POPULATION DISTRIBUTION, THREATS AND CONSERVATION STATUS OF
Semnopithecus priam thersites AT MIHINTALE SANCTUARY, SRI LANKA

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Abstract

The Dry zone grey langur *(Semnopithecus priam thersites)* is a subspecies endemic to Sri Lanka. In this research investigated the population distribution, threats and conservation status of the *S. priam thersites* in the contiguous forest of Mihintale Sanctuary in Sri Lanka. Population study done by direct counting and vocal sounds along the permanent line transects. Threats were identified by using a questionnaire survey. A total of 03 troops and least 60 individuals were recorded during the study period from December 2009 to May 2010. These three troops were sighted in Kaludiyapukuna forest (19 individuals), Rajagiri lena forest (21 individuals) and the boundery near kumarasirigama village (18 individuals). The remaining populations living almost completely in disturbed habitats due to human influences. The average group sizes were 16.8 ± 2.65 and 19.14 ± 3.76 in forested areas and forests neighboring human habitation respectively and the all three groups were recorded as multimale groups. The troop's distribution varied with the food availability and restricted to human habitation and disturbed forest patches. The species is vulnerable to hunting and retaliatory killing in response to crop damage.

1. INTRODUCTION

Sri Lanka has five primate species all of which are threatened (Dela 2007; Rudran 2007). Among the diurnal primates in Sri Lanka detailed studies were carried out only on wet zone forest dweller purple-faced langurs Trachypithecus (Semnopithecus) vetulus which is Critically Endangered species in Sri Lanka. (IUCN, 2006; Rudran 2007, Dela, 2006, Nahallage et al, 2008). The grey langur *(Semnopithecus priam thersites)* belongs to the family Cercopithecidae and sub family Colobinae. The dry zone grey langur is considered as a subspecies endemic to Sri Lanka (Phillips 1980). The International Union for the Conservation of Nature (IUCN) in 2007 classified the '*Semnopithecus priam thersites*' as Lower Risk; widely distribute but endangered species in Sri Lanka. The major draw back of the diurnal primates in Sri Lanka is lack of detailed research studies.

The grey langurs is found throughout the well wooded areas of the country's dry zone from south of Jaffna in north to the shores of the extreme southern coast (Nekaris and Wijeyeratne, 2009). This species is restricted to the scrub forests in the dry zone. Changers of the habitats decrease the habitat quality and langurs invade human settlements. While reducing the habitats quality of langurs and increasing the population number these species became a problematic animal groups for the human.

Most of the forests in dry zone areas have been fragmented. As a result, mainly dry zone gray langurs tend to frequent houses and agricultural plots in search of food. This inevitably creates conflict, as has been reported in Anuradhapura district especially around Mihintale Sanctuary area. In order to implement effective conservation strategies, it is important to know the current distributions of this species and identify threats which they face. The main objective of the study is to determine the population distribution, their threats and the ecological requirement of the *Semnopithecus priam thersits* within the Mihintale sanctuary. Further this study focused on the determination of the population composition, their abundance, distribution, feeding ecology and some of the behavioural patterns of *Semnopithecus priam thersits*.

2. STUDY AREA

Mihintale sanctuary is located in the Anuradhapura District of the North-Central Province of Sri Lanka, between $8^018'$ - $8^023'$ N and $80^027'$ – $80^035'$ E containing in extant about 2,470 acres (999.6 Ha). There are no proper demarcated boundaries for the sanctuary (Fig.1). The region is influenced by the northeast monsoon. It comprises of semi residual forest, Scrublands, Water-edge habitats, highly degraded tertiary forests and vegetation in archaeological sites. The extend of area covered in this study was approximately 100 ha within the Mihintale sanctuary. In these study two types of habitats; disturbed and undisturbed forest areas were selected for the data collection. The study area consists of three major vegetation types; semi deciduous forest, shrub lands and teak dominated forests. The Kaludiya pokuna forest (KPF) , Ethvehera forest (EVF) and forest at Mihintale rock (MRF)were considered as undisturbed while Rajagirilena forest (RLF) and Boundary between Mihintale sanctuary and Kumarasirigama village (BF) were selected as disturbed area for the data collection (Fig.1)

3. METHODS

3.1 DATA COLLECTION ON TROOPS
One troop was initially discovered through a preliminary observation in the Kaludiyapokuna forest and the other troops were recorded during the study. The study was conducted from December 2009 to May 2010, each month during morning from 06.00 hr to 10.00 hr 11.00 hr to 13.30 hr in the mid day and 15.00 hr to 18.30 hr in the evening. Individuals were counted within a fixed 500 m lines transect which was marked during the pilot study. The counted individuals were placed into sex and age categories. The grey langures were categorised into adult males, adult females, juveniles and infants (Southwick *et al*., 1961). Identified "focal groups" according to the dominant behavour pattern of the males of the troops (Riaz et al, 2010).

3.2 BEHAVIOURAL OBSERVATIONS
The activity patterns of the troops were recorded through scan sampling methods (Altmann, 1974) on focal animals. Different activities performed by the langures were noted at set time of 15 min intervals over 05 days for each on the individual that were visible at time. This data make possible an estimate of activity/ time budget for different behaviuor . Table 01 describes the different behavour categories used for the study.

Table 1: List of the types of behavioural catergories used in the scan sampling

Activity	Description
Movement	Climbing/ jumping/ hanging/ walking/ running
Feeding	Picking, chewing, or placing food in mouth, as well as filling the contents of a cheek pouch.
Resting	Sitting or lying down
Social	Playing, grooming, sexual and quarreling behaviour

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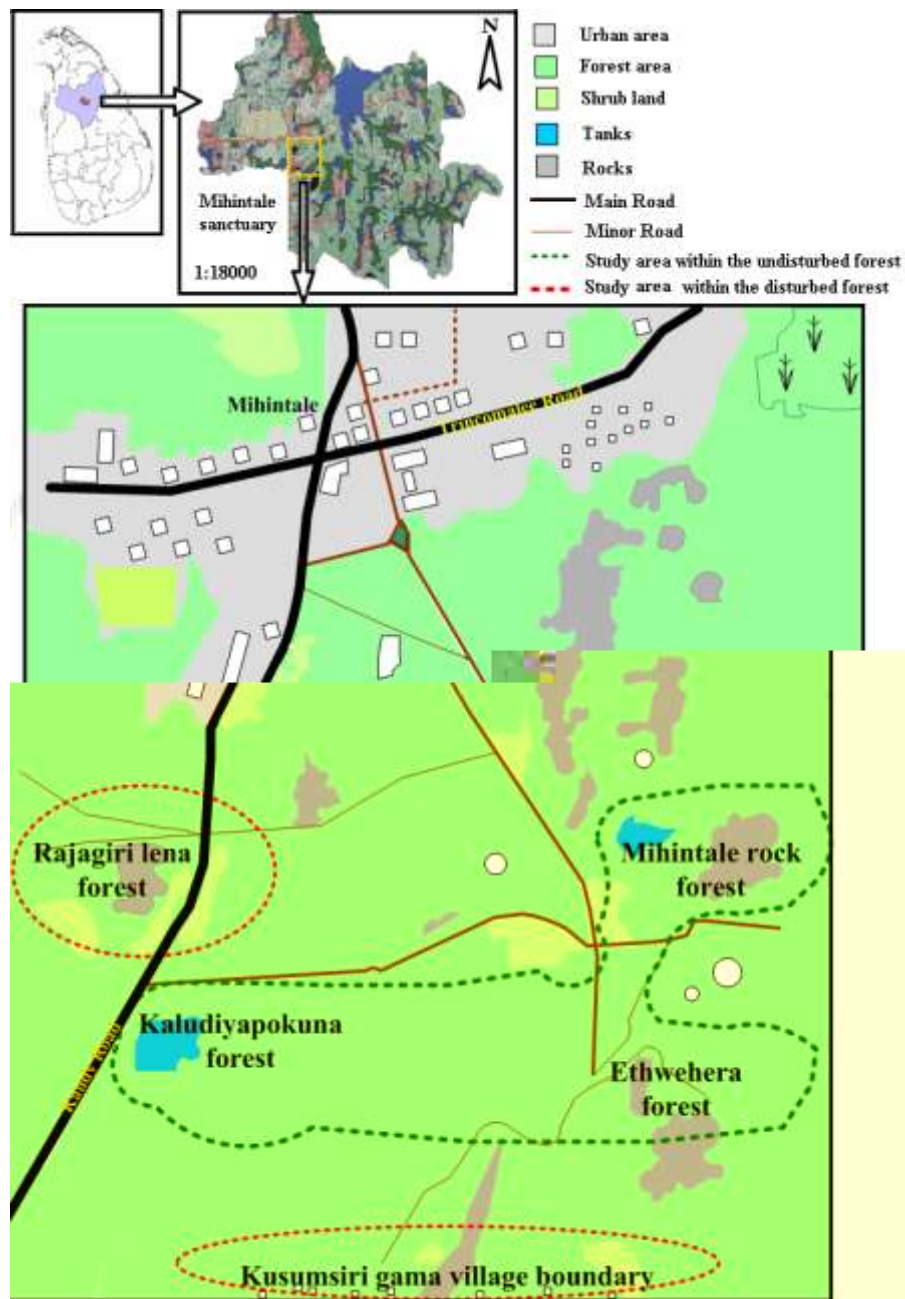
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Figure 1: Locations of langure groups for which reliable counts were obtained

Vegetation was sampled by using a belt transects of 1 km × 1 km, each containing ten 25 m × 25 m plots. For the assessment of habitat, vegetation type including herbs, shrubs and trees, topography and dominant plant species were recorded. Threats were identify by interviewing the community peripheral to the study area.

4. RESULTS AND DISCUSSION

4.1 HABITAT CHARACTERISTICS

The Kaludiyapokuna forest (KPF) has semi deciduous forest dominated by the *Ficus* spp, *Drypetes ebunum* and *Schleichera oleosa* while the other undisturbed forest sites (Mihintale rock (MRF) and Eth wehera forests(EVF)) dominated by the *Drypetes* spp, *Schleichera oleosa*, *Dialium ovoideum* and *Dimocarpus longan*. The Rajagirilena forest (RLF) is an undisturbed area consists of shrub lands and some semi deciduous forest species. Dominant

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tree species are *Schleichera oleosa* and *Drypetes sepiaria*. The other disturbed site; boundary between Kumarasirigama and Mihintale sanctuary (B) consists of three vegetations such as teak forests, shrub lands and home gardens.

4.2   GROUP SIZE AND COMPOSITION

A total of 03 bisexual groups were located in the forest patches and close to the human settlements. There were no any single troops recorded in the dense forest habitats (Table 2). This may be due to the food availability of langurs in disturbed forests than the dense forest. The absence of gray langurs along the rout of mihintale rock due to the dominant behaviour of *Macac sinica sinica*. Overall the troops group varied in size between 14 and 21 langurs (mean 2.1) within the study area. The number of adult males in a group varied between 3 to 6 (mean 0.4) and the adult females between 10 and 13 (mean 0.5). The group size was low in forest than the contiguous forest in human settlements (Fig. 2). The size of the grey langur group in Rajagirilena forest is about 16-20 members with an average value of 19.14 ±3.76 within such a group, there were 5-6 males and 10-12 females (Table 2). The group size of grey lanures in Kaludiyapokuna forest ranges between 14-18, with an average value of 16.8±2.65. (Fig.3a). There were 4-5 males and 10-13 females recorded. In the boundary between Mihintale sanctuary and kumarasirigama village, ranges between 15-19 with an average value of 18.44±1.34. Within a group, there were 3-4 males and 10-12 females (Fig. 3b). With increasing food abundance, it was observed that decrease in langur group size. According to Newton-Fisher et al. [2000], food is an important factor governing grouping in areas of low abundance, but not in areas of higher abundance. Similar phenomenon shown in Kaludiyapokuna groups.

Table 2: Age sex structure of the population

Age sex	KPF (N =30)	EVF (N=25)	MRF (N =33)	RLF (N =30)	B (N =30)
Adult male	4-5	-	-	5-6	3-4
Adult female	10-13	-	-	10-12	10-12
Sub adult males	2	-	-	3	2
Juveniles	4	-	-	3	4
Infants	4-6	-	-	5-7	3-5

Disturbed forest patches.: Boundary between sanctuary and village **(B)** and Rajagirilen forest **(RLF)**

Undisturbed forests ;   Ethvehera forest **(EVF)** , Kaludiyapokuna forest **(KPF)** and forest in Mihintale rock **(MRF)**

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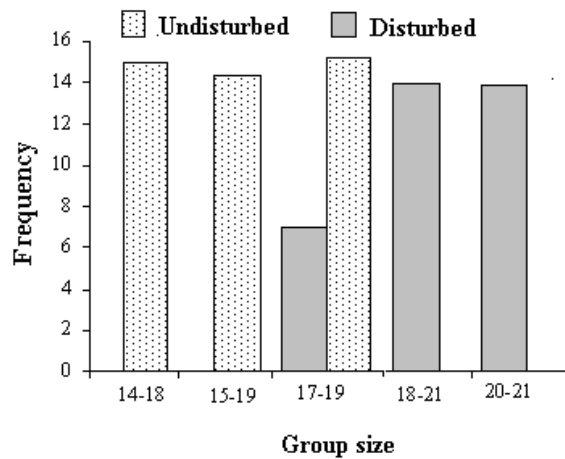
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Figure 2: Group size in undisturbed forest (Kaludiyapokuna forest) and disturbed forest habitats (Rajagirilena forest and Boundary).
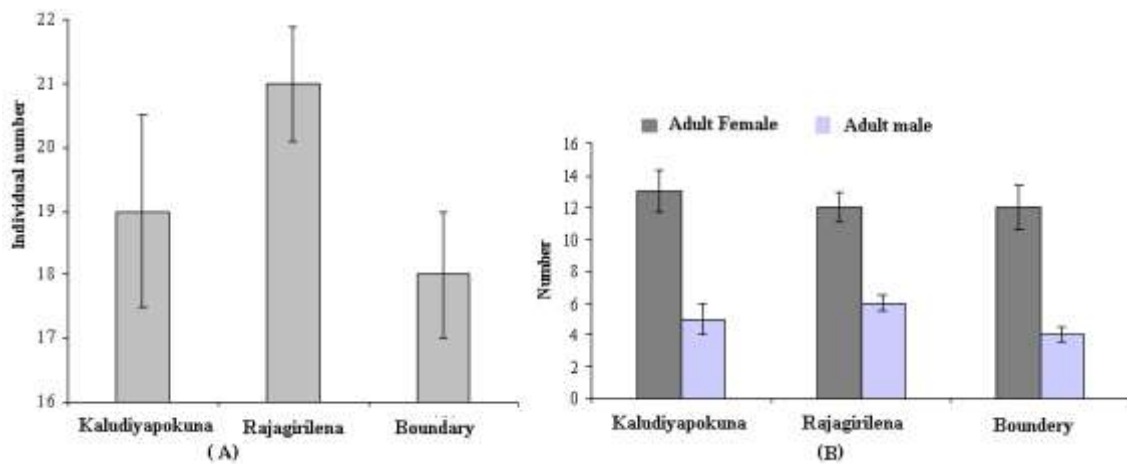

Figure 3: Individual number (A) and adult mal female (B) in different troops within the study area

4.3   HABITAT UTILIZATION

Langurs of study troops were observed consuming plant parts of over 13 species (Table 3), found naturally in their habitat. Three species restricted to the boundary.   During the monsoon months of December to January they were frequently observed consuming insect larvae. It has been observed during the present study that the langurs ingest 38.12 % mature leaves, 25.27 % young leaves, 18.00 % fruits, 1.19 % flowers, 2.28 % stems and 8.45 % bark of the plants. It shows that during the dry season, the number of species comprising food goes down and langurs migrated to the human settlements.

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Table 3: Food tree species used for the foraging of langurs during the study period.

Edible plant species	Kaludiyapokuna	Rajagirilena	Boundary
Kaluwara (*Drypetes ebunum*) YL, ML, SE	*	*	
Ehela (*Cassia fistula)* YL, ML, FL, SE		*	
Welan *(Pterospermum canescens)* YL	*	*	
Weera (*Drypetes sepiaria*) YL,FR	*		
Thimbiri (*Diospyros malabarica)* YL, FR	*	*	
Kappetiya (*Mallotus eriocarpus)* YL, ML, SE	*	*	
Palu *(Manilkara hexandra)* YL, ML, FR	*	*	*
Koon (*Schleichera oleosa*) YL, FL, FR	*	*	*
Burutha (*Swietenia macrophylla*) YL, SE, OT	*	*	*
Wood apple (*Schinus limonia*) YL, ML, FR, FL		*	*
Ficus YL, ML, SE	*	*	
Ipil Ipil (*Leucaena leucocephla*) SE			*
Attikka (*Ficus racemosa*) YL, FR	*	*	
Ehetu (*Ficus tinctoria, Ficus tsiela*) YL, FR	*	*	
Manioc (*Manihot esculenta)* YL, OT			*
Guajava (*Psidium guajava*) FR			*
Mango (*Mangifera indica*) FR, YL			*

YL; Young leaves ML; Mature leaves FL; Flowers FR; Fruits   SE; Seeds OT; Other parts

4.4   ACTIVITY BUDGET

A total of 15 days (5 days for each group) of scan sampling were used to prepare an activity budget. Mean values were calculated for the different activities participated in order to obtain an average daily budget (Table 4). Further the days of observation were divided into four different sets, in order to compare the differences in activity throughout the day (Fig. 4 and Table 4)

Table 4: Mean daily activity budgets for the three troops

Troop	Movement	Feeding	Resting	Social
Kaludiyapokuna forest	20.2 ± 4.5	25.4 ±6.4	48.6 ±9.8	7.2 ± 4.7
Rajagirilena forest	20.5 ± 3.4	25.6 ± 3.3	45.4 ±6.4.	6.7± 2.3
Boundary	45.6 ± 8.2	30.7 ± 6.5	20.6 ± 2.3	5.4 ± 2.1

The three bar-charts (fig.4) reveal that by far the most frequent activity for the three troops resting. This peaks at the 12-3pm period for both troops in Kaludiyapokuna forest and Rajagirilena forest and consists of over 55 % of the activity observed these two troops while in boundary over 40%. In the boundary showed that at the 9-15 hrs troops moving and resting. This may the reason for their adaptive behaviour. Leaf eating primates compensate for the energy lost when they feed in morning hours. Also they can make use of the cooler temperature at these times, spending   the middle of the day, when the temperature are highest, resting and conserving energy in the shade (Huang, 2002).

4.5   SLEEPING SITES

Several sleeping sites were observed during the study period. At the end of the day two troops were selected caves as their sleeping sites while the other used tree species for the roosting.

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They mainly used *Ficus* species, *Swietenia macrophylla*, *Drypetes sepiaria* and *Manilkara hexandra* for roosting. Reason may be due to the protection. The high proportion of food trees in this study area also implies a possible clustering of all trees coincident with the clumping of resource trees. The clumping of all trees could lead to the presence of open areas where groups would gain greater advantage from increased vigilance. Same phenomena shown by the Vasudev *et al* (2008) for the
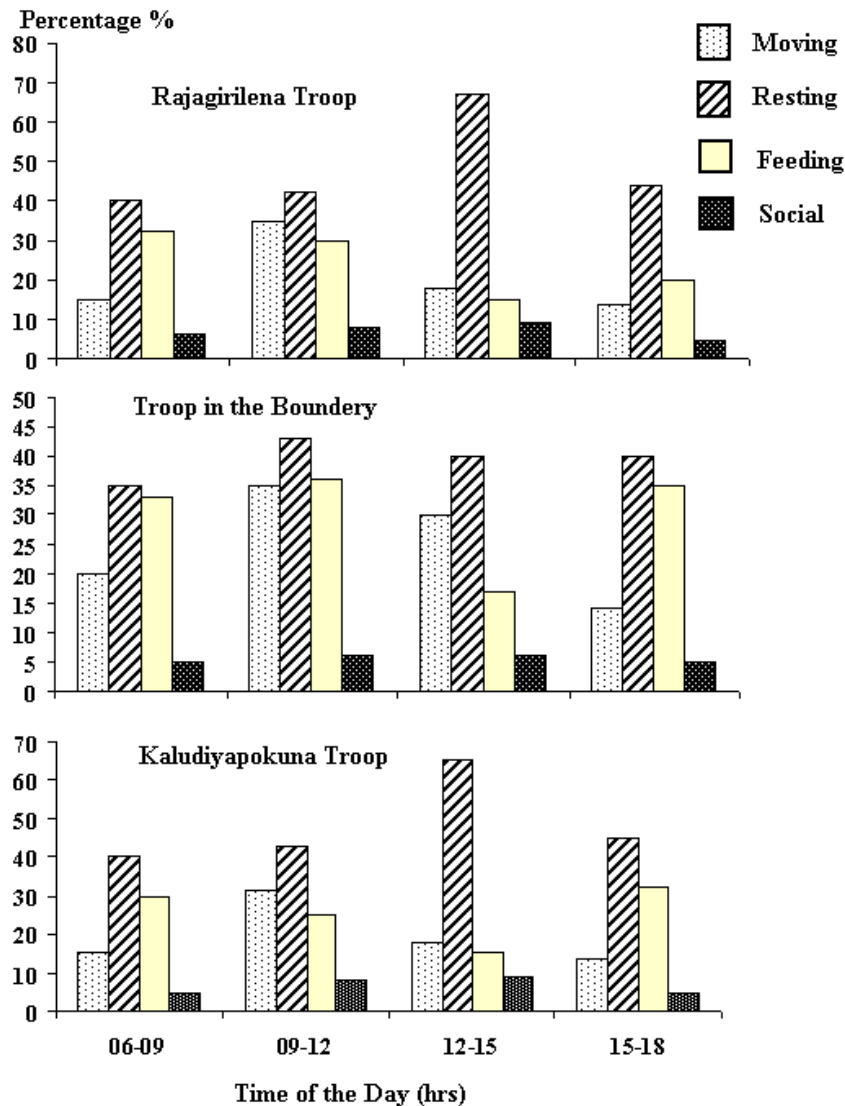*Semnopithecus entellus* in India.

Figure 4: Activity budget for all individuals in three troops. Percentage for four types of activity were calculated over the five days observational period (N=1030)

4.6   THREATS FOR THE *Semnopithecus priam thersites*

There were three major threats identified in the study areas. In Rajagirilena and Kaludiyapokuna forests mainly these animals die due to the road accidence (55%) This is because these two troops cross the A9 road frequently. Over 20% of the langurs kill by the natural predators. Adults mainly killing by the leopard while the juveniles eaten by fox, predatory birds etc. Major threat along the boundary was hunting (55%). Over 97% of the inhabitants of Mihintale mentioned that their houses and yard growings are harmed by mostly temple monkeys. Grey langurs cause fewer losses than temple monkeys. Methods that people have undertaken to minimize these losses include chasing away by lighting crackers or by

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throwing stones at them. About 2% of the people mentioned that, because of the heavy damages caused by these monkeys, drastic measures such as killing monkeys by giving poison are being carried out.

In conservation point of view cutting the forest lands for chena cultivation is one of the major problem for the survival of monkeys. Hence the habitat for the monkeys decreasing an alarming rate and this leads to increase conflicts between monkeys and humans. This is one reason for increase the rate of vulnerable of this species. Fixing a strong fence around the sanctuary at the boundary and making security points along the boundary and appointing officers to guard the sanctuary boundary, enable unauthorized usage of the sanctuary land. Also habitat enrichment will help to increase the food availability within the sanctuary.

1. CONCLUSIONS

On the basis of the results of this study it was clear that the multimale troops were dominated in this area. The troop's size varied between 14 and 21 langurs (mean 2.1) and adult males changed 3-6 and female changed 10-13. The troop sizes mainly depend on the food availability. The troop's distribution restricted to human habitation and disturbed forest patches due to habitat fragmentations. *Semnopithecus priam thersites* used selected tree species as food plants of which *Manilkara hexandra* ,*Drypetes sepiaria* and *Pterospermum canescens* were frequently consumed. The activity of the grey langurs is changing with the human influences. But this study could not consider other factors such as the lack/abundance of preferred seasonal food on the behaviour of grey langur due to time limitation. The major threats on this creature were killing by farmers and the road accidents. Habitat enrichment, minimizing chena cultivation and frequent patrolling by the authorities will help to minimize the threats on this species.

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