

**Full Length Research Paper****Population Status and Distribution of the Endangered Lion Tailed Macaque (*Macaca silenus*) in Kodagu, Central Western Ghats, India**

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**Abstract**

The Brahmagiri Wild Life sanctuary which falls under Central Western Ghats of Karnataka was surveyed during March-April 2011 to assess the status and distribution of the endangered lion-tailed macaque (*Macaca silenus*). A total of 11 individuals in two troops were sighted during the survey. These troops were sighted in Abailu (CPT-14) and Narimalai (CPT-12) compartments which are relatively undisturbed areas. In addition to LTM, other associated species were also recorded which included 9 troops of common langur, 1 troop of Nilgiri langur and 23 No. of Malabar giant squirrels. The present study also reviews the population status in the region from 1985 to 2011. The present paper also suggests suitable management strategies for inclusion in the working plan.

**Key words:** Lion-tailed macaque, *Macaca silenus*, Central Western Ghats, Brahmagiri Wild Life Sanctuary, endangered primate, population status.

**Introduction**

The Lion-Tailed Macaque (*Macaca silenus*) is endemic to the tropical rainforests of the Western Ghats. It is considered the ancestor of all Asian macaques, since it is probably the direct descendent of the first macaque to reach Asia (*Macaca paleoindica*), nearly 5 million years ago, more or less the time when man evolved. This ancestor, the fossils of which have been obtained from Shivalik Hills, is thought to have reached Southeast Asia through southern India. Geo-climatic changes during the Pleistocene, especially glaciations and the monsoonal climate isolated the ancestral stock to the Western Ghats, whereas the stock which had reached Southeast Asia underwent repeated speciation to give rise to most of the extant macaques. The Lion tailed macaque is a descendant of that stock which was isolated in the Western Ghats. Having been isolated in the tropical rainforests for all its life, the species shows striking adaptations to this habitat.

Even within historical times, the Lion-Tailed Macaque (LTM) was distributed as a contiguous population from the southern end of the Western Ghats to well into the state of Maharashtra. Over the past many centuries, however, its distribution range in the north has shrunk to just north of the Sharavati River in Karnataka, as most of the rainforests in the states of Maharashtra and Goa were wiped out. Similarly, the lowland rainforests in Kerala and Karnataka were also wiped out, confining the lion-tailed macaque to higher elevations. Moreover, the remaining forests have been fragmented into numerous small isolated patches. Presently, therefore, the lion-tailed macaque occurs as numerous small populations.

LTM belongs to kingdom Animalia, phylum chordate, class mammalian, order primates, family Cercopithecidae, genus *Macaca* and species *silenus*. An adult generally appears as a medium-sized macaque, having glossy black pelage, brownish grey to grayish white facial rough and a tufted tail. Males are larger in size and the tail-tuft more developed than that of females. Body weight of male and female varies from 6.75 kg and 2.28 kg, respectively. Head appears as crown blackish, frontal hairs directed backwards with hairs on vertex radiating to form a whorl. Face blackish massive ruff on either side of head, meeting below the chin, brownish to grayish white in colour and lips black. The newborn has pale pink skin with brown hairs. After a month, the skin darkens to pale brown and hairs to black.

LTM, an almost entirely arboreal mammal, is endemic to the rainforests of the Western Ghats of Karnataka, Tamil Nadu and Kerala. Due to its highly selective feeding habits, limited range of occupancy (about 2500 sq. km.), delayed sexual maturity, long inter-birth intervals, low population turnover and a small remaining wild population, the species has been classified as endangered (IUCN

2003). In addition, habitat loss, habitat fragmentation and hunting have most drastically affected its populations (Karanth 1992; Krishnamurthy & Kiester 1998). The LTM is at the apex of the wildlife chain in such ecosystem.

Karanth (1985) had estimated population size of 123 groups distributed across the forests of the Western Ghats of Karnataka (Table 1). In the same study Karanth reported 4 groups in Brahmagiri Wildlife Sanctuary (WLS). Later study carried out by Kumara & Singh (2004a) recorded only one group of LTM in this region and the authors were of the opinion that the population status of the LTM appears to be similarly threatened in other Protected Areas of the state as well. With this background an attempt was made to: (i) assess the present status and distribution of LTM in Brahmagiri WLS; (ii) assess the status of other associated arboreal mammals and (iii) recommend conservation measures.

## Materials and Methods

### Study area

This study was carried out in the Srimangala range during March-April 2011, which is a pristine in geographical location and forms major part of Brahmagiri WLS, covering an area of 129.47 sq km out of the total sanctuary area of 181.29 sq km (Fig. 1). Being in continuity with important protected areas (PA's) such as Madumalai WLS (Tamil Nadu), Bandipur National Park (NP), Rajiv Gandhi NP (popularly known as Nagarhole NP) and Aralam WLS (Kerala), Brahmagiri WLS provides extended habitat for large mammals like tiger, elephant, primates, birds etc. Srimangala range also act as a corridor for all these protected areas.

### Vegetation type

The study area mainly constitutes of four forest types viz., Tropical Wet evergreen forests, Semi evergreen forests, Shola forests and Grass lands.

**Tropical Wet evergreen forests:** These forests forms nearly 80 per cent of Urty reserve forests and 50 per cent of Brahmagiri reserve forests. Some of the major floristic elements of these forests are *Artocarpus species*, *Calophyllumapetalum*, *Syzygiumspecies*, *Cinnamomum species*, *Holigarna species*, *Dimocarpuslongan*etc in the tree layer and *Psychotrianigra*, *Strobilanthus species*, *Helicterusisora*etc are some of the most common species found in the under story (shrub layer).

**Semi-evergreen:** These forests are found both in Urty and Brahmagiri reserve forests. The major floristic elements of this vegetation include *Terminalia species*, *Lagerstroemia microcarpa*, *Syzygium species*, *Diospyros species*, *Holigarna species*, *Albizzia species*, *Mallotus species* etc.

**Shola forests:** These forests are also often called as high altitudinal evergreen forests as the elevation of these forests is less than 1500 m above mean sea level. These are the patches of forests found on the hillocks along the valley amidst the grasslands. The floristic elements of these forests are evergreen in nature with stunted growth and relatively smaller leaf size. Some of the important floristic elements are *Litsea floribunda*, *Glochidionmalabarica*, *Syzygium species*, *Ligustrumperrottetii*, *Memecylon species* etc.

**Grass lands:** These are found on the top portion of the hillocks especially in large extents in the Brahmagiri hill ranges.

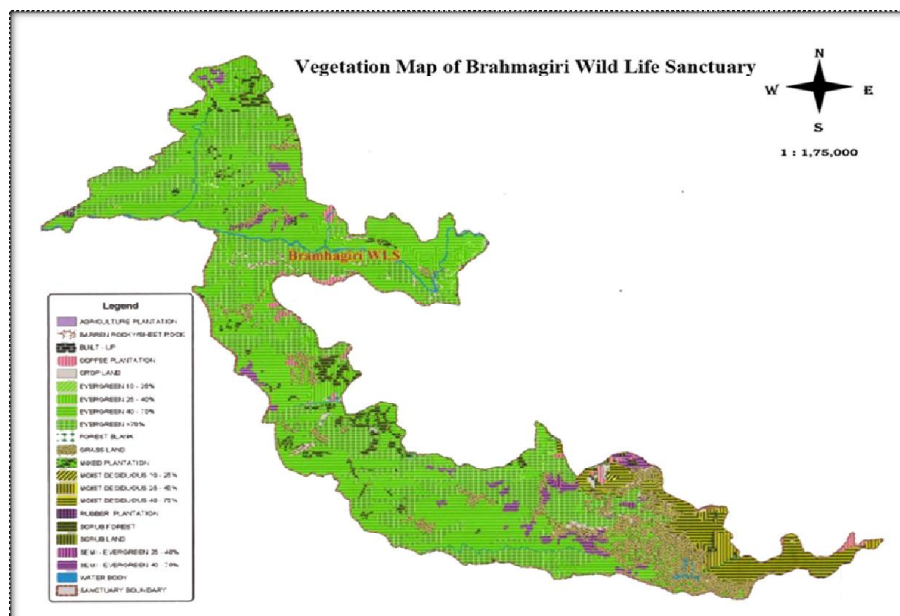


Figure 1: Vegetation map of Brahmagiri wildlife sanctuary

**Site factors**

The area receives heavy rain fall ranging from 2500 mm to 6000 mm, of which the major downpour is within four months from June to September. Climate of the Brahmagiri WLS can be divided into two major seasons. Cold season sets in the end of November and passes into the hot season by middle of February.

The terrain is generally undulating with several steep valleys and hillocks with few rocky areas. The highest peak in the areas is Brahmagiri which is 1607 meter above mean sea level. This forest is the source of perennial rivers which drain towards Bay of Bengal and Arabian Sea. The rivers which flow towards Arabian Sea are Barpole, Segamanihole and Somahole. Lakshmana thirtha flow towards Bay of Bengal and also Lakshmana thirtha is a very important tributary of river Cauvery that originates in shoals of Srimangala range. In addition to these rivers, there are several perennial streams which come out from the patch forests in the valleys.

**Sampling methodology**

The study area is linear in shape and runs in curved boundary touching agricultural lands and coffee estates in larger parts (Fig. 3) and for about 55 km it runs in a common boundary of the Karnataka and Kerala interstate boundaries (Plate 1). Most of the boundary line of the sanctuary runs along the adjacent

**Table 1:** Lion-tailed macaque groups in different protected areas and adjacent ranges in Karnataka state, India.

Area	Ranges	Karanth, 1985		Recent surveys	
			No. of groups		Source
Brahmagiri WS	Srimangala, Makut <sup>1</sup>	4	0		Kumara & Singh, 2004a
Makut	Makut <sup>1</sup>	6	1		
Talakaveri WS	Bhagamandala	10	4		Kumara & Sinha, (2004)
Pushpagiri WS	Sampaje <sup>2</sup>	1	0		
Subramanya RF	Subramanya <sup>2</sup>	6	1		
Yesalur RF	Yesalur <sup>2</sup>	1	0		
Sakaleshpur RF	Sakaleshpur <sup>2</sup>	2	1		
Kudremukh NP	Kerekatte	9	10		Singh <i>et al</i> , 2000
Kudremukh NP	-	44	20		Kumara & Singh, 2007
Mookambika WS	-	12	6		
Someshwara WS	-	6	4		
Sharavathi V WS	Kogar <sup>3</sup>	5	2		Kumara & Sinha, (2004)
Bhatkal RF	Bhatkal <sup>3</sup>	2	1		
Gersoppa RF	Gersoppa 1 <sup>3</sup>	2	0		
Gersoppa RF	Gersoppa 2 <sup>4</sup>	2	10		Kumara & Singh, 2004a
Siddapur RF	Siddapur <sup>4</sup>	2	2		
Kyadagi RF	Kyadagi <sup>4</sup>	1	17		
Honnagara RF	Honnagara <sup>4</sup>	0	3		
Kumata RF	Kumata	1	0		
Kumta RF	Kumta	1	0		

<sup>1</sup>Brahmagiri-Makut population, <sup>2</sup>Pushpagiri-Subramanya population, <sup>3</sup>Sharavathi-Gersoppa population, <sup>4</sup>Sirsi Honnagara population; WS: Wildlife Sanctuary, RF: reserve Forest, NP: National Park

(Adopted from Kumara and Sinha (2004) and updated with the recent findings)

agricultural land, so the pressure on sanctuary for grazing and collection of minor forest produce is high. One side is safe guarded by the protected areas of Kerala and the other side is populated by human settlements.

As LTM occur in low numbers in the study area and are highly restricted to narrow strips of rainforests, estimation of their density through line transect survey or distance sampling does not seem feasible as it requires an enormous effort. Laying of transect lines is often not possible over much of the species range. The total count method has thus been widely adopted to estimate populations of such rare and patchily distributed species (Whitesides *et al.* 1988; White & Edwards 2000). The approach constitutes simultaneous and repetitive walks for three times by many trained people in a selected grid or region. We adopted 'sweep sampling' method in the present study with some modifications. The compartments were taken as the unit for sampling. In this method, since the effort is intensive, the accuracy of the information is expected to be high. One researchers, forest staff and couple of volunteers were made to walk in the forest on predetermined paths (trials) in the forest without cutting the line, with the help of local field assistants. The selection of the locals was done based on their knowledge of the LTM presence in different compartments. GPS co-ordinates of the locations of LTM sightings were recorded.

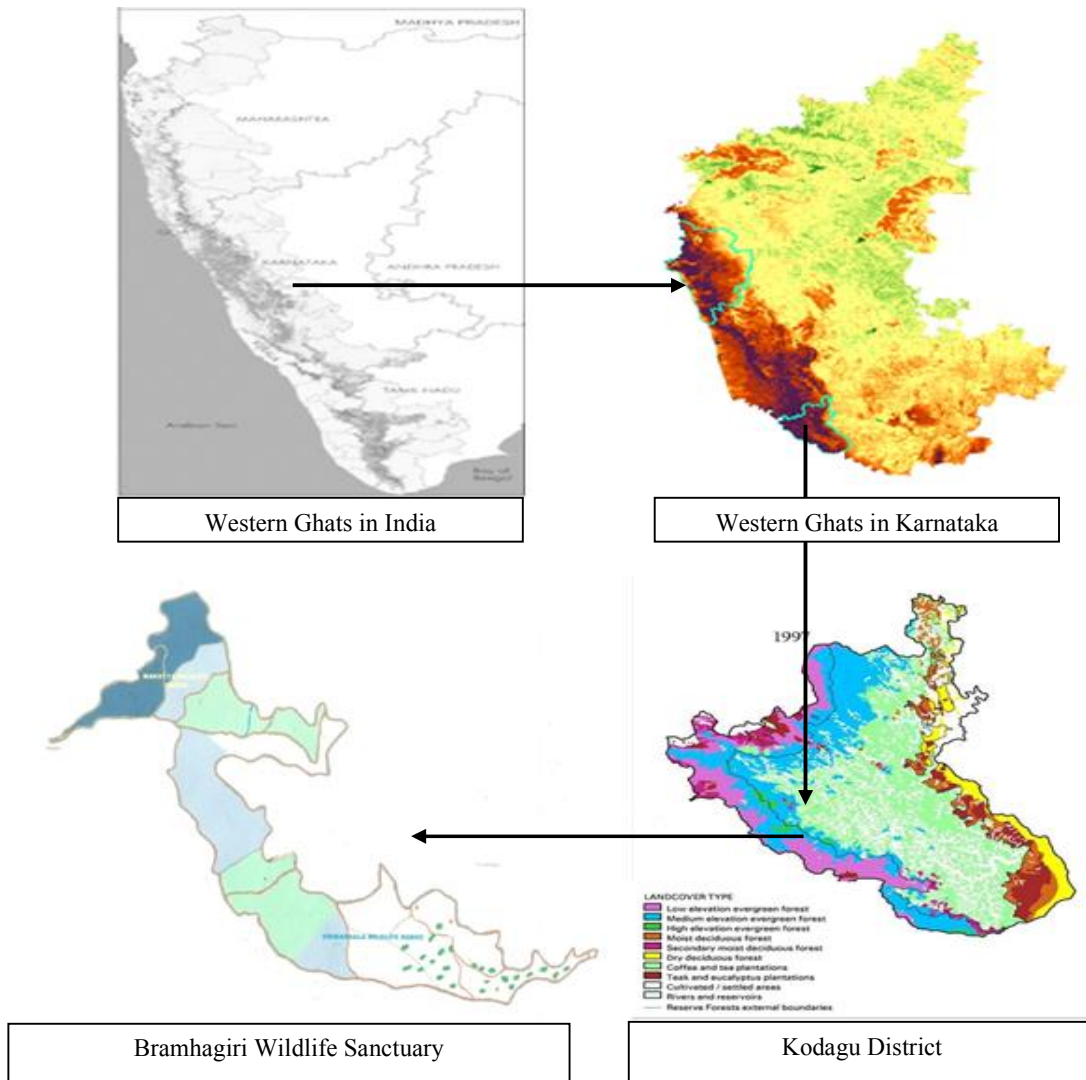


Figure 2: Map depicting compartments of Srimangala wildlife range

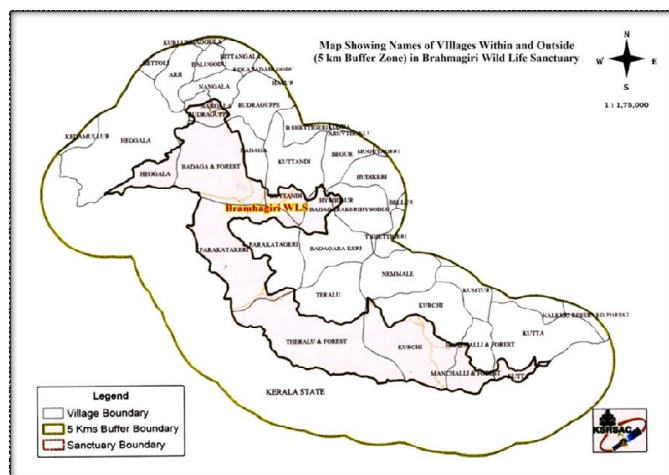
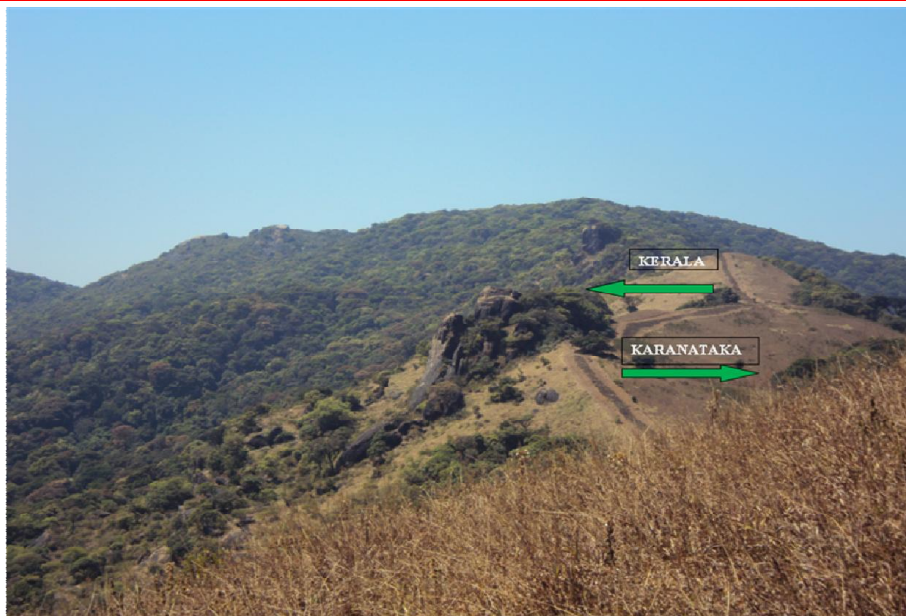


Figure 3: Map showing names of villages within and outside (5 km buffer zone) in Bramhagiri wildlife sanctuary.



**Plate1:** Interstate border line between Karnataka and Kerala forests

Further, secondary data for the sightings in the last few years from the local people and the department personnel were pooled and the suitable available habitat identified. This information provided the possible area for lion tailed macaque in each of the compartment and helped in selecting specific areas for the survey. The trained persons made consecutive walks in each fixed areas for two to four days. In each fixed areas, walks were made using established trails and in fixed direction through undisturbed forests. During each walk, at least two to three people walked parallel to each other with a 100 m inter individual distance. During the walk, after sighting a macaque group, sufficient time was spent to obtain a proper count of individuals and following observation were noted *viz.*, time of sighting, GPS location, altitude, slope, vegetation type etc. Previous studies have documented the home range of a single group to be about 5 sq. km. (Green & Minkowski 1977; Kumar 1987). Hence, we considered each group that was sighted within a range of 1.5 km radius from the other group as same, unless the two groups were sighted in a short span of time and the group identity of each was confirmed as different.

**Other associated parameters:** The additional data of other associated primates and mammals was also collected during walks *viz.*, Niligiri langur, Common langur, Indian giant squirrel etc. Secondary data on floristic composition will be used to check food availability for LTM in future course of time.

### Results and Discussion

The total number of LTM individuals and troupes sighted during the survey period are summarized in the Tables 2 and 3. LTM troupes were sighted in two compartments (CPT 12 and CPT 14), out of 12 compartments in Srimangala range. The two groups were named with the area of their sighting *viz.*, Aabailu and Narimalai. The Aabailu group size was six individuals. Among the sighted individuals, three were adults, one juvenile, one younger and another one was unidentified (Plate 4). It was not possible to distinguish male and female due to the inconvenience of underground vegetation and dry litter that caught the attention of LTM and they fled away. The group was sighted nearer to the Somohole river that is perennial in nature and with thick evergreen forest patch adjacent to Aralam WLS, Kerala (Plate 3). The second group was sighted in Kengergi shola forest (In Kannada Kengergi means Indian giant squirrel) at the state border line of Kerala, near Munikal caves which comes under CPT 12 (Plate 4). The group size was five individuals in which, four appeared to be adults (three female and one male) and one juvenile. The aerial distance between the two troupes was 7.2 km (Plate 3). Previous studies have documented the home range of a single group to be about 5 sq. km, so they were considered as two separate troupes (Green & Minkowski 1977; Kumar 1987). In both, troupe size was similar and average size of four to seven. Green & Minkowski (1977) reported 15 individuals per troupe and Kumar & Kurup (1993), based on a detailed repeated census of 20 troupes, suggested a troupe size of 18.4 and 19.1 in the areas south and north of Palghat gap, respectively and suggested an average of 19 for the whole population. But in the present study at the Srimangala range the troupe size is smaller.

Karant (1985) reported presence of four troupes in Srimangala range but Kumara & Singh (2004) reported only a single group in Brahmagiri-Makutta Reserve forest and concluded that Srimangala range has no presence of LTM. But the present study has revealed the presence of LTM population. Any how the population has declined from 1985 as indicated in figure 3. Srimangala range with unique geographical location has a suitable habitat for LTM.

When we look into the vegetation type map, we notice thick evergreen patch with semi evergreen forest that is contiguous with evergreen forest of Aralam WLS, this enhances a good habitat for LTM. These strips of evergreen and semi evergreen forest patch at the Kerala border are rich in species composition. These forests are dominated by species like *Artocarpus spp*, *Antidesma spp.*, *Elaeocarpus serratus*, *Elaeocarpus tuberculatus*, *Garcinia gummi-gutta*, *Mesua ferrea*, *Olea dioica*, *Chionanthus malabarica*, *Schleichera oleosa*, *Knema attenuate*, *Myristica malabarica*, *Myristica dactyloides* and *Cullenia spp.* and also the presence of Malabar giant squirrels show the food availability for LTM. Srimangala range has also been gifted with

**Table2:** Geographic locations of the LTM troupes sighted

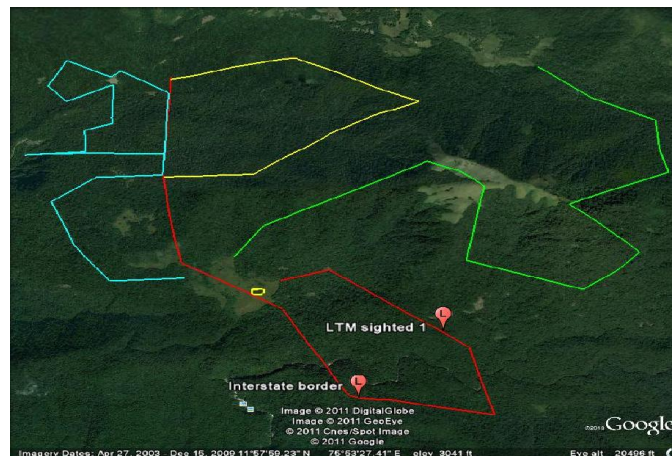
Place	Compartment	Time of sighting (IST 24:00 hrs)	Distance covered (kms)	No. of troupes sighted	GPS location	Altitude (m)	Slope (degrees)	Remarks
Aabailu	CPT 14	15:45	19	1	N 11 <sup>0</sup> 57'' 22.2' E 75 <sup>0</sup> 53'' 56.1'	958.6	10	Perennial water source
Narimalai	CPT 12	10:35	14	1	N 11 <sup>0</sup> 56'' 21.1' E 75 <sup>0</sup> 57'' 44.2'	1457	5	Interstate boarder near Munikal caves

**Table 3:** Population status and demography of LTM troupes in Srimangala Wildlife range

Troupe	No of individuals	Adults	Juveniles	Infants	Unidentified
Aabailu	6+	3	1	1	1
Narimalai	5	4	1	-	-



**Plate 2:** Lion tailed macaque sighted in Aabailu, Srimangala wildlife sanctuary



**Plate 3:** Transect line covered during the survey in CPT 14



Plate 4: Location of LTM sighted in Kengeri shola forest, Srimangala wildlife range (CPT 12)

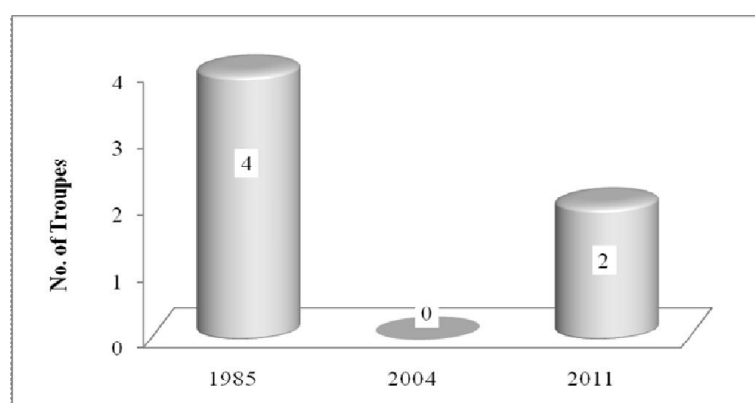


Figure 3: Trend of population status of LTM in Srimangala wildlife range

excellent network of water source. Easa et al (1997) have reported the presence of LTM in Aralam WLS that is adjacent to Srimangala range, both being the suitable habitat for LTM encourages migration from both sides of forest and gives the scope for enhancing their home range.

Brahmagiri WLS with the contiguous forest patch makes enough area to maintain survival viable population as reported by Green & Minkowski (1977), who has stressed the importance of a large interbreeding population for maintaining genetic viability and suggested the need for a contiguous evergreen patch of about 135 sq km for survival of a viable population of about 500 animals.

As a habitat specialist, LTM dwells exclusively in the evergreen environments of the Western Ghats. Srimangala wildlife range and adjacent contiguous forest remain one of the viable habitats left for this endangered primate. Brahmagiri WLS with adjacent Aralam WLS is undoubtedly the best, being the southernmost, at a low elevation and not logged.

Data on the presence of other associated arboreal mammals was also collected during the present study. The data obtained are listed in the Table 4. These mammals include Bonnet macaques, Common langur, Niligiri langur and Malabar giant squirrels. In addition to 2 groups of LTM sighted, we observed 07 groups of common langur, 23 individuals of giant squirrels and one group of Niligiri langur. Interestingly we did not sight any group of Bonnet macaque. The LTM were never found in disturbed areas. Common langur and Malabar giant squirrel were sighted even in disturbed forest of CPT 08, CPT 09, CPT 11 and CPT 15. Niligiri langur was sighted in undisturbed forest *i.e.* CPT 14.

### Conservation strategies and Recommendations

Conservation strategies should be area specific and planned only after at least a short term study of the ecological parameters of the area concerned. Strict measures also may have to be taken to maintain the contiguity of the existing patches in the interest of LTM conservation in the Central Western Ghats. We suggest that appropriate management strategies for wildlife conservation should be developed while preparing Management plan for this area. Any heavy developmental works should be completely banned with immediate effect, so that there will be no further habitat disturbance. Habitat degradation seems to be the major threat to the existence of LTM in all the compartments.

Table 4: Distribution of other associated arboreal mammals

Compartment	Distance walked (km)	Bonnet macaque	No. of common langur troops	No. of Nilgiri langur troupes	No. of Giant squirrels
CPT 08	09	-	1	-	-
CPT 09	08	-	2	-	3
CPT 10	11	-	-	-	-
CPT 11	15	-	1	-	3
CPT 12	14	-	-	-	4
CPT 13	09	-	-	-	1
CPT 14	19	-	2	1	6
CPT 15	08	-	2	-	2
CPT 18	05	-	1	-	4

Collection of non-wood timber forest products (NTFP's) will deprive the diet of LTM. In order to curb this activity, eco-development projects should be implemented for the tribal and rural populations living in and adjacent to the LTM habitats to reduce their impact on the forests. In order to ensure survival of LTM and success of conservation projects within and around the forest areas where animals and human beings share space, a sustained education and publicity campaign will create awareness for conservation particularly, of lion-tailed macaque. LTM is considered opportunistically omnivorous, but plants comprise the vast majority of the diet. Hence, recognition and utilization of available plant resources become a critical component of conservation. Enrichment plantation work may be taken where ever possible with the tree species that are more feed by LTM, *Cullenia* spp. which comprises of 21.85 % and *Ficus* spp. of the diet of LTM may be encouraged for planting.

Existing roads that passes through LTM habitats should not be widened, as it would degrade the canopy continuity, which is very crucial for this highly arboreal species. A tourism zone should be demarcated outside, to reduce anthropogenic pressure in the core zone. As one of the LTM troupe (CPT 12) was sighted adjacent to the trekking path of Munikalcaves and Bramhagiri hills.

Forest fire should be avoided completely by taking suitable measures. Fire affected areas should be monitored and measures must be taken for the regeneration to establish. Planting seedlings of food species of primates in these areas is to be prioritized. Monitoring of population parameters of LTM should be continued to manage the population effectively and protect the species from the threat of extinction.

Core zone for LTM should be demarcated considering Bramhagiri WLS and Aralam WLS as one unit, since both of them act as a migratory habitats. Co-ordination committee should be formed between Bramhagiri WLS and Aralam wildlife sanctuary that shares the habitat of LTM. This committee may take up discussion on conservation strategies across the borders and also provide a platform for speedy communication on fire, poaching etc.

## Conclusion

Lion-Tailed Macaque, an almost entirely arboreal mammal, is endemic to the rainforests of the Western Ghats of Karnataka, Tamil Nadu and Kerala. Due to its highly selective feeding habits, limited range of occupancy, delayed sexual maturity, long inter-birth intervals, low population turnover and a small remaining wild population, the species has been classified as endangered. Earlier studies have indicated that the LTM population from Bramhagiri WLS have been lost or might have migrated to Arlam wild life sanctuary. However, in the present study two groups have been sighted in the Bramhagiri WLS indicating the presence of LTM and thus conservation strategies have been proposed with view to conserve the remnant populations.

## Acknowledgement

The authors are grateful to the Karnataka Forest Department for the financial and logistic support. We are also thankful to the range forest officer of Srimangala range for the assistance rendered during the field work. We would also thank volunteers involved in survey work

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**Annexure 1:** Checklist of tree species and parts eaten by LTM in Srimangala Wildlife range, Brahmagiri Wildlife Sanctuary

S. No	Species	Family	Part eaten by LTM
1	* <i>Acacia auriculiformis</i>	Fabaceae	
2	<i>Acrocarpus fraxinifolius</i>	Fabaceae	
3	<i>Actinodaphne hookeri</i>	Lauraceae	F
4	<i>Actinodaphne malabarica</i>	Lauraceae	
5	<i>Actinodaphne bourdillonii</i>	Lauraceae	
6	<i>Aglai ajainii</i>	Meliaceae	
7	<i>Aglai alawii</i>	Meliaceae	X
8	<i>Albizzia lebeck</i>	Fabaceae	
9	<i>Albizzia odoratissima</i>	Fabaceae	
10	<i>Antidesma menasu</i>	Euphorbiaceae	F B
11	<i>Aphanamixis polystachya</i>	Meliaceae	
12	<i>Apodytes beddomei</i>	Icacinaceae	X
13	<i>Aporosa lindleyana</i>	Euphorbiaceae	F
14	<i>Archidendron monadelphum</i>	Fabaceae	
15	<i>Artocarpus heterophyllus</i>	Moraceae	F S
16	<i>Artocarpus hirsutus</i>	Moraceae	F S
17	<i>Bambusa bamboos</i>	Poaceae	S
18	<i>Bischofia javanica</i>	Euphorbiaceae	F
19	<i>Bombax malabaricum</i>	Bombacaceae	N
20	<i>Bombax cieba</i>	Bombacaceae	N
21	<i>Callicarpa tomentosa</i>	Verbenaceae	
22	<i>Calophyllum apetalum</i>	Clusiaceae	F
23	<i>Canarium strictum</i>	Burseraceae	X
24	<i>Canthium dicoccum</i>	Rubiaceae	X
25	<i>Carallia brachiata</i>	Rhizophoraceae	F
26	<i>Careyaarborea</i>	Lecythidaceae	
27	<i>Cassia fistula</i>	Fabaceae	F
28	<i>Celtis philippensis</i>	Ulmaceae	
29	<i>Chionanthus leprocarpa</i>	Oleaceae	X
30	<i>Chionanthus malabarica</i>	Oleaceae	X
31	<i>Chrysophyllum roxburghii</i>	Sapotaceae	
32	<i>Chukrasia tabularis</i>	Meliaceae	
33	<i>Cinnamomum macrocarpum</i>	Lauraceae	X
34	<i>Cinnamomum malabathrum</i>	Lauraceae	X
35	<i>Cinnamomum sulphoratum</i>	Lauraceae	X
36	<i>Clerodendron viscosum</i>	Verbenaceae	
37	<i>Cordia dichotama</i>	Boraginaceous	F
38	<i>Dalbergia latifolia</i>	Fabaceae	
39	<i>Dillenia pentagyna</i>	Dilleniaceae	F
40	<i>Dimocarpus longan</i>	Sapindaceae	F N
41	<i>Diospyros candolleana</i>	Ebenaceae	
42	<i>Diospyros paniculata</i>	Ebenaceae	X
43	<i>Diospyros species</i>	Ebenaceae	X
44	<i>Diospyros sylvatica</i>	Ebenaceae	S
45	<i>Elaeocarpus serratus</i>	Elaeocarpaceae	F
46	<i>Elaeocarpus tuberculatus</i>	Elaeocarpaceae	F
47	<i>Erythrina indica</i>	Fabaceae	N

International Journal of Life Sciences		Devagiri G.M. et.al.,	Vol. 3 No.4	ISSN: 2277-93x
48	<i>Euodialum-ankenda</i>	Rutaceae		
49	<i>Euonymus indicus</i>	Celastraceae		
50	<i>Euriya japonica</i>	Theaceae		
51	<i>Feronia elephantum</i>	Rutaceae		F
52	<i>Ficus asperima</i>	Theaceae		
53	<i>Ficus hispida</i>	Moraceae		F
54	<i>Ficus nervosa</i>	Moraceae		F
55	<i>Ficus beddomie</i>	Moraceae		F
58	<i>Flacourtia montana</i>	Flacourtiaceae		F N
59	<i>Garcinia gummi-gutta</i>	Clusiaceae		F
60	<i>Garcinia morella</i>	Clusiaceae		X
61	<i>Glochidion malabaricum</i>	Euphorbiaceae		X
62	<i>Gluta travancorica</i>	Rutaceae		
63	<i>Gmelina arborea</i>	Verbenaceae		
64	<i>Grewia eliaefolia</i>	Tiliaceae		
65	<i>Holigarna arnottiana</i>	Anacardiaceae		F
66	<i>Holigarna beddomei</i>	Anacardiaceae		
67	<i>Holigarna grahamii</i>	Anacardiaceae		F
68	<i>Hopea parviflora</i>	Dipterocarpaceae		
69	<i>Hydnocarpus pentandra</i>	Flacourtiaceae		F
70	<i>Knema attenuata</i>	Myristicaceae		F
71	<i>Lagerstroemia microcarpa</i>	Lythraceae		
72	<i>Lannea coromandelica</i>	Anacardiaceae		
73	<i>Leportea crenulata</i>	Urticaceae		
74	<i>Ligustrum perrottetii</i>	Oleaceae		
75	<i>Litsea floribunda</i>	Lauraceae		F
76	<i>Litsea mysorensis</i>	Lauraceae		X
77	<i>Lophopetalum wightianum</i>	Celastraceae		
78	<i>Macaranga peltata</i>	Euphorbiaceae		F B
79	<i>Madhuca nerifolia</i>	Sapotaceae		
80	<i>Mallotus philippinensis</i>	Euphorbiaceae		
81	<i>Mangifera indica</i>	Anacardiaceae		F
82	<i>Margaritaria indica</i>	Euphorbiaceae		
83	<i>Mastixia arborea</i>	Cornaceae		
84	<i>Melia dubia</i>	Meliaceae		F
85	<i>Memecylon malabaricum</i>	Melastomataceae		
86	<i>Memecylon talbotianum</i>	Melastomataceae		
87	<i>Memecylonum bellatum</i>	Melastomataceae		
88	<i>Mesua ferrea</i>	Clusiaceae		F
89	<i>Meyna laxiflora</i>	Rubiaceae		
90	<i>Michelia champaca</i>	Magnoliaceae		
91	<i>Mimusops elengi</i>	Sapotaceae		F
92	<i>Mitragyna parviflora</i>	Rubiaceae		
93	<i>Myristica dactyloides</i>	Myristicaceae		A
94	<i>Myristica malabarica</i>	Myristicaceae		A
95	<i>Neolitsea zeylanica</i>	Lauraceae		X
96	<i>Nothopegia beddomei</i>	Anacardiaceae		F
97	<i>Nothpodytes foetida</i>	Icacinaceae		
98	<i>Olea dioica</i>	Oleaceae		X
99	<i>Otonophelium stipulaceum</i>	Sapindaceae		
100	<i>Palaquium ellipticum</i>	Sapotaceae		F
101	<i>Pavetta indica</i>	Rubiaceae		
102	<i>Persea macrantha</i>	Lauraceae		F
103	<i>Phyllanthus emblica</i>	Euphorbiaceae		F
104	<i>Polyalthia fragrans</i>	Annonaceae		F
105	<i>Pterocarpus marsupium</i>	Fabaceae		
106	<i>Randia spinosa</i>	Rubiaceae		X
107	<i>Sapindus emarginatus</i>	Sapindaceae		
108	<i>Schfflera capitata</i>	Araliaceae		
109	<i>Schfflera venulosa</i>	Araliaceae		
110	<i>Schleichera oleosa</i>	Sapindaceae		F
111	<i>Scleropyrum pentandrum</i>	Santalaceae		

International Journal of Life Sciences	Devagiri G.M. et.al.,	Vol. 3 No.4	ISSN: 2277-93x
112	<i>Spathodea companulata</i>	Bignoniaceae	
113	<i>Spondias pinnata</i>	Meliaceae	
114	<i>Sterculia guttata</i>	Sterculiaceae	S
115	<i>Stereospermum chelonoides</i>	Bignoniaceae	
116	<i>Stereospermum personatum</i>	Bignoniaceae	
117	<i>Symplococus chinensis</i>	Symplocaceae	F
119	<i>Symplococus racemosa</i>	Symplocaceae	X
120	<i>Syzygium cuminii</i>	Myrtaceae	F
121	<i>Syzygium laetum</i>	Myrtaceae	F
122	<i>Syzygium lanceolatum</i>	Myrtaceae	F
123	<i>Syzygium gardnerii</i>	Myrtaceae	F
124	<i>Syzygium mundagam</i>	Myrtaceae	F
125	<i>Syzygium munronii</i>	Myrtaceae	F
126	<i>Tabernaemontana heyneana</i>	Apocynaceae	
127	<i>Tectona grandis</i>	Verbenaceae	
128	<i>Terminalia bellirica</i>	Combretaceae	
129	<i>Terminalia paniculata</i>	Combretaceae	
130	<i>Terminalia tomentosa</i>	Combretaceae	
131	<i>Toona ciliata</i>	Meliaceae	
132	<i>Trema orientalis</i>	Ulmaceae	
133	<i>Trichilia connaroides</i>	Meliaceae	
134	<i>Vepris bilocularis</i>	Rutaceae	F
135	<i>Vitex altissima</i>	Verbenaceae	
136	<i>Xanthophyllum flavescens</i>	Polygonaceae	B

\* Secondary data on species composition

Note: F- Fruit; S- seeds; B- Blossoms/flower; N- Nectar; R- Resin/Gum; A- Aril;

X- LTM was found harbouring on these species but exactly we could not find out the parts on which the LTM was feeding