2000). Influence of timber extraction routes on Central African Small-mammal communities, forest structure, and tree diversity. *Conservation Biology*, **14:** 1623-1638.

MOE (2012). The National Red List 2012 of Sri Lanka; Conservation Status of the

Fauna and Flora. Ministry of Environment, Colombo, Sri Lanka. viii + 476pp.

Nekaris, K. A. I. (2003). Observations of mating, birthing and parental behaviour in three subspecies of slender loris (*Loris tardigradus* and *Loris lydekkerianus*) in India and Sri Lanka. Folia primatologica; *international journal of primatology*. **74:** 312-36.

Nekaris, K, A. I. and J. Jayewardene (2003). Pilot study and conservation status of the slender loris (*Loris tardigradus* and *Loris lydekkerianus*) in Sri Lanka. *Primate Conservation*, **19:** 83-90.

Nekaris, K. A. I. and J. Jayewardene, (2004). Survey of the slender loris (Primates, Lorisidae Gray, 1821: *Loris tardigradus* Linnaeus, 1758 and *Loris lydekkerianus* Cabrera, 1908) in Sri Lanka. *Journal of Zoology*, **262:** 327-338.

Nekaris, K. A. I., G. Blackham, and V. Nijman, (2008). Conservation implications of low encounter rates of five nocturnal primate species (*Nycticebus* spp.) in Asia. Biodiversity and Conservation. **17:** 733-747.

Nekaris, K. A. I., S. M. Jaffe, and G. Donati, (2012). Forest Fragmentation Imperils Red Slender Lorises (*Loris tardigradus tardigradus*) in South-Western Sri Lanka. 89-96. In Eds. J. Masters, M. Gamba and F. Genin), Leaping Ahead: Advances in Prosimian Biology. DOI: 10.1007/978-1-4614-4511-1_10.

Nekaris K. A. I, W. K. D. D. Liyanage and S. Gamage, (2005). Relationship between forest structure and floristic composition and population density of the southwestern Ceylon slender loris (*Loris tardigradus tardigradus*) in Masmullah Forest, Sri Lanka. *Mammalia*, **69:**201 – 2010.

Nekaris, K. and N. Stevens, (2006). Not all lorises are slow: rapid arboreal locomotion in *Loris tardigradus* of Southwestern Sri Lanka. *American Journal of Primatology*, **69:** 113-121.

Perera, M. S. J. (2008). A Review of the distribution of Grey Slender Loris (*Loris lydekkerianus*) in Sri Lanka. *Primate Conservation*, **23:** 89-96.

Pliosungnoen, M., G. Gale, and T. Savini, (2010). Density and microhabitat use of Bengal slow loris in primary forest and non-native plantation forest. *Am J Primatol*, **72:** 1108-1117.

Popham, F. H. and D. Hunt, (1993). *Dambulla: A sanctuary of tropical trees*. Richmond, p. 134.

Singh, M., D. G. Lindburg, A. Udhayan, M. A. Kumar and H. N. Kumara, (1999). Status survey of slender loris *Loris tardigradus lydekkerianus* in Dindigul, Tamil Nadu, India. *Oryx*, **33:** 31.

Vitarana, K. M. and W. A. P. P. D. Weerarathna, (2008). Survey of fauna in Dambulla arboretum. Ruk Rakaganno 24pp.

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