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Studies on Status and Distribution of Lion-Tailed Macaque (*Macaca Silenus*) in Meghamalai Wildlife Sanctuary, Tamil Nadu, India

Yogaraj Panner[1], Kalaivanan, N.[2], Pandiyan, J.[1]

[1]PG and Research Department of Wildlife Biology, A.V.C. College, Mannampanda-609 305, Mayiladuthurai, Tamilnadu, India
[2]Veterinary Assistant Surgeon and Veterinary Dispensary, Thevaram

Abstract: **A field study was carried out to conservation accept for Lion tailed macaque *(Macaca silenus*) the surveyed of Meghamalai Wildlife Sancturary. A total of 16 troops were sighting encountered during the study period from December 2012 to March 2013. Considering location details of each group of lion-tailed macaque, group size and age class and individual identification marks total of minimum number of group in the study area established as 12 troops with about 275 individuals. One new group was found in the eastern part of the Santhanakavu hills which has connectivity with Grizzled Giant squirrel Wildlife Sanctuary.**
Habitat fragmentation and degradation is the most important threats for LTM anywhere in the landscape. Many anthropogenic pressures are apparently visible during the study period in the study area. During the study at every sighting, tree preference, tree in which LTM feeds and sighted and parts eaten were observed.

Keywords: **Lion tailed macaque, Distribution, Meghamalai wildlife Sanctuary, Troop size, Anthropogenic pressure.**

1. INTRODUCTION

The **lion-tailed macaque** (*Macaca silenus*) one of the most endangered primates endemic to the tropical rainforest of Western Ghats spread over Kerala, Tamilnadu and Karnataka. The lion-tailed macaque ranks among the rarest and most threatened primates. The number has also been reduced by the continued loss of rainforest habitat in the Western Ghats (Green and Minkowski, 1977; Karanth, 1985) and few numbers only left the wild. Because of their highly selective feeding habits, limited overall range (*ca.* 2500 km2), delayed sexual maturity, long inter birth interval, low population turnover and small wild population (3000-3500 individuals), they are endangered (IUCN, 1996). The population at present is estimated to be less than 3500 individuals (Lacy *et al.*, 1986). At present there appears to be no viable population considering its habitat is becoming largely fragmented (Signh.M, *et al*., 2011, Molur.S. *et al*., 2003. It is similar to Nilgiri Langur (*Presbytisjohnii*) except in the colour of mane and in the presence of tail tuft. The new born have brown hair and pink skin.

Ajith Kumar, 1993, described age and sex classification as follows,

i. Infants: Upto one year after birth

ii. Juvenile: 1 to 5years, In females nipple become visible towards the end of the third year or at the start of fourth year, sexual cycles proably at the end of the fourth year

iii. Sub adult: For female five years to first birth: nipples clearly visible , sexual cycle start in early fifth year. For males ; 5years to adulthood at about 10 years age.

iv. Adult female: Multiparous female as indicated elongated nipples and baggy breast.

v. Adult male: Males with fully developed musculature, canines and tail tuft.

Most of the groups in undisturbed forests have only one adult male (mean 1.5, median 1), with 6 to 7 adult females and one sub-adult male, the remaining being immature. However, groups with as many as 4 adult males occur in forest fragments. In the groups, the number adult males varied from 1 to 3, sub adult male from none to 5, adult female from 5 to 12 and immature from 5 to 14 (Ajith, 1993). The mean group size of the Lion-tailed macaque is slightly smaller than that reported for other macaques, in the range of 20–30 animals. Moreover, the adult sex ratio in a group is more biased towards the females, with about 5–6 females per male compared to 2-3 females per male reported for most other macaques. The mean sex ratio was roughly about 4.5 to 6.5 found in a long term study in Anamalai Hills (Ajith 1993). There is no indication of geographical variation in group size and composition (Ajith 1993). For example, the populations south and north of the Palghat Gap have similar group sizes (18.4 and 19.1 respectively). Their age/sex compositions are also not significantly different. Information on other life history parameters comes almost entirely from the Anamalai Hills, where the species has been studied for over a decade.

The inter birth interval, age at first birth and post reproductive stage (infertile period after the reproduction to next reproductive stage) was reported about 2.47 years, 6.6years and 51 months respectively (Ajith 1993) and gross survival rate of an individual in free ranging wild population was about 0.96/individual/year, reported in a long term study in Anamalai Hills.

Adult males often migrate between groups and also can be seen as solitary individuals (Ananda Kumar *et al.*, 2001). Groups which inhabiting forest fragments most of which are smaller than 2-3sq.km, adult male having constraints in dispersal and thus end up in more than one adult male in the group (Singh.M.*et al.*, 2002). Emigration appeared to be higher in male older than six years, noticed both in adult as well as sub adult male. It was very likely that emigration followed by immigration in other groups (replacement of the resident adult male) (Ajith 1993) and it happened once in every 2.8years. Even though, Hutton in 1949 recorded the presence of lion-tailed macaque in Highway Mountain the area which adjacent Periyar Tiger Reserve so far no studies has been done except the few departmental census operation and 5 days population estimation survey in 2009. Since no studies has been conducted in this region this preliminary was undertaken to understand population change to compare with previous survey and to record status and distribution of lion-tailed macaque in the Meghamalai.

2. STUDY AREA

Theni forest division is geographically located between 90 30'to 100 30' N and 770 to 780 30' E in the political boundary of Theni District of Tamil Nadu State. The Government declared (269.10sq.km) of Reserved Forest Area (RF) as Magamalai Wildlife Sanctuary. The Megamalai Wildlife Sanctuary can be an excellent buffer to the by Srivilliputhur Grizzled Giant Squirrel Sanctuary in the south, Palani hills in the northeast Periyar Tiger Reserve (PTR) and connects the Grizzled Squirrel Wildlife Sanctuary (GSWLS) of Srivilliputhur in the southwest and can immensely strengthen conservation in the southern Western Ghats, the range of hills south of the Palakkad Gap.

Highways of the southern Western Ghats have remnant evergreen forests that have been severely fragmented and overexploited to raise economic crops such as tea, coffee, cardamom, etc. Detailed data on any aspect of mammals are not available for this hill system. We present here findings from a survey of primates in the evergreen forests and adjoining dry disturbed forests in the Highways and discuss the conservation value of the hill system. The elevation ranges from 300 to 2016 m above msl. The average rainfall ranges from 700 mm in the foothills to over 2500 mm in the higher reaches12. The forest types13, 14 include shola forests and grasslands at high altitude, evergreen and semi-evergreen forests at slopes and plateau (i.e. 108.44 sq. km), moist deciduous forests and its degraded stages (i.e. 103.38 sq. km) deciduous forests towards the edge on eastern side (i.e. 228.73 sq. km) and plantations and commercial croplands of tea, coffee and cardamom (i.e. 49.78 sq. km). The commercial crop that is grown in the region is coffee, tea, cardamom, clove, cashew and silk cotton. This mountain range forms an important catchment area for the river Vaigai and Vaipaar that feed the dry eastern plains of the south Tamil Nadu (Map 1).

Highway mountains and its adjacent hills of the southern Western Ghats is home to certain remnant patches of wet forests and those patches have been severely fragmented and over exploited for raising economic crops and plantations. Highway environs are the offshoot in the southern Western Ghats and the Highway Mountain alone locally called as Meghamalai (means clouded hill) because most of the time the hill is covered with cloud. In the beginning of 19th

century, Wroughton (1917) identified 25 mammals and later (Hutton., 1949) reported 56 mammals including certain range restricted and threatened species. The above review states that the Highway environs are home to diverse mammal species with patchy distribution limits. Despite such destruction, the base line information such as occurrence of a species and its distribution, status and the factors that regulate the population are lacking. Differences in diversity partitions among landscapes and taxa indicate the need for flexible conservation strategies. Importantly, the updated information on the distribution status of large mammals in the reserve is required for the effective management of the fauna as well as the reserve and to fill the existing gaps in the protected area network.

The present sitting was carried out sit different area viz.,

1. Meghamalai Range (GPS value: 9.68963°N, 77.39551°E, Elevation- 1453)
2. Varusanadu Range (GPS value: 9.59733°N, 77.46720°E, Elevation- 1435)
3. Chinamonure Range (GPS value: 9.69431°N, 77.40239°E, Elevation- 1512)

3. MATERIAL AND METHODS

In the preset study for estimating the LTM population the prominent head count (True census) method was adopted.

The Lion Tailed Macaque (LTM) exhibit slow gait and the manner of their progression is also very characteristic. It would jump from tree to tree, but, catches the branch of the neigh boring tree carefully and passes to the canopy of the next tree. Following the same branch, the other individuals also cross the next tree. This is in contrast to the gait followed by Nilgiri Longurs, which progress by long jumps (Karr, 1973). Taking this special mode of movement as an added advantage, a suitable tree was selected on the direction of the movement of the troop. The individuals in a troop are another. This new method is called 'CANOPY JUNCTURE COUNT METHOD". The males and females were distinguished from their thigh marks. Each troop was categories into adults, Sub-Adults and Juveniles. Adults and Sub-Adults were intern grouped into males and females form their thigh marks. The census was repeated at various posts following canopy Juncture count method to get an error free census report. Researchers have therefore widely adopted the total count method (NRC 1981) to estimate populations of LTM.

4. OBSERVATION AND RESULT

Population Estimation and Distribution:

Prominent head count method (True census) was adopted in present study for estimating lion tailed macaque population. The survey area was demarcated and selected based on the area with frequent sighting of LTM during the departmental census, questionnaire survey with departmental frontline field staff and estate workers and patches of evergreen forest around the LTM existing area was also included.

A total of 16 group sighting were encountered during the study period from December 2012 to March 2013. Considering location details of each group of lion-tailed macaque, group size and age class and individual identification marks total of minimum number of group in the study area established as 12 with about 275 individuals (Table:1).

The details of group sighted, area sighted, troop identification mark with age sex classes are tabulated (Table: 1). Troops are given identity- name based on the sighting location. This population has been observed in 3 ranges of Meghamalai wildlife sanctuary. Among three ranges highest number of 171 individuals were in the Vellimalai range, followed by 56 individuals were sighted in the Chinnamanur range and 28 in santhanakavu. The sighting location plotted on the vegetation map found that the group mostly in river beds of degraded rainforest. Mostly the group was restricted to only rainforest, out of 12 groups 11 was sighted in the degraded rain forest, coffee and cardamom plantation. All the groups sighted were associated with or found adjacent to private estates.

All the population was sighted at an altitude of the ranges from 840 to 1475 meter above Mean Sea Level. In general, the LTM population is found in entire hill system except on the western side where tea plantation is predominant. Population was distributed across the Highway Mountain around the denuded patches of rocky or grass land hill top in the narrow strip of evergreen forests. Highway Mountain has wide array of forest types due to high variation in altitude and rainfall. The vegetation gradient varies from dry scrub forest in the foot hill to grass land mountain shoal at higher altitude and in between in middle array dry deciduous, moist deciduous at low altitude and evergreen rain forest at high altitude adjacent to grassland in the hill top. Drastic bioclimatic changes by the steep environmental cline create very restricted habitats

and niches (Kumara *et al*., 2011). Population distributed as four sub population. Even though, highway mountain has connectivity with continuous habitat of forest (array of evergreen, degraded shola, coffee plantation, rocky out crops, grass land and tea estates) with reference to the rainforest canopy connectivity lion-tailed macaque distribution consider as three subpopulation in the study area. Cardana estate area in Chinnamanur range has 56 individuals with 2 two troop may constitute one sub population, Bommarajapuram, engineering estate and vellimalai area of vellimalai range has 171 individuals with 9 troops may constitute another subpopulation and the subpopulation in Santhanakavu area of Varusanadu range has 28 individuals one troop. In the Vellimalai subpopulation, between bommarajapuram and engineering estate even though there is forest connectivity the presence of a patch grass land and deciduous forest the possibility dispersal of lion-tailed macaque is doubtful. The group size was ranged from 8 to 43, smallest being 8 and largest being 43 individuals with mean group size was 22.5±11.90. The average group size was slightly bigger than the in previously reported 18 to 19 in a long term studies (Kumara *et al*., 2011). Large group size 43 and 42 was found in Cardana and Bommarajapuran a fragment which is comparatively smaller than the Vellimali and Santhanakavu. Smaller group was found comparatively in all the subpopulation. Individuals were sighted in Varusanadu range Frequency of group sighting is graphed on the (Fig: 1) the group size with the range of 5-10, 10-20, 20-30, 30-40 and 40-45 individuals were sighted respectively with the frequency of 2,3, 8, 0 and 2. The most frequently sighted group size was 25 and median group size was 23 (Table: 2).

Age and sex class:

During the study period from December 2012 to March 2013, 12 different groups were identified with 275 individuals. All the individuals in the group were classified for their age and sex (Table: 1). Individuals in a group were classified as infants (up to 1yr old), juveniles (1 to 5years old), sub-adults (% 5yr to first birth at about 6.5yr for female; 5yr to about 8yr for males), adult females (females that have given birth at least once), and adult males (>yr old). Overall, higher percentage sub adult female (23%) and adult female (22%) was found in the population than the 15 % of sub adult male and 13% of adult female respectively (Fig. 2). Sub adult female more in the population may also due to high percentage of individuals were not identified (8%). Five out of 12 groups was not completely classified. Thus if we included those individuals the sub adult male composition may increase. It is obvious that sexing of sub adult categories are difficult than the others.

The higher percent of infants (5%) and juvenile (14%) age class indicate that the population is breeding well and higher turnover rate of the population. As the LTM is the polygamous species with patriarchal social hierarchical system (Males lead the troop), the percent composition of males was less which constituted 13% of the overall population. No solitary animals or all male groups could be seen during the study period. The number of adult male in a group ranged from 1 to 6 (7 - 18.5%), with the maximum observed in the largest group and 2 smaller group (Table: 2) the percentage of males do not show with percentage of females in the groups. The adult female in a group ranged from 2 to 10 (7.1 -39.1%). The adult sex ratio was 0.6 to 2.7 females per male (Table: 2). the percentage of immature individuals in a group ranged from 27.8% to 84.6% (Table. 2).

The sex ratio of the adult LTM is positively skewed towards females, the proportion of males is less than females. The similar trend was observed in the sub-adults as well (1:1.5). Two out of 10 individual females were with infants, indicates the higher breeding success in the females.

With a view to find out the changes and growth of population demographic variable of present study was compared with 2009 survey (Kumara. *et al*., 2011) in the same study area (Table: 3). The total number of individuals had slightly increased from 266 to 275. The mean group size was bigger (33.25 ± 18.78) than the present study (22.9 ± 11.9). The number group was less (08) than present study (12) but there is not much change in the total individuals. This may be due split of some group in this 3-4 years period as reported by (Umapathy. *et al*.,2011), in a long term study in Anamalai hills.(Table. 3).

The group with 28 individuals was indentified in the Santhanakavu area. Other than that, 3 new groups were identified in Bommarajapuram, Engineering estate and Eellimalai complex subpopulation. Troop identity, location of sighting, GPS co-ordinate and group size of the 2009 survey is not perfectly matching with present study details. The details of age-sex classification were not available for past study. Thus, group change and growth rate cannot be workout during the past 4years period between 2009- 2013. The data given in the 2009 survey (Kumara. *et al*., 2011) was collected by the volunteers and more or less secondary in nature (Table. 3).

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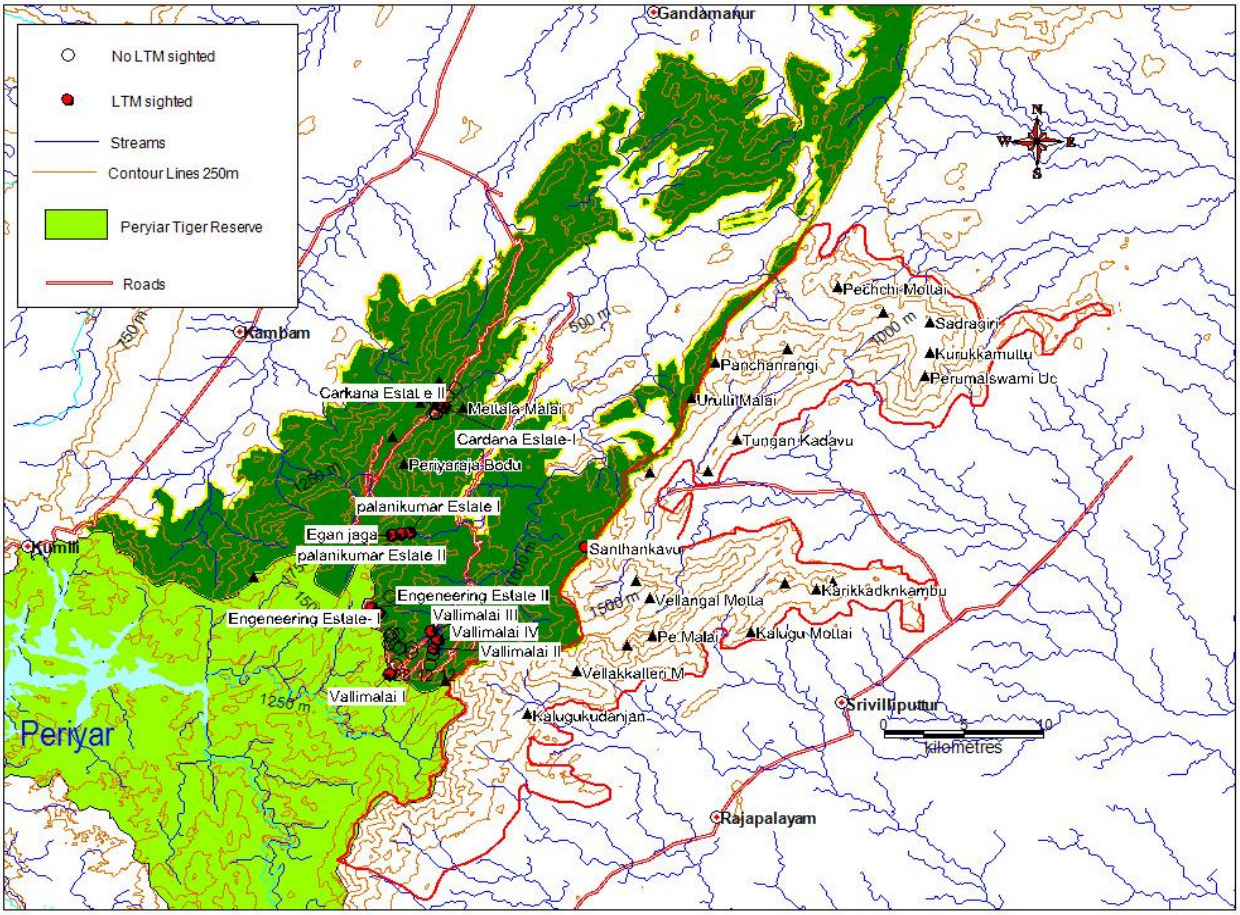
Threats and Anthropogenic pressure:

Habitat fragmentation and degradation is the most important threats for LTM anywhere in the landscape. Many anthropogenic pressures are apparently visible during the study period in Highway Mountain. Commercial plantation of tea, coffee and cardamom in hill leads to most of rainforest and evergreen Shola become degraded. Three dam built in hills have submerged vegetation in the valley. Nilgiri langur and lion-tailed macaque is found mostly restricted to eastern part of the hills, in west tea estate acting as barriers. LTM is now mostly restricted to coffee and cardamom plantation. Anthropogenic pressures like tree felling, presence of stray dogs and other human disturbance is observed during the study period. *Erythrinaindica* is not natural vegetation to the highway mountain, is planted by the estate workers. It is observed next to natural fodder tree like C*ullinea sp* LTM show preference to *Eythrinaindica* in during the study period (Fig 3). This may be a seasonal preference. The estate workers are selectively felling *Eythrinaindica* tree because the larval attack from the tree are known affect coffee plantation as well. This may be affect LTM food preference. Organophosphorous pesticide was used by cardamom planters to control insect attack (Fig. 4). Use of organophosphorus compound to the cardamom plantation may affect survivability and reproductively of lion tailed macaque. Poaching and hunting was not visualized during the study period. But, enquires with the villagers revealed that there was hunting and poaching pressures were prevalent on the LTM population in the study area. Some jack fruit cultivated estate workers are seasonably illegal activity in crackers being arranged in the cotton rope with a sequence used to drive away LTM (Fig. 5).

1. Map showing the distribution of Lion tailed Macaque in different areas studied during the study periods from December 2012 to March 2013, Meghamalai Wildlife Sanctuary, Theni District, Tamil Nadu, India.



5. DISCUSSION

Population and Distribution:

Lion tailed macaque is one the rarest and unique among the primates with its dwindled population and its living in high altitude rainforest. It is an endangered species inhabitation tropical evergreen forest of western Ghats. Population LTM is considerably reduced with steady deterioration its habitat evergreen forest in its quantity and quality in the Western Ghats

(Roonwal and Mohnot, 1997). LTM habitat is becoming largely fragmented, at present the its appear to viable population (Molur *et al*.,2003). Because of its highly selective feeding habitats, smaller area of occupancy, delayed maturity, long birth interval due to sexual suppression among the adult females, low turnover this population is considered and categorized in on the IUCN Red list (IUCN, 2008). Majority of the LTM population restricted to degraded rainforest and forest fragments except Kalakad-Mundanthura population, it is believed to hold relatively a larger population (Molur *et al*., 2003).

As stated by many authors the LTM population in Meghamalai Wildlife Sanctuary is also restricted to mostly coffee and cardamom plantation (Kumara *et al*.,2011). Even though considerable area of rain forest in Highway Mountain, most of it occurring as narrow strip of forest. Although the primates species was reported in all part of sanctuary the lion tailed macaque distribution in hill majorly restricted to eastern part of hills than western part where tea estate acting as barrier (Kumara *et al.*,2011). The ever green forest of the sanctuaries is contiguous with Periyar Tiger Reserve (PTR) in Kerala in the south and Grizzled Giant squirrel Wildlife Sanctuary (GGWS) on the eastern side. The present enumerated total number of population about 275 individuals in 12 groups is promising one. The total population in this landscape may much larger than the present finding since the population continuous with Periyar Tiger Reserve (PTR) and Grizzled Giant squirrel Wildlife Sanctuary (GGWS). However it needs detailed study in the neighbouring area or need confirmation from their earlier findings. Considering the present population trends and their conservations status the present finding of larger population has high conservation value.

Age sex class-demographic variables:

Lion tailed macaque reported to live with mean group size of 20.7 (Ajith,1987) in Anamalai hills. In the present study the group size of 22.5 with 12 groups was closer to that. But not match with 2009 survey group size of 33.5 with 8 groups in the same study area reported by (Kumara *et al*.2011). This may be due split of group as reported (Ajithkumar, 1987) in Anamalai hills. Group fission observed in free ranging lion-tailed macaque mostly when group size approaches 30 individuals. Although, it is difficult reason out with present data, it needs detailed long term study.

In general, macaque live in female bonded groups, female seldom migrate between groups. Group fission and subsequent dispersal by matrilineal because inability use tree less and resource limited vegetation (Umapathy.*et al*.,2011). Few report are available that a group even might split into subgroups with an inter-subgroup distance of more than 100 meters (Sakthivelou and Kumar 1998) and sleep at different places in the night (Singh. *et al*.,2006). The lion tailed macaque live in a distinct social groups, the demographic interaction between groups involves only frequent dispersal and movement of male between the groups. The group level and group size expressed in relation to population density in the social system 9 (Levin, 1969)

Largest group size 43 and 42 was sighted in Cardana and Bommarajapuram, this may be a fragmented population. More number of individuals in a group may be due fragmentation and consolidation of habitat with estates (Ajith 1987). Usually in an undisturbed habitat the number adult male reported to be in the group was one. Between groups ,the number of adult males varied from one to 3, sub adult males from none to 5, adult females from 5 to 12 and immature from 5 to 14(Ajith,1987). The mean adult male in the population was 3 with range from 1 to 7. More number of males in the groups is found in group with fragmented habitats. Male dispersal is difficult in group with fragmented population. In the present study certain group was with more than one adult male more than mean number 3 indicates male dispersal may be unlike in certain subpopulation of Cardana and Bommarajapuram. It needs to conduct detailed study to find narrow strip connectivity between above mentioned three sub population.

Adult sex ratio was skewed towards female, i.e.4 to 6 females per adult (Ajith, 1987). In the present study the sex ratio was 1:6 female per male. Only in Cardana, Bommarajapuram and engineering estate group more number of female was found that ration correlates with group size. If more number adult in the group leads to competition for its foods as well for its reproductive cycle. Adult males often migrate between groups and also can be seen as solitary individuals (Ananda Kumar.*et.al*, 2001). In the present study no such solitary adult male was found. Adult to infant ratio between present and 2009 survey not show any change. This shows population is breeding well. A reduction in birth rate and survival of immature is first response to resource shortage in group living mammals, adult live for considerable for many years.

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Threats and Anthropogenic pressures;

Since, the major population as restricted to privates estates threats like poaching, hunting, tree felling, habitat loss due to conversion green cover for extending farming activities, fragmentation of habitat due to roads, tower line and other development activities was recorded. More than 40% population in the Western Ghats facing same kind of threats (Kumara *et al*., 2007) this need urgent attention to minimize threats to the conservation of LTM

Table: 1 Group composition of lion-tailed macaque in the MWS.

Area sighted	Troop ID	Troop Identification	Troop size	AM	AF	SAM	SAF	Juvenile	Infant	Un-classified
Cardana (N=2)	CardanaEstat I	Large group with 3 adult male in Cardana area	43	3	7	8	13	8	2	2
	CardanaEstat II	Small group with one adult female in cardana area	13	1	1	4	6	0	1	
Bommarajapuram (N=4)	palanikumar Estat I	Large group with 10 females and 3 infants	42	6	10	5	7	7	3	4
	palanikumar Estat II	Troop with 2 adult male and 3 adult female	14	2	3	1	2	4		2
	Egan jaga	Troop with 3 adult male and 3 infants	18	5	6	2	2		3	
Vellimalai (N=7)	Vallimalai I	An adult male with wound on the chest	25	3	8	5	6	3		
	Vallimalai II	Only one Infant individuals	23	4	9	4	3	2	1	
	Vallimalai III	An individual's without hair tuft in the tail	25	2	3	3	5	5		7
	Vallimalai IV	Small group in vellimalai area	8	1	2	0	2	3		
Engeneering estate (N=2)	Engeneering Estate I	Small group with 2 adult male	9	2	2	1	4			
	Engeneering EstateII	Troop with 5 adult male	27	5	3	3	6	4	2	4
SanthanaKavu (N=1)	Santhanakavu	Troop with 2 adult female and male	28	2	2	5	11	3		5
Total Individual			**275**	**36**	**56**	**41**	**67**	**39**	**12**	**24**

Group range - 08 to 43 N= Number of sighting
Mean group size - 22.9 ± 11.9 SD
Mode - 25

Table: 2 Demographic parameters of 12 group's lion-tailed macaque in MWS. Studied during the study pride from December to Marche

S.No	Fragment	No. of adult males	No of adult females (%)	No of immature individuals (%)	No. of adult Females per male	No. of female per male overall	Group size
1	Cardana Estate I	3(7)	7 (16.3)	29 (67.4)	2.3	1.8	43
2	Cardana Estate II	1(7.7)	1 (7.7)	11 (84.6)	1	1.4	13
3	Palanikumar Estate I	6(14.3)	10 (23.8)	19 (45.2)	1.7	1.5	42
4	Palanikumar Estate II	2(14.11)	3 (21.4)	7 (50)	1.5	1.7	14
5	Egan jaga	2(11.11)	2 (11.1)	5 (27.8)	1	1.1	18
6	Vallimalai I	3(12)	8 (32)	14 (56)	2.7	1.8	25
7	Vallimalai II	4(17.4)	9 (39.1)	9 (39)	2.6	1.5	23
8	Vallimalai III	2(8)	3 (12)	13 (52)	1.5	1.6	25
9	Vallimalai IV	1(12.5)	2 (25)	6 (75)	2	4	8
10	Engeneering Estate I	2(22.2)	2 (22.2)	5 (55.6)	1	2	9
11	Engeneering Estate II	5(18.5)	3 (11.1)	13 (48.1)	0.6	1.1	27
12	Santhanakavu	2(7.1)	2 (7.1)	19 (67.9)	1	1.9	28
	Over all	**36(13.1)**	**56(20.4)**	**147(53)**	**1.6**	**1.6**	**275**

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Table: 3 Mean numbers of different age-sex individuals and sex ratio of Lion-tailed macaque compared with 2009 survey

Age/sex	Mean value/ Ratio	2009 survey
Adult male	3	1.75
Sub adult male	3.4	1.25
Adult female	4.6	7
Sub adult female	5.5	1
Juvenile	3.9	6.75
Infant	2	2
Adult male: Adult female	01:01.6	01:03.9
Adult :immature	01:01.5	01:01.3
Adult female: Infant	01:00.2	01:00.3
Sub adult male: Sub adult female	01:01.6	----
Group size range	8 to 43	7 to 55
Mean Group size	22.9 ± 11.9	33.25 ± 18.78
Total population	275	266
Number identified troop	12	8

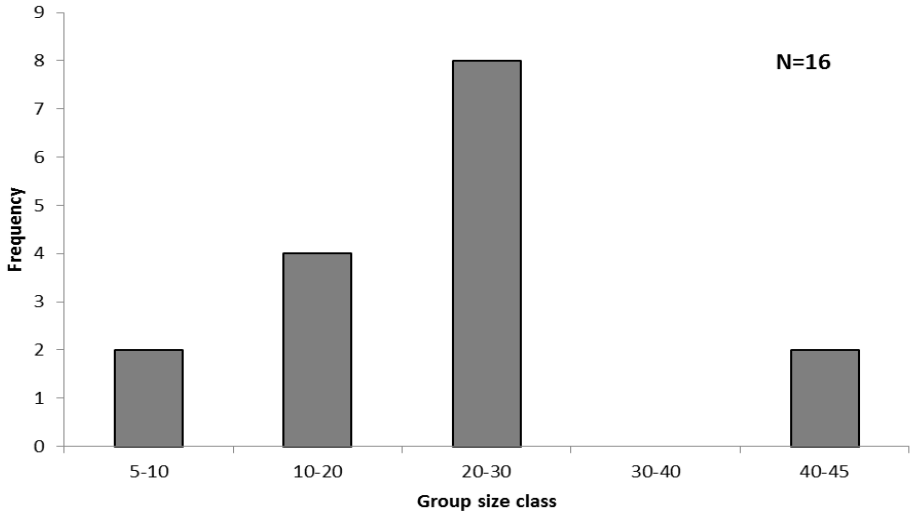

Fig. 1 Frequency of sightings of LTM in different group size class in Megamalai Wildlife Sanctuary

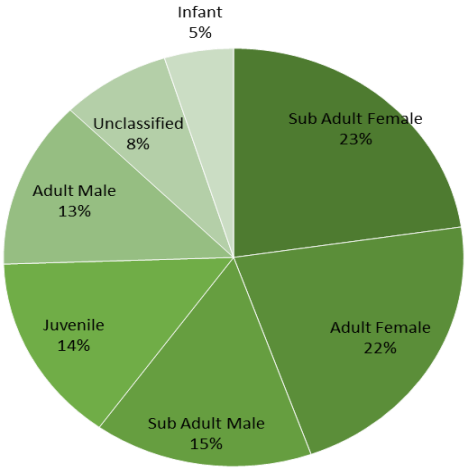

Fig. 2 Age-sex composition of LTM (n=275 individuals) in Megamalai Wildlife Sanctuary

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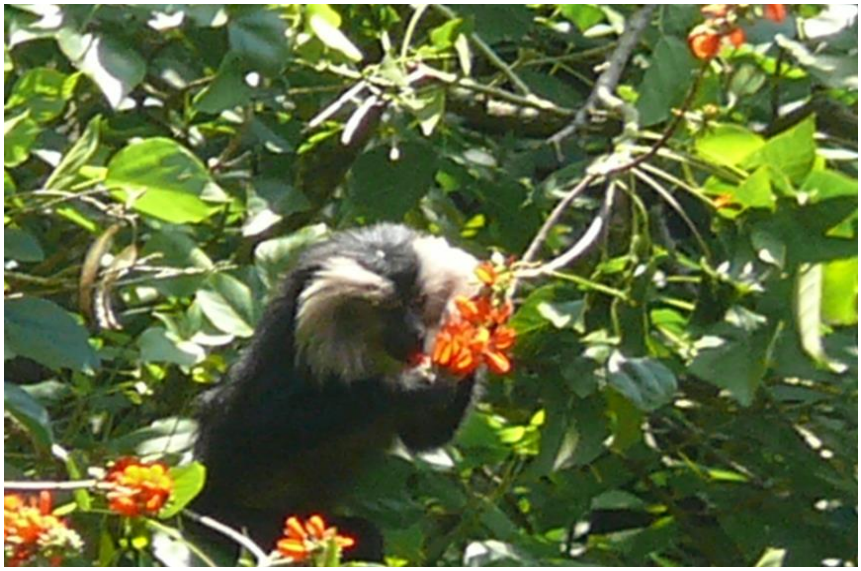

Fig. 3 Adult male lion–tailed macaque feeding on the flowers of Eythrinaindica Megamalai Wildlife Sanctuary.

Fig.4 Empty containers of organophosphorus pesticide which disposed of in the estate

Fig. 5 Crackers being arranged in the cotton rope with a sequence used to drive away LTM Megamalai Wildlife Sanctuary

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REFERENCES

[1] Ajith Kumar,(1987), The ecology and population dynamics of the lion-tailed macaque *(Macaca silenus)* in South India, Ph.D. thesis, Cambridge University, UK.

[2] Ajith Kumar, (1993) Ecology and Population Dynamics of the Lion tailed macaque in South India.Vol.9.22-80. pp.

[3] Ajith Kumar, (1995a), The life history, ecology, distribution, and conservation problems in the wild, in: *The Lion-tailed Macaque: Population and Habitat Viability Assessment Workshop*, A. Kumar, S. Molur, and S. Walker, eds., Zoo Outreach Organization, Coimbatore, India

[4] Ananda Kumar, M., Singh, M., Kumara, H. N., Sharma, A. K. and Bertsch, C., Male migration in lion-tailed macaques. *Primate Rep*., 2001, 59, 5–17.

[5] Chandran, M. D. S., Mesta, D. K., Rao, G. R., Ali, S., Gururaja, K. V. and Ramachandra, T. V., (2008), Discovery of two critically endangered tree species and issues related to relic forests of the Western Ghats. *Open Conserv. Biol. J.*, 2, 1–8.

[6] Green, S. M. and K. Minkowski. 1977. The lion-tailed macaque and its south Indian rainforest habitat. In: *Primate Conservation*, G. H. Bourne and H.S.H. Prince Rainier (eds.), pp.289–337.

[7] Hutton, A. F., Notes on the snakes and mammals of the Highwavy Mountains, Madura District, South India. *J. Bombay Nat. Hist. Soc*., 1949, 48, 681–694.

[8] IUCN (1996).1996 IUCN Redlist of Threatened Animals, IUCN, Gland, Switzerlands.Wildlife Institute of India, retrieved 3/31/2007 List of Proposed Wildlife Sanctuaries in India.

[9] IUCN (2008). "Information sources and quality". *IUCN Red List website. Archived from the original on 17 September 2008*. Retrieved 19 September 2008.

[10] Karanth, K. U. 1985. Ecological status of the lion-tailed macaque and its rainforest habitats in Karnataka, India. *primate Conserv*. No. 6:73-77.

[11] Karr, J.R. 1973. Ecological and behavioral notes on the liontailed macaque (Macaca silenus) in South India. Journal of the Bombay Natural History Society, 70:191. [244].

[12] Kumara, H. N. and Singh, M. (2007), Distribution of primates and conservation of *Macacasilenus*in rainforests of the Western Ghats.

[13] Kumara, H. N., &Sinha, A. (2009).Decline of the endangered lion-tailed macaque,*Macacasilenus*, in the Western Ghats, India.*Oryx*, 43, 292–298.

[14] Kumara, H. N., R. Sasi, R. Suganthasakthivel and G. Srinivas. 2011a. Distribution, abundance and conservation of primates in the Highwavy Mountains of Western Ghats, Tamil Nadu, India and conservation prospects for lion-tailed macaques. *Curr. Sci.* 100: 1063–1067.

[15] Lacy, R.C, Flesness, N.R., and Seal, U.S. 1989. Puerto Rican parrot population viability analysis. Report to the U.S. Fish and Wildlife Service. Captive Breeding Specialist Group, Species Survival Commission, IUCN, Apple Valley, Minnesota.

[16] Levin, R., 1969, Some demographic and genetic consequences of environmental heterogeneity for biological control, *Bull. Entomol. Soc. Amer*. 15: 237–240.

[17] Molur, S., D. Brandon-Jones, W. Dittus, A. A. Eudey, A. Kumar, M. Singh, M. M. Feroz, M. Chalise, P. Priya and S. Walker. 2003. *Status of South Asian Primates: Conservation Assessment and Management Plan (C.A.M.P.).* Workshop Report, Zoo Outreach Organization/CBSG-South Asia, Coimbatore, India.

[18] National Research Council (NRC) (1981).Techniques for the study of primate population ecology.National Academy Press. Washington, DC.

[19] Roonwal, M.L. and Mohnot. S.M. 1977. *Primates of South Asia: Ecology, Sociobiologyand Behaviour*. Cambridge, Massachusetts: Harvard University Press.

[20] Singh, M., Singh, M., Kumar, M. A., Kumara, H. N., Sharma, A. K., &Kaumanns, W. (2002).Distribution, population structure and conservation of lion-tailed macaques (*Macacasilenus*) in the Anamalai Hills, Western Ghats, India.*American Journal of Primatology*, 57, 91–102.

[21] Singh, M., Sharma, A. K., Krebs, E., & Kaumanns, W. (2006a). Reproductive biology of lion-tailed macaque (Macaca silenus): an important key to the conservation of an endangered species. Current Science, 90, 804–811.

[22] Singh, M., Jeyaraj, T., Prashanth, U. and Kaumanns, W., Male–male relationships in lion tailed macaques (*Macaca silenus*) and bonnet macaques (*Macaca radiata*). *Int. J. Primatol*., 2011, 32, 166–176.

[23] G. Sakthivelou and Ajith Kumar Temporary Group Splitting in the Lion tailed Macaque (Macaca silenus) in a Forest Fragment in Indira Gandhi Wildlife Sanctuary, Tamil Nadu., J., Bombay Natural History Society. 95(3) Dec., 1998, 422-425

[24] Umapathy, G., S. Hussain and S. Shivaji. 2011. Impact of habitat fragmentation on the demography of lion-tailed macaque (*Macaca silenus*) populations in the rainforests of Anamalai Hills, Western Ghats, India. *Int. J. Primatol.* 32: 889–900.