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STATUS SURVEY OF PRIMATES IN SHENDURNEY WILDLIFE SANCTUARY AND ADJACENT AREAS

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ABSTRACT

A survey of primates was conducted during December 1992 to June 1995, in the Shendurney Wildlife Sanctuary and adjacent areas of Kerala State, to map the distribution of the primates: to study the habitat and to monitor the species. The study reveals that the primates of the sanctuary consist of four species viz. the bonnet macaque *(Macaca radiata);* lion-tailed macaque *(Macaca silenus),* Nilgiri langur *(Presbytis johni)* and slender loris *(Loris tardigradus).*

Bonnet macaque is the most common primate in all types of forests. They are highly adaptable and were more frequently observed in the peripheral areas of the sanctuary, especially in the Thenmala village area often attaining a minor pest status. The number of bonnet macaques in the study area was estimated to be 513 individuals in 34 troops. Lion-tailed macaques were found only in the evergreen and semi-evergreen forests of the sanctuary. Maximum sightings were from the catchments of rivers Umi Ar and Chendurny Ar. followed by the evergreen forests in the Rockwood area which is contiguous with the Kulathupuzha Reserved Forest south of the sanctuary. Lion-tailed macaques in the area consists of nine troops with 131 individuals. Nilgiri langur troops are present in moist deciduous, semi-evergreen and evergreen forests in the area. The Nilgiri langur was estimated as 25 troops with 142 individuals. Slender loris was sighted only once.

1. INTRODUCTION

Distribution of eight primate genera consisting of 18 species shows a remarkable primate diversity in India. Of these six species are exclusively Indian in their distribution. Among the rest seven are also found in adjacent countries like Afganisthan, Pakistan, Nepal, Bhutan and Myanmar. However the remaining five species have got restricted distribution (Mohnot. 1978). The Wcstern Ghats provide a striking example of primate endemism and it holds a highly fragmented population of India's most endangered primate species namely the lion-tailed macaque, *Macaca silenus* and Nilgiri langur. Presbytis johni The distribution of Hanuman langur, *Presbytis entellus* extends up to the southern region of the Western Chats (Roonwal and Mohnot, 1977). Peninsular India holds two other primate species the bonnet macaque *(Macaca radiata)* and the slender loris *(Loris tardigradus).* A few field surveys were carried out elsewhere to estimate the status of these primate populations in the Western Ghats (Pocock, 1928: Hutton. 1949; Poirier. 1969; Kurup, 1971, 1975, 1978: Green and Minkowski, 1977; Karanth, 1985:Ali. 1985: 1986).

Shendurney and adjacent areas have a very rich and diverse flora and fauna. The first comprehensive working plan was prepared for the forests of Shendurney Valley in 1908. Previous working plans of Thenmala Forest Division has identified the four objectives for the management of the forests. They are a) watershed protection b) wood production to meet industrial demand c) Production of non-wood products such as bamboo, reeds, canes, mfp etc. and d) revenue to exchequer. Conservation of genetic diversity and wilderness value were not either explicitly or implicitly considered during that period. Wildlife protection was not an objective of management of the past but was indicated only as a function (Nair, 1984). The Punalur Paper Mills, bamboo-reed- based paper mill in Asia established in 1890. was getting its resource from Shendurney and Kulathupuzha Valley (Achuthan, 1982). Eventhough selection felling has taken place in almost all accessible areas, some of the best tropical evergreen forests are found within the ranges of Shendurney Wildlife Sanctuary, Kulathupuzha, Upper reaches of Neyyar and Peppara Wildlife Sanctuaries. Accessibility through Aryankavu Valley by Trivandrum-Shencottah road and the Quilon-Shencottah railway line

accelerated forest exploitation in Aryankavu Valley, in contrast, the adjoining Shendurney Valley remained comparatively less accessible and are near natural (Nair, 1984), Shendurney Wildlife Sanctuary was declared in 1984. Joseph (1985) and Vignarjan (1990) indicated presence of primates in this area. A more recently carried out wildlife census in Kerala throws light on the status of these primate in the state (KFRI, 1993). The study highlights the existence of a fairly good lion-tailed macaque population in the rain forest patches of Agastyamalai region of the Western Ghats. However, very little is known regarding the status, distribution, patch size and contiguity of the more localized rain forest patches in the entire range of the endangered primates like lion-tailed macaque and Nilgiri langur. So far there has not been any detailed primate survey in this area. This project envisages generation of first hand information on the status of primates in this part of the Western Ghats.

1.1 SHENDURNEY WILDLIFE SANCTUARY

Shendurney Wildlife Sanctuary is located between 77° 4' and 77° 17' E longitude and between 8° 48' and 8° 58' N latitude (Fig.1). in the Pathanapuram Taluk of Quilon district in Kerala State. The name 'Shendurney'' is derived from the magnificent *Gluta travancorica* trees in the valley which is called 'Chenkurinji' locally. This sanctuary is surrounded by Thenmala Forest Division in the North, Trivandrum Forest Division in the South, Tamil Nadu Forests in the East and Yeroor Reserve Forest of Punalur Forest Division in the West. Shendurney Wildlife Sanctuary is 25 km by 10 km at its longest and broadest points and about 100 km2 in extent. The sanctuary forms the catchment area of Parappar (Kallada) reservoir constructed across Kallada river. The major rivers which drain to the Kallada reservoir are Shendurney, Kalthurutty and Kulathupuzha. The elevation of the wildlife sanctuary varies from 120 m to 1550 m at Alwarkurichi peak (Fig. 2). The water spread area of Parappar (Kallada) dam is 13.72 km^2, with the maximum water level of 119 m. The area receives mean annual rainfall of 3000 mm. Figure 3 gives the monthly mean rainfall data of the Thenmala dam site area in the sanctuary. As per the wildlife sanctuary management plan (Vignarajan. 1990) there are 40 km^2 of evergreen forest, 10 km^2 of semi-evergreen forest, 15 km^2 of moist deciduous forest, 5 km^2 of grassland. 6 km^2 of reed and cane brakes in the sanctuary. In addition to the above vegetation type the water spread area and enclosures are also included in the sanctuary.

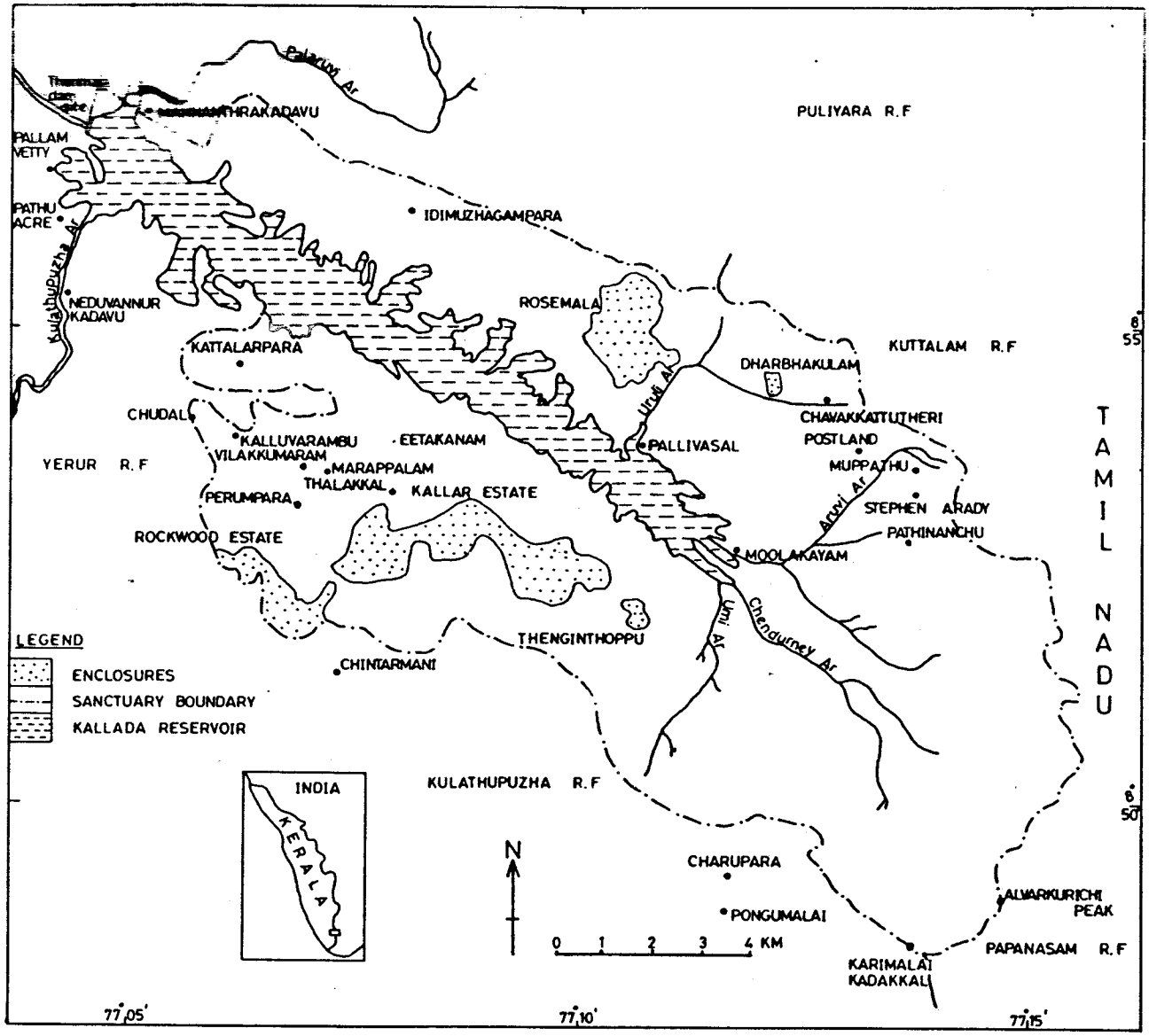


Fig.1. Map of Shendurney Wildlife Sanctuary

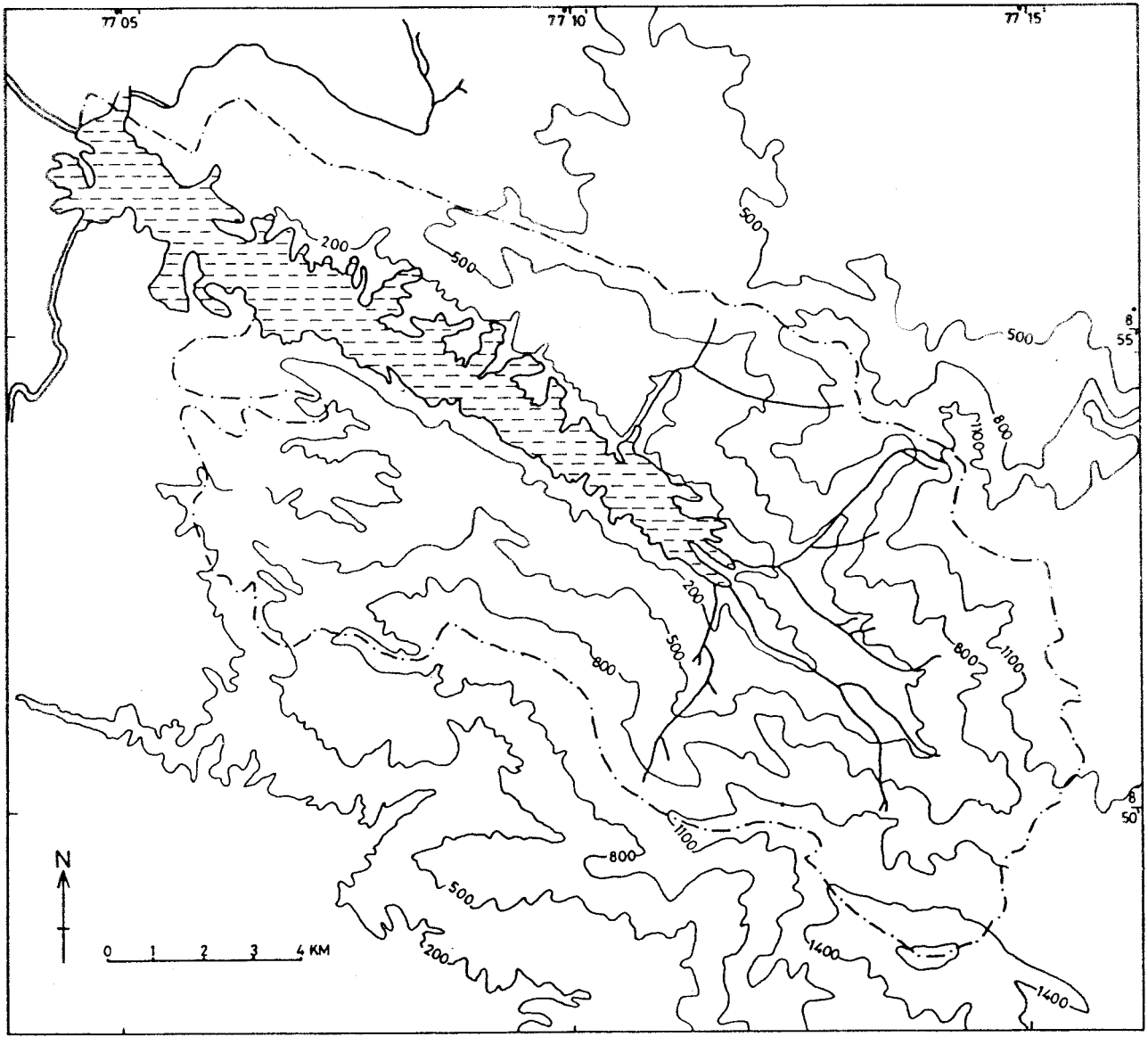


Fig.2. Map of Shendurney Wildlife Sanctuary showing the contour at 300 m intervals

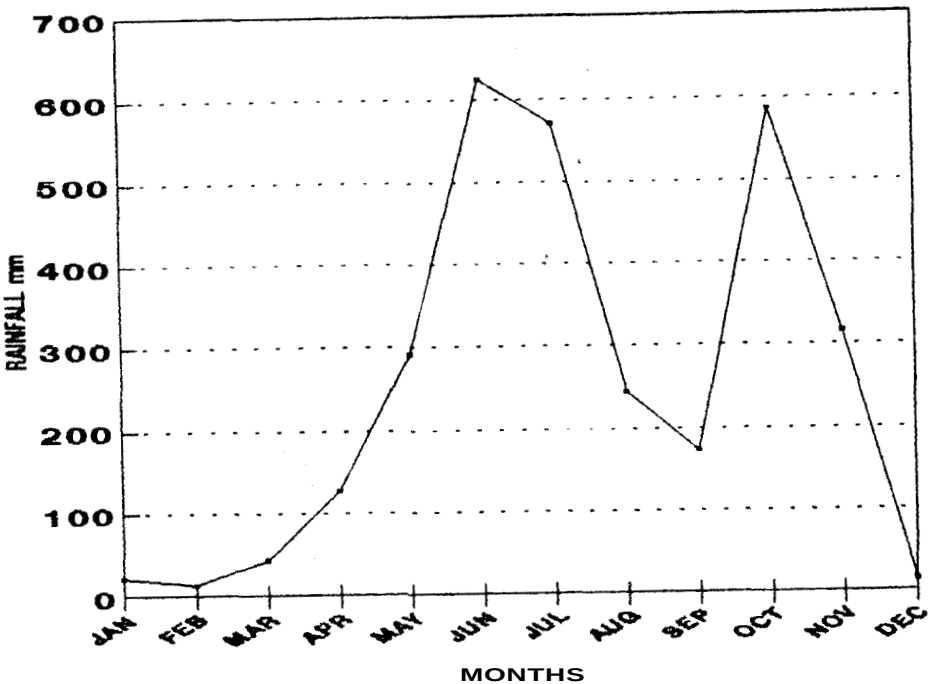


Fig.3. Mean monthly rainfall at Thenmala dam site

Evergreen areas are found in the south eastern portions of Umayar, Dharbhakulam, Pattakulam, Kallar, Rockwood. Postland and Pathinanchu areas. Semi-evergreen areas are located in Edappalayam, Mannanthara. Marapalam and Chudal areas. Moist deciduous forests are found in Idimuzhanganpara. Kattalappara, Reservoir fringes and Muppathu areas. Southern montane tropical evergreen forests are found in Pandimottai and eastern border ridges.

1.2 ENCLOSURES IN THE SANCTUARY

There are about 580 ha of enclosures with approximately 405 families living inside this sanctuary as per the Management Plan (Vignarajan, 1990). Roseniala is the biggest enclosure with approximately 307 families occupying 618 acres with 407 adult niales and 362 adult females as per the recent voters' list (Table 1).Kattalappara swamp is located adjacent to the sanctuary with about 25 ha with 40 families and having a population of 150 individuals. There are 450 ha of vested forests within limits of the sanctuary.

Table 1. Details of enclosures in Shendurney Wildlife Sanctuary

Sl. Mo.	Enclosure Name	Status	Extent (ha)	Families	Male	Female
1	Rosemala	Revenue	200	300	333	298
2	Kallar					
	2.1 Lower Eldersely	Revenue	25	10	-	-
	2.2 Eldersely	Revenue	150	40	-	-
	2.3 Herriford	Revenue	125	30	-	-
	2.4 Goatfell	-	40	10	-	-
3	Rockwood (Part)	Revenue	40	15	-	-
			580	405		

Source: Vignarajan, 1990.

1.3 ROADS AND FIRELINES IN THE SANCTUARY

Roads from Kattalappara to Kallar is under the control of PWD. There are 10 stretches of forest trails totalling 71 km and 9 stretches of fire lines totalling 90 km maintained in the sanctuary. Table 2 gives the list of forest trails and fire lines in the

Table 2. List of forest trails and fire lines in Shendurney Wildlife sanctuary

Forest trails	
Chudal-Rockwood	16 km
Mannanthrakadavu-Rosemala	12 km
Kallar-Pandimotta	10 km
Mamoodu-Umayar	7 km
Karadipara-Mamoodu	6 km
Eeetakanam-Marappalam	4km
Onnamile-Chudal	4km
Kattalappara-Chudal	4km
Eeetakanam-8 Acre	4km
Rosemala-Pallivasal	4 km
Fire lines	
On either side of Kattalappara-Kallar Road	16 km
On either side of Chudal-8 Acre forest trail	16 km
Around Chudal-Rockwood	15 km
Thenmala dam-Edapalayam	13 km
Around Kallar private estate	10 km
Chudal Rockwood	7 km
Around Rosemala enclosure	7 km
Around Rockwood estate	5 km
Around Kattalapara swamp	1 km

1.4 ADMINISTRATIVE DIVISIONS

For administrative convenience the sanctuary is divided into three sections, they are 1)Kalamkunnu 2) Kalluvarambu and 3) Eettappadappu.

1.5 OBJECTIVES

Objectives of the study were a)To map the distribution of the primates in the area b) To study the habitat continuity of the endangered primates. c) To study the food and feeding habits of the primates d) To monitor the population of the primates and e) establishment of a database.

2. METHODS

The sanctuary area was extensively perambulated to locate the primates and to know the status and distribution of these animals. Data on troop structure composition and sex ratios were also attempted. The individuals were classified as Adult male, Adult female, Cradling female, sub adult male, sub adult female, juvenile and cradled infant. (Kumar, 1987; Krishnamani, 1994). Individuals which cannot be classified pertaining to any of the above class were grouped into unidentified adults.

Troop composition of seven bonnet macaque troops were monitored for two successive years. The troops were selected from different areas like Kattalappara. Chudal, Irikkapara. Vilakkumaram and Kallar. Two troops were monitored from Irikkapara and Vilakkumaram areas and one each from the rest.

The primate population was estimated using a combination of line transect and sweep sampling methods (Burnham *et al.* 1980; NRC, 1981; Whitesides *et al.* 1985). Transects were the already available straight paths in the sanctuary. The computer programme, TRANSECT (White. 1987) was used to estimate the primate density. Following are the seven transects in the sanctuary. 1) Kattalappara - Thalackal = 1 km; 2) Kattalappara - Chudal = 1 km; 3) Kattalappara - onnatnile = 1 1/2 km; 4) Iruttar - Chudal vilakkumaram = 1 1/2 km 5) Rosemala - Moonnumukku = 2 1/2 km 6) Rosemala - Pallivasal = 2 1/2 km and 7) Rosemala - Rosemala vilakkumaram = 3 km.

Following areas in the sanctuary like Rosemala. Dharbakulam. Thenmala. Mannanthrakadavu, Kattalappara, Chudal, Vilakkumaram, Kallar, Umi ar area, Eetakanam, Mamood, and adjoining areas of the sanctuary like, Kalluvarambu, Pandimottai area, Amakulam areas in the Kulathupuzha Valley were intensively perambulated on foot and sightings of primates were recorded.

Structural data of forest stand was collected by Point Centered Quadrant method (Muller Dombois, 1978). PCQ sampling was done in four places inside the sanctuary namely, Kallar. Kattalappara. Rosemala and Rockwood to study the resource availability of the area.

3. RESULTS

3.1 PRIMATES

Three species of diurnal and one nocturnal non-human primates are found in the sanctuary. They are bonnet macaque *(Macaca radiata),* Lion-tailed macaque *(Macaca silenus),* Nilgiri langur *(Preshytis johni)* and slender loris *(Loris tardigradus).*

3.1.1 Bonnet macaque (Macaca radiata)

3.1.1.1 Distribution

This is the most common non-human primate found in Shendurney Wildlife Sanctuary. They are found inside the sanctuary as well as in the adjacent habitations in Thenmala. namely Thenmala DFO's Qtrs area, KIP Colony area, Thenmala Village Office area, 10 Acre area and Wildlife Qtrs area. Figure 4 shows the sighting location of bonnet macaque troops in the sanctuary. The bonnet macaques are found in almost all the wooded forests like, moist-deciduous, semi-evergreen and evergreen. Inside the sanctuary they are found in Rockwood, Kattalappara, Vilakkumaram. Kalluvarambu, Chudal. Kallar, Irikkapara, Idimuzhamganpara. Rosemala, Neduvan-nurkadavu- Kattalappara road and Iruttar area. They forage into the nearby teak plantations, rubber plantations of Rehabilitation Plantation Corporation and even the home steads. They are also found to frequent the *Myristica* swamp forests in the adjacent forests in Kulathupuzha Valley.

3.1.1.2 *Troop size and composition*

During our study period in a total of 398 sightings with a total of 4294 bonnet macaques were sighted. This is the most common primate found in the study area. In a total of estimated 34 troops of bonnet macaques 513 individuals were seen. A troop with largest number ie. 43 individuals was seen in the peripheral area of the sanctuary which range into the habitations at Thenmala. The largest troop encountered inside the sanctuary area was with 32 individuals in the Vilakkumaram area. Smallest troop was with four

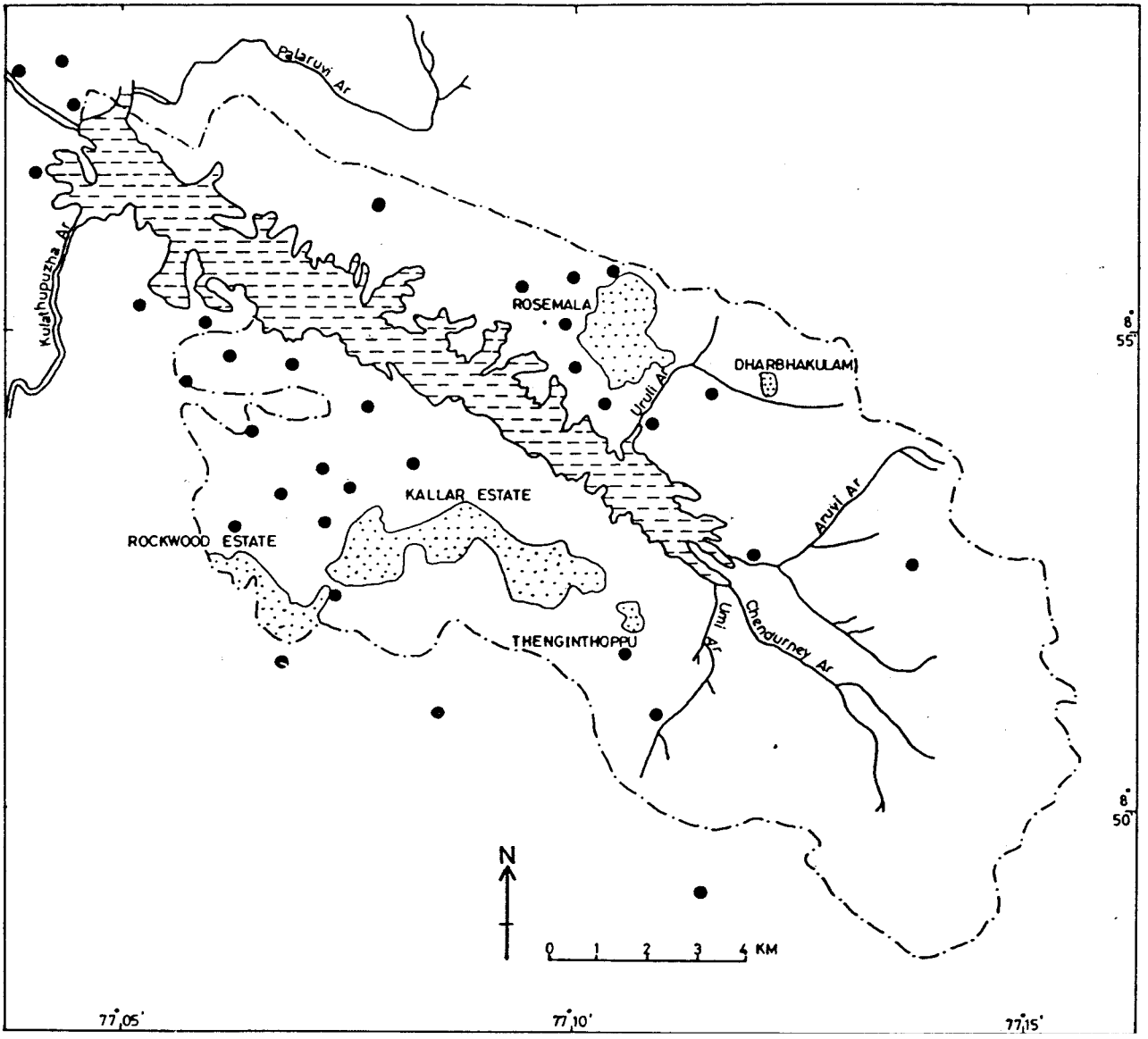


Fig.4 Locations of bonnet macaque troop sightings in Shendurney Wildlife Sanctuary

individuals. Table 3 shows the troops which were counted inside the sanctuary during the study. The maximum number of sightings were of troop size ranging between 6-10 individuals. followed by troop size with 11-15 individuals (Fig. 5). Average troop size of bonnet macaque in the troops was 15.08. During the study 16.95% of the individuals belonged to the adult male age/sex class, while 7.40% of the individuals were adult females and 9.55% of them were adult females with cradling Infants. Sub adult males were 1.36% and sub adult females were seldom sighted A total of 35.86% of the individuals were classified as immatures, excluding the sub adults. They constitute 26.31% of juveniles and 9.55% cradled infants. Eventhough 71.2% of the individuals were identified as to specific sex class 28.8% remained as unidentified adults (Fig. 6).

The number of individuals in each age/sex class varied considerably between years in the same group as a result of births, deaths, and migrations. A total of 23 births were recorded during the study; of these 13 adult females gave birth in the first year of study (in 1993) and the rest in the succeeding year (Table 4). Maximum number of adult females in a troop that gave birth during the study period was observed to be three each in four troops (Chudal, Irikkapra 2, Vilakkumaram2 and Kallar). A total of nine individuals were found to be missing from four study troops. While in two Irikkapara troops and Kallar no individuals were found to be missing. In Irikkaparal troop two adult males were immigrated in the succeeding year in addition to the already existing seven individuals.

3.1.1.3 Population density

In a total of 105 km line transect observation, 50 troops of bonnet macaque troops were observed. Density of bonnet macaque troop is 15.83 troops/km^2 with Standard Error = 1.698; % Coefficient of variation = 10.7 (Mean troop size is taken as 9.7 animals). The density of bonnet macaques amounts to 153 animals/km^2.

3.1.1.4 *Food and feeding*

Food items of the bonnet macaque were recorded mainly of plant origin. The food consists of leaves, leaf buds, flowers, fruits. wild figs, and seeds of a variety of both moist deciduous and evergreen tree species. The monthly

Table 3. Sightings of Bonnet macaque in Shendurney Wildlife Sanctuary

Sl. No.	Location	AM	AF	AF +1	SA M	SA F	J	CI	UA	Total
1	Thenmala DFO Qtrs.	10	7	7	-	-	12	7	-	43
2	Thenmala KIP Colony	8	5	3	-	-	5	3	-	24
3	10 Acre	4	2	-	-	-	7	-	4	17
4	Pallamvetty	1	-	-	-	-	1	-	15	17
5	2nd Mile N. Kadavu	7	3	3	-	-	7	3	-	23
6	Kattalapara	4	3	1	-	-	4	1	-	13
7	1st Mile	3	4	3	-	-	6	3	3	22
8	Irikkapara	2	-	1	-	-	3	1	-	7
9	Eettakana	2	2	-	-	-	-	-	7	11
10	Kallar I	-	-	5	-	-	5	5	12	27
11	Kallar II	-	2	-	-	-	2	-	2	6
12	Chudal	4	-	2	-	-	5	2	-	13
13	Thalakkal	7	3	1	-	-	5	1	3	20
14	Kalluvarambu	3	-	2	-	-	7	?	10	24
15	Vilakkumaram	1	-	3	-	-	-	3	5	12
16	V'Pacha I	1	-	-	-	-	-	-	7	8
17	V'Pathal	9	-	1	-	-	10	1	11	32
18	V'Pacha II	4	-	4	-	-	7	4	-	19
19	Perumpara	1	-	2	-	-	3	2	3	11
20	Rockwood I	2	-	-	-	-	2	-	7	11
21	Rockwood II	2	1	-	7	-	7	-	-	17
22	Chintamani	-	-	-	-	-	-	-	6	6
23	Charupara	-	-	-	-	-	-	-	6	6
24	Idimupara I	-	-	1	-	-	-	1	4	6
25	Idimupara II	-	-	-	-	-	-	-	4	4
26	Moolakayam	-	-	-	-	-	2	-	5	7
27	Postland	-	-	1	-	-	5	1	2	9
28	Mupathu	1	-	1	-	-	3	1	3	9
29	Mupathu II	3	2	2	-	-	7	2	5	21
30	Urullar Top	1	1	1	-	-	-	1	8	12
31	Pallivasal	2	1	3	-	-	7	3	3	19
32	Munnumukku I	2	-	-	-	-	5	-	7	14
33	Munnumukku II	-	-	1	-	-	5	1	2	9
34	Rosemala V. maram	3	2	1	-	-	3	1	4	14
		87	38	49	7	-	135	49	148	513

AM = Adult male, AF = Adult female, AF+1 = Cradling female, SAM = Sub adult male, SAF = Sub adult female, J = Juvenile, CI = Cradled infant, UA = Unidentified adults

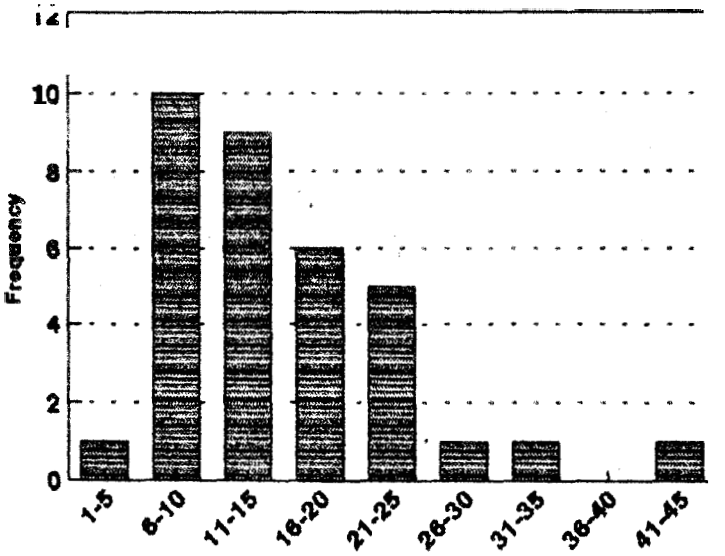
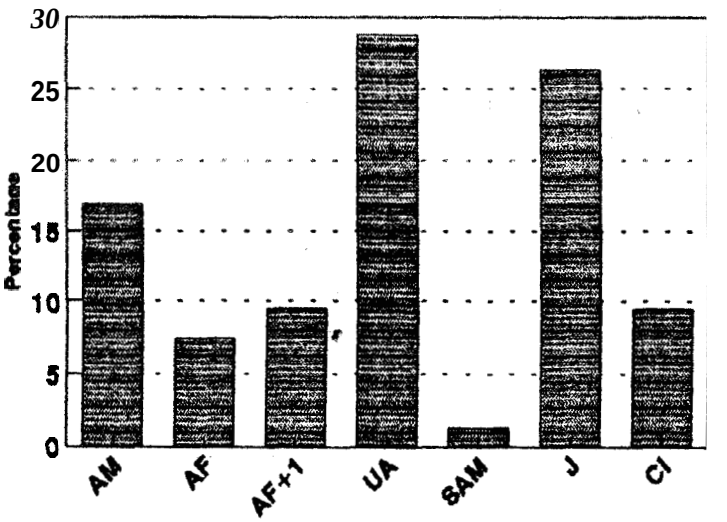


Fig 5 Frequency distribution of bonnet macaque troops in Shendurney Wildlife Sanctuary



AM = Adult Male; AF = Adult Female; AF+1 = Cradling Female
SA = Sub Adult; J = Juvenile CI = Cradled infant; UA = Unidentified Adult

Fig.6. Demographic patterns of bonnet macaque troops in Shendumey Wildlife Sanctuary

Table 4. Demographic change in selected Bonnet macaque troops

Location	Year	AM	AF	AF+1	SAM	SAF	J	CI	UA	Total
Kattalappara	1993	2	3	-	-	-	3	-	5	13
	1994	3	2	1	3	-	3	1	-	13
Chudal	1993	3	1	2	-	1	3	2	-	12
	1994	3	-	3	-	-	4	3	-	13
Irikkappara 1	1993		-	2	-	-	3	2	-	7
	1994	2	2	-	-	-	5	-	-	9
Irikkappara 2	1993		-	3	-	-	6	3	3	15
	1994	2	2	2	-	-	4	2	5	17
Vilakkumaram 1	1993	1	2	2	-	-	-	2	6	13
	1994	3	1	1	-	-	3	1	-	9
Vilakkumaram 2	1993	1	2	3	-	-	-	3	3	12
	1994	1	2	-	-	-	-	-	9	12
Kallar	1993	2	-	1	-	-	-	1	5	9
	1994	3	-	3	-	-	2	3	-	11

AM = Adult male: AF = Adult female: AF+1 = Cradling female:
SAM = Sub adult male: SAF = Sub adult female: J = Juvenile:
CI = Cradled Infant; UA = Unidentified adults

variation in the diet is shown in Table 5. A total of twenty three plant species were observed feeding during the study period. Of these *Knerna attenuata Xanthophyllurn arnottianum, Aporusa lindleyana Ficus* sp. were used for tnany months either for fruit flesh, flowers or leaves. *Knerna attenuata* was exploited from April onwards to October except for the month of August. Out of the 23 feeding plants observed mesocarp of fifteen species were used: six species *(Cullenia exarillata, Knema attenuata Fahrenheitia zeylanica, Loranthus* sp. *Acacia auriculiformis, Acacia* sp.) were used for flowers. Four species *(Xylopia parvifolia, Mesuu ferrea, Diospryos bauxifolia* and an Ochlandra species) were used for leaves or leaf buds. One species of *Acacia* was observed as a food species for bonnet macaque exploiting flowers, fruits as well as seeds. From the overall feeding observations 70.12% of the diet were consisting of fruits, 12.76% flowers, 10.63% leaves, 4.25% leaf buds, and 2.22% of seeds.

Table 5. Food plants of Bonnet macaque in Shendurney Wildlife Sanctuary

Month	Species	Parts eaten
January	*Ochlandra* sp.	leaf, leaf buds (4)
	Ficus sp.	fruit (4)
	Xylopia parvifolia	leaves, leaf buds (2)
	Cullenia exarillata	flower (1)
February	*Xanthophyllum arnottianum*	fruits (4)
	Mesua ferrea	leaf (1)
	Ficus sp.	fruit (1)
March	*Aporusa lindleyana*	fruit (3)
April	*Dillenia pentagyna*	fruits (3)
	Xanthophyllum arnottianum	fruits (2)
	Knema attenuata	flower (2)
	Artocarpus hirsutus	fruits (1)
	Aporusa lindleyana	fruits (1)
	Artocarpus heterophyllus	fruits (1)
	Elaeocarpus serratus	fruits (1)
May	*Xanthophyllum arnottianum*	fruit (2)
	Ficus sp.	fruit (1)
	Fahrenheitia zeylanica	flower (1)
	Artocarpus gomezianus	fruit (1)
	Loranthus sp.	fruit & flower (1)
	Dillenia pentagyna; *Aporusa*	fruit (1)
	lindleyana	fruit (1)
	Knema attenuata	fruit (1)
June	*Knema attenuata*	fruit (2)
	Aporusa lindleyana	fruit (2)
July	*Garcinia*	fruit (2)
	Grewia tiliifolia	fruit (2)
	Knema attenuata	fruit (1)
	Acacia sp.	flower (1)
	Aporusa lindleyana	fruits (1)
August	*Myristica canarica*	fruits (2)
	Garcinia sp.	fruit (1)
	Acacia auriculiformis	flower (1)
	Grewia tiliifolia	fruit (1)
September	*Knema attenuata*	fruit (3)
	Xylopia parvifolia	leaves (1)
	Myristica canarica	fruits (1)
October	*Xanthophyllum arnottianum*	fruits (2)
	Knema attenuata	fruit (1)
	Diospyros bauxifolia	leaf (1)
November	*Ficus* sp.	fruit (7)
	Vateria indica	fruit (1)
December	*Acacia* sp.	fruit and seed (2)

Figures given in the parenthesis denotes number of feeding observations whose duration was more than quarter of an hour.

3.1.2 Lion-tailed macaque *(Macaca silenus)*

3.1.2.1 Distribution

Inside the Shendurney Wildlife Sanctuary. Lion-tailed macaque troops were found at Kallar area, Moonnumukku area In Rosernala region and on the way to Pandirnottai area only. Lion-tailed macaque troops were found in evergreen forests of Kulathupuzha Valley adjoining the sanctuary. A total of nine lion-tailed macaque troops with 131 individuals were estimated by observing the troop structure and repeated sightings of same troop in a particular area. Largest troop observed was KallarIII troop with forty individuals and the sniallest troop (Chintarmani) with five individuals (Table 6). Average troop size was 15.55 individuals.Figure 7 gives the location of sightings of lion-tailed macaque troops in the study area.

Month wise sighting observation of lion-tailed macaque has been analyzed in different areas like Kallar, Vilakkumaram, Rockwood. Moonnumukku, Marappalam, Chintarmani and Chendurney Ar areas (Table 7). Sightings of lion-tailed macaque were more concentrated in the months of January and May: while in March, June, July, August, and September months no

Table 6. Sightings of Lion-tailed macaque in Shendurney Wildlife Sanctuary

Sl. No.	Location	AM	AF	AF +1	SAM	SAF	J	CI	UA	Total
1	Chintarmani	-	-	1	-	-	-	1	3	5
2	Kallar I	-	-	1	-	-	3	1	1	6
3	Kallar II	3	-	1	3	-	5	1	7	20
4	Kallar III	1	1	4	-	-	14	4	16	40
5	Kallar IV	-	-	3	-	-	3	3	1	10
6	Vilakkumara pacha	1	1	-	5	-	5	-	5	17
7	Chenturni ar	1	-	-	-	-	2	-	3	6
8	Rockwood	1	1	-	2	-	3	-	10	17
9	Moonnumukku	3	1	-	3	-	1	-	2	10
		10	4	10	13	-	36	10	48	131

AM = Adult male: AF = Adult female: AF+1 = Cradling female:
SAM = Sub adult male: SAF = Sub adult female: J = Juvenile:
CI = Cradled Infant: UA = Unidentified adults

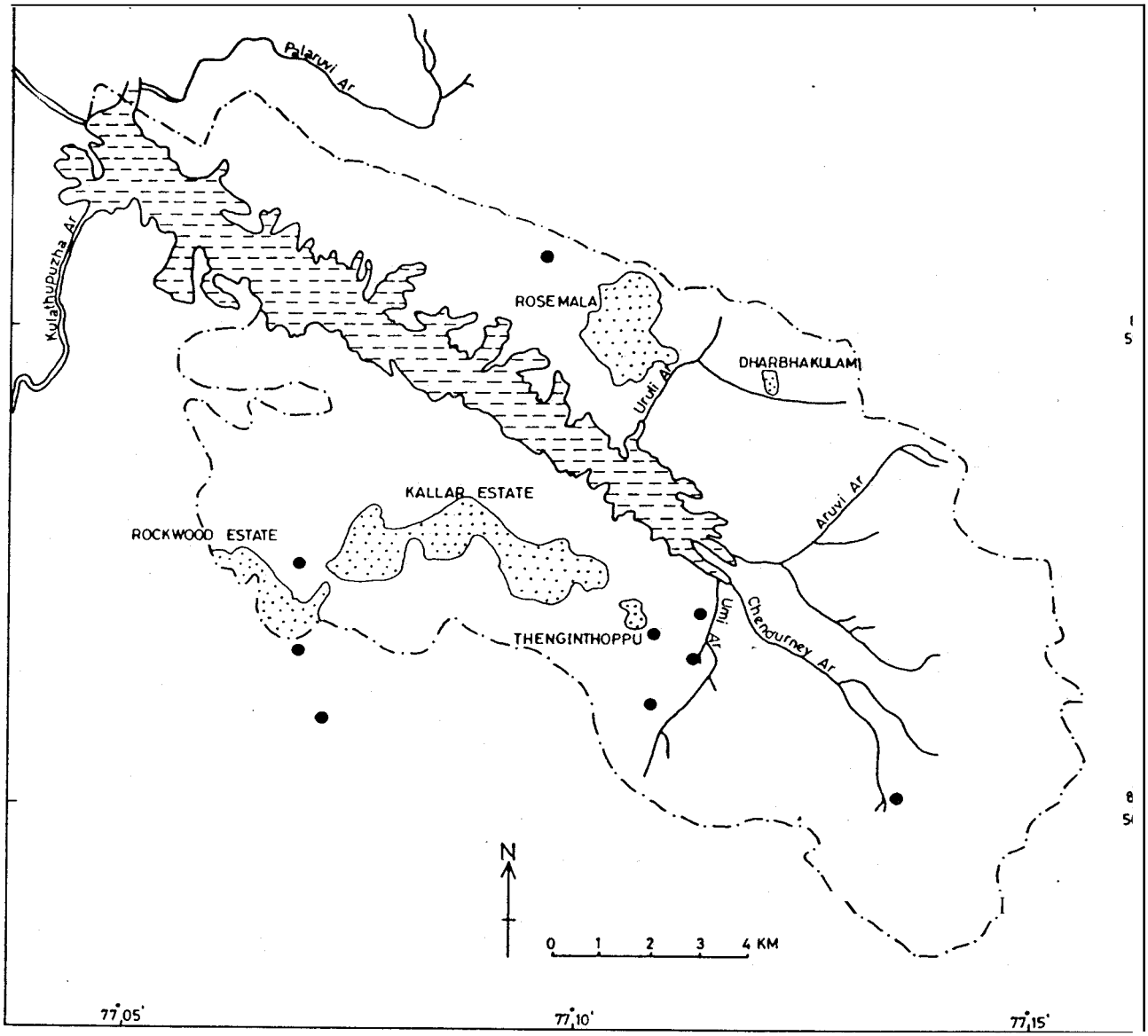


Fig.7. Locations of lion-tailed macaque troop sightings in Shendurney Wildlife Sanctuary

Table 7. Month wise sighting data of Lion-tailed macaque in Shendurney Wildlife Sanctuary

Location	AM	AF	AF+1	SA M	SA F	J	CI	UA	Total
January									
Kallar	2	-	4	-	-	7	4	9	26
Kallar	-	-	3	-	-	3	3	7	16
Vilakkumaram Pacha	2	2	-	-	-	4	-	4	12
Rockwood	1	-	-	-	-	2	-	12	15
Rockwood	-	-	-	-	-	-	-	7	7
Rockwood	1	1	-	2	-	3	-	10	17
Kallar	4	2	-	-	-	1	-	11	18
									111
February									
Kallar	-	-	1	-	-	-	1	4	6
									6
April									
Kallar	3	-	2	3	-	5	2	15	31
Moonumukku	3	1	-	3	-	1	-	-	8
Moonumukku	1	1	-	-	-	1	-	5	8
									47
May									
Kallar	-	-	2	-	-	3	2	23	30
Kallar Transect 18	1	-	5	-	-	15	5	34	60
Kallar	-	-	1	-	-	6	1	28	36
Kallar	1	1	-	-	-	10	-	6	18
Kallar	2	-	4	-	-	14	4	9	33
Kallar	2	-	-	-	-	-	-	3	5
Moonumukku	3	1	-	-	-	-	-	6	10
									192
October									
Vilakkumaram Pathal	-	-	-	-	-	5	-	8	13
Vilakkumaram Pathal	-	-	-	-	-	5	-	12	17
Vilakkumaram	1	-	-	-	-	-	-	2	3
Vilakkumaram Pacha	1	-	-	-	-	3	-	13	17
									50
November									
Vilakkumaram Pacha	1	-	-	-	-	5	-	6	12
Marappalam	3	1	-	5	-	3	-	1	13
									25
December									
Chintarmani	-	-	1	-	-	-	1	3	5
Chenturuni ar	1	-	-	-	-	2	-	3	6
Vilakkumaram Pacha	2	1	-	-	-	3	-	7	13
									24

AM = Adult male; AF = Adult female; AF+1 = Cradling female; SAM = Sub adult male; SAF = Sub adult female; J = Juvenile; CI = Cradled infant; UA = Unidentified adults

sightings were recorded. Majority of the lion-tailed macaque sightings were in May (43.34% of the sighting) and in January (25.06%). Most of the repeated sightings could be made from the Kallar (40.74%) and Vilakkumaram areas (25.92%). 11.11% of the macaques were sighted each from Rockwood and Moonnumukku areas. The rest of the sightings (3.7% each) constituted from the Marappalam, Chendurney ar areas inside the sanctuary and Chintarmani in the Kulathupuzha range out side the sanctuary limits.

3.1.2.2 *Troop size and composition*

Age and sex composition of nine troops in Shendurney Wildlife Sanctuary were observed (Table 6). The percentage composition revealed that 7.63% of the total individuals in these troops were adult males. Adult females constituted 3.05%. while cradiling females constitute 7.63% of the total. Sub adult male constituted 9.92%; juveniles formed 27.5%: and cradled infants constituted 7.63% out of the total individuals. Altogether, 63.36% of the total individuals were sexed while 36.64% of individuals remained as unidentified adults.

3.1.2.3 Food and feeding

Though extensive feeding observations of lion-tailed macaques were not undertaken in the study area, the animals were found to feed on the fruits of *Artocarpus gomezianus, Ficus* sp., in Kallar area in the month of May. In January they were found to feed on the flowers of *Cullenia exarillata* in Rockwood area and fruits of Palaquium ellipticurn and flowers of *Loranthus* in Moonnumukku area in the month of May.

3.1.3 Nilgiri langur *(Presbytis johni)*

3.1.3.1 Distribution

The Nilgiri langur troops were randomly distributed in different forest types of Shendurney Wildlife Sanctuary. The troops were distributed in all the three forest types namely, moist deciduous, semi-evergreen and evergreen. Nilgiri langur was sighted in areas like Rosemala, Dharbhakulam, Stephen arady. Chavakkattutheri. Pathinanchu, Postland, Umayar. Kattalappara. Karadippara, Eetakanam. Chudal, Marappalam, Onakkathodu, Onakkayar, Mamoodu, Moolakkayam, Thalakkal, Vilakkumaram, Perumpara,

Irikkappara, Kallar, Thenginthoppu and Peruvazhikala which are inside the sanctuary and also in Rockwood. Charupara and Kalluvarambu areas in the adjoining areas of the sanctuary In Vilakkumaram. Pathinachu. Irikkappara and Kallar areas solitary adult male Nilgiri langur were frequently sighted. Figure 8 gives the sighting location of the Nilgiri langur in the Shendurney Wildlife Sanctuary.

Table 8. Sighting of Nilgiri langur in the Shendurney Wildlife Sanctuary and adjacent areas

Location	No. Indv.
Charupara	5
Chavakkattutheri	3
Chudal I	6
Thalakkal	15
Irikkappara	6
Eeettakanam	4
Mamoodu	4
Kannampally medu (Rosemala)	7
Dharbakulam I	1
Dharbakulam II	1
Moolakkayam	2
Onakkayar	14
Stephen Arady	2
Umayar	2
Pathinachu	1
Postland	1
Thenginthoppu	15
Kallar I Km	8
Kallar 4 Km	7
Kallar 8 Km	5
Vilakkumaram pacha	1
Vilakkumaram pathal	8
Perumpara	5
Marappalam	1
Onakkathodu	18
	142

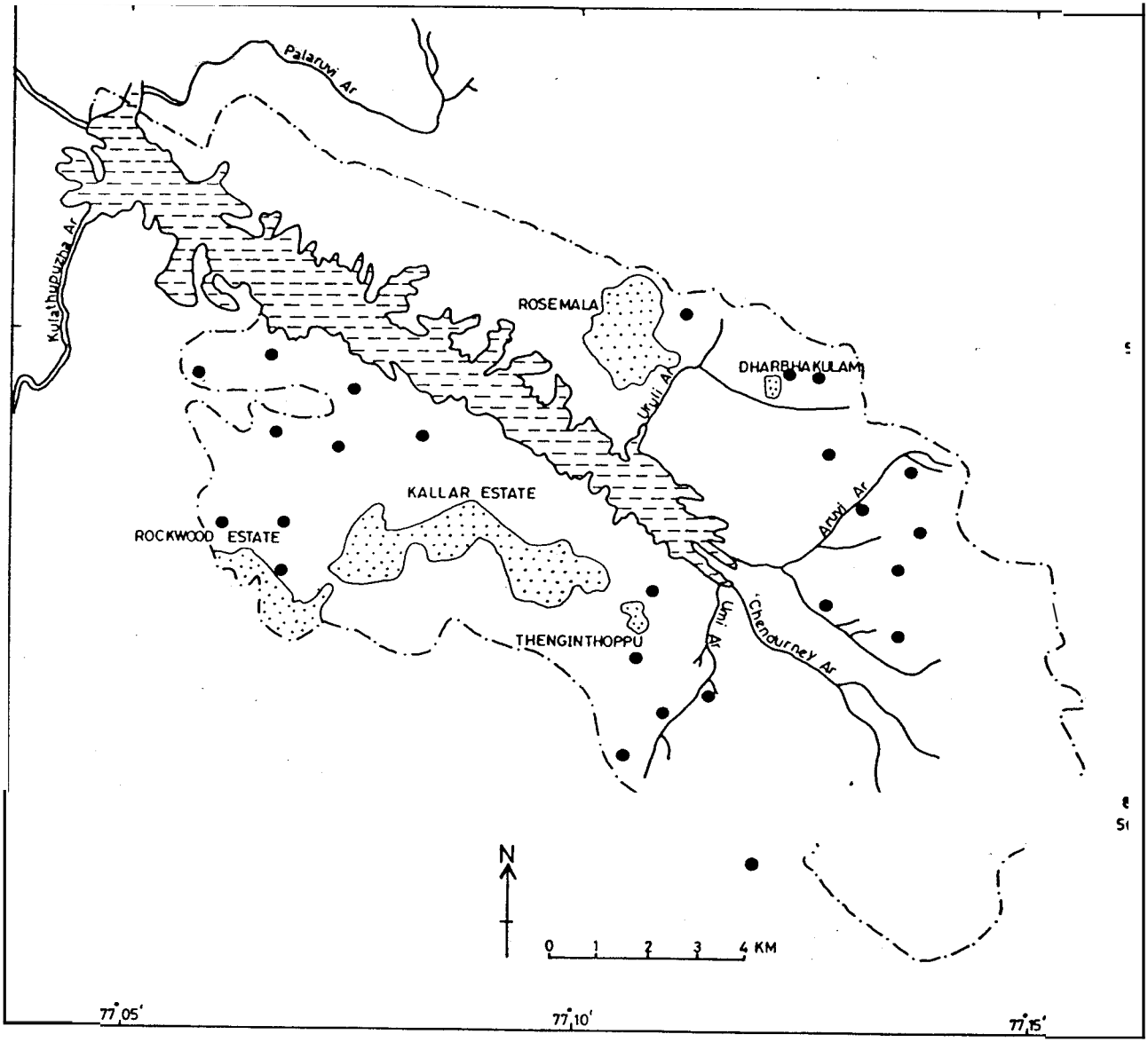


Fig.8. Locations of Nilgiri langur troop sightings in Shendurney Wildlife Sanctuary

A total of twenty five troops were identified from in and around the sanctuary (Table 8). Of these 24 troops were sighted inside the sanctuary while one troop of Nilgiri langur was sighted from Charupara in the southern border of the sanctuary. Maximum nuniber of individuals observed in all the troops were 18 individuals in Onakkathodu troop. Mininium number of individuals observed was one individual each in six localions namely Dharbhakulam I, Dhrabhakulam II. Pathinanchu, Postland, Vikakkumaram Pacha, and Marappalam. Periodic monitoring of a few Nilgiri langur troops could be done in the study period.

Nilgiri langur troop frequently sighted in the First Mile area had five individuals with 4 adult females and one adult male during the first year of our study. No infants were seen in that troop during 1993. During the successive year all the females in that troop gave birth and all of them were seen wilh cradled infants.

During the first year of our study period there was no instance of sighting Nilgiri langur any where near the Kattalappara picket station. In the second year of the study in October 1994 a lone Nilgiri langur was sighted in the Kattalappara forest area. Probably this had come from First Mile area.

3.1.3.2 Population density

In a total of 50.5 km of line transect observation. 12 Nilgiri langur troops were observed. Density of Nilgiri langur troop is 7.5 troops/km^2. Standard error = 1.57 and % Coefficient variation = 21. (Mean troop size is taken as 8.83) The density of Nilgiri langur is estimated to be 66 animals/km^2.

3.1.3.3 Food and feeding

The diet of Nilgiri langur observed was mainly of plant origin. It contained fruits, flowers, leaf buds and leaves of many species. The percentage composition of the diet observed were fruits (70.37%), leaf buds (14.8%).leaves (1l.l%) and flowers (3.7%). During the study period 13 plant species were exploited in different months (Table 9). These were *Vateria indica, Knema attenuata, Diospyros buxifolia, Myristica malabarica, Flacourtia jangomas, Lophopetalum wightianum, Bauccarea courtallensis, Myristica canarica*

Table 9. Food plants of Nilgiri langur in Shendurney Wildlife Sanctuary

Month	Species	Parts eaten
January	*Ochlandra* sp. *Ficus* sp. *Vateria indica* *Knema attenuata*	leaf bud (5) fruit (1) fruit (1) leaf (1)
February	*Diospyros buxifolia* *Knema attenuata*	leaf (1) fruit (2)
March	*Myistica malabarica* *Flacourtia jangomas*	fruit (1) fruit (1)
April	*Ochlandra* sp. *Lophopetalum uightianurn*	leaf bud (1) fruit (1)
May	*Ficus* sp. *Artocarpus gomezianus* *Lophopetalum uightianum* *Ochlandra* sp.	fruit (2) fruits (1) fruit (2) leaf bud (1)
June	*Ochlandra* sp. *Baccaurea courtallensis* *Ficus* sp.	1eaf bud (1) fruit (1) fruit (1)
July	*Knema attenuata*	fruit (1)
August	*Myistica canarica* *Garcinia* sp. *Ochlandra* sp. *Mesua*	fruits (2) fruit (1) leaves (1) leaves (1)
September	*Myristica canarica*	fruits (1)
October	*Ficus* sp. *Knema attenuata*	fruit (1) flower (1)
November	*Vateria indica*	leaf (1)
December	*Vateria indica*	leaf (2)

Figures given in parenthesis denotes number of feeding observations whose duration was more than quarter of an hour.

Garcinia species, *Mesua ferrea, Ficus* sp. and a reed species. Of lhe total feeding observations 14.81% accounted on three species namely *Knema attenuata, Ficus* sp. and *Ochlandra* sp. 11% of feeding sightings were on *Vateria indica* The rest of the feeding sightings were on the other nine species. An instance of a Nilgiri langur feeding on the tuber of a climber (Dioscorea sp.) was observed in Kattalappara-Chudal area,

3.1.4 Slender Loris *(Loris tardigradus)*

3.1.4.1 Distribution

Loris was sighted once in the sanctuary. The animal was was located in the canopy of trees. in the marshy area of Kattalappara, inside the sanctuary. The animal was located at about 5m above ground. It was spotted during the night observation when the flash of its eye was picked up and later confinned by closer examination. The animal was reported to be quite common in the past.

3.2 FOREST STAND STRUCTURE

3.2.1 Kallar Area

Altogether 47 tree species were recorded during the PCQ sampling. The trees occurring in Kallar area in the order of Important Value index are *Knema attenuata, Dipterocarpus indicus, Strombosia ceylanica. Myristica dactyloides, Aglaia lawii, Calophyllum poIyanthum, Syzigium gardneri, Syzygium sp.., Terminalia bellirica, Alstonia scholaris, Cullenia exarillata Humboldtia decurrens, Litsea oleoides, Holigarna grahamii, Antidesmu menasu, Mesrra ferrea. Semecarpus auricu1ata, Xanthophyllum arnottianum, Aporusa acuminata, Palaquium ellipticum, Dysoxylum malabaricum, Bischofia javanica Drypetus malabarica, Diospyros sp.. Diospyros bourdilloni. Artocarpus heterophyllus, Erythroxylum, Fahrenheitia zeylanica, Aglaia barberi, Vateria indica, Turpinia malabarica, Syzygium mundagam, Gluta travancorica, Macaranga peltata, Ailanthus triphysa, Aglaia tomentosa, Mitragyna tubulosa, Erythrophyllum, Poeciloneuron indicum. Jambosa mundagam, Canthium pergracile, Symplocos macrocarpa, Baccurea courtallensis, Cinnamomum malabatrum, Euonymus indicus* and *Canarium strictum.*

3.2.2 Kattalappara area

Forty five tree species were recorded in the area. The tree species occurring in the area in the order of greater Important Value Index are *Lagerstroemia flos-reginae, Hopea parviflora, Syzygium sp., Persea macrantha, Terminalia paniculata, Vitex altissima, Vateria indica, Knema attenuata, Cinnamomum malabathrum, Kingiodendron pinnatum, Dillenia pentagyna, Myristica malabarica, Strombosia ceylanica, Aporusa lindleyana, Schleichera oleosa, Lophopetalum wightianum, Mesua ferrea, Hydnocarpus pentandra, Macaranga peltata, Lagerstroemia microcarpa, Dipterocarpus indicus, Xylopia parvifolia, Eugenia montana, Elaeocarpus serratus, Artocarpus hirsutus, Canthium pergracile, Aglaia* sp., *Myristica magnifica, Gymnacranthra canarica, Actinodaphne sp., Lannea coromandelica, Anocolosa densjflora, Carallia brachiata, Prunus ceylanica, Anthocephalous chinensis, Syzygium cumini, Dysoxylum malabaricum, Stereospermum colais, Sapindus laurifolia, Euodia lunu-ankenda Croton malabaricus, Anogeissus latifolia, Hydnocarpus alpina* and *Mitragyna parviflora*

3.2.3 Rosemala area

Forty five tree species were encountered in Rosemala area in the PCQ sampling, The trees in the order of greater Important Value Index are *Canthium pergracile, Hopea racophloea, Vateria indica, Syzygium sp., Kingiodendron pinnatum, Sterculia guttata, Walsura trifolia, Syzygium gardneri, Dipterocarpus indicus, Sageraea dalzellii, Knema attenuata, Cullenia exarillata, Artocarpus hirsutus, Strombosia ceylanica, Bombax ceiba, Bischofia javanica, Tetrameles nudiflora, Polyalthia fragrans, Flacourtia montana Myristica* sp.. *Hydnocarpus pentandra, Hopea parviflora, Semicarpus auriculata, Aglaia sp., Diospyros buxifolia, Dysoxylum malabaricum.* Unidentified *sp., Mesua ferrea, Terminalia bellirica, Schieichera oleosa, Lannea coromandalica, Baccaurea courtallensis, Aglaia perviridis, Stereospermum colais, Cinnamomum malabathrum, Mangifera indica, Sterculea banbanghias, Macaranga peltata, Croton malabaricus, Alstonia scholaris, Xanthophyllum arnottianum, Elaeocarpus serratus, Diospyros paniculata* and *Hopea* sp.

3.2.4 Rockwood area

Forty tree species were recorded in the area. They are *Humboldtia decurrens, Palaquium ellipticum, Poeciloneuron indicum, Aglaia lawii, Cullenia*

exarillata, Litsea oleoides, Agrostistachys borneensis, Heritiera papilio, Vateria indica, Drypetes malabaricum, Gluta travancorica, Ficus nervosa, Elaeocarpus tuberculatus, Diospyros sp.,*Diospryoscumilis, Polyalthia coffeoides, Mesua ferrea Dysoxylum malabaricum. Drypetus elata Euonymus indicus. Aglaia tomentosa, Otonephelium stipulacecum, Parinarium travancoricum, Ardisia pauciflora, Myristica dactyloides, Syygium gardneri. Holigarna ferriginae, Erythroxylum sp., Knema attenuata, Antidesma menasu, Drypetus wightii, Polyalthia fragrans, Diospyos ghatensis, Cinnarnomum sp., Buccaurea courtallensis, Dimorphocalyx lawianus, Cinnamomum travancoricum, Nothopegia sp.*. and *Syzygium laetum.*

3.3 OTHER ARBOREAL ANIMALS

Shendurney Wildlife Sanctuary has a variety of arboreal mammals such as Malabar giant squirrel, flying squirrels arid brown palm civets. Their popula-Lion was also estimated as they may be regarded as the potential competitors for primates in some ecological niches.

3.3.1 Malabar giant squirrel *(Ratufa indica maxima)*

Malabar giant squirrel was found in all the wooded forests in the sanctuary. They are solitary arboreal animals. In a total of 107 km of line transect observation, 78 Malabar giant squirrels were observed. The density of the animal was estimated to be 35/km^2 (Standard error = 4.544 and Percentage coefficient variation 15.2. Mean animal sighting = 1.17 animals).

3.3.2 Flying squirrels

Flying squirrels are commonly found in the wooded region of the sanctuary especially the Kattalappara. Chudal area. They are *Pelaurista petaurista* and *Pelinomys fuscocapillus.* The former is quite common and is more abundant than the latter. Petaurista petaurista was sighted on more than 20 occasions while *Petinomys fuscocapillus* was sighted only twice.

3.3.3 Palm civet/ Toddy cat *(Paradoxurus hermaphroditus)*

This animal was also seen crossing the road while on nocturnal observation. The animal is quite common.

3.3.4 Brown palm civet/Jerdon's Palm civet *(Paradoxurus jerdoni)*

Brown palm civet was located in the Chudal and Vilakkumarm area inside the sanctuary. In the sanctuary area night observation with spotlight was conducted. The animal was located on three occasions. All the instances, the animals were found on trees with about 75 cm gbh. Locations of sighting in two occasions were only one km apart. On two occasions the animal was observed for longer duration (more than 10 minutes) while on the third occasion the animal was observed for about a minute. There was lots of variation in the pelage colour in the brown palm civets observed in the sanctuary. There is need for in depth studies on this arboreal civet. It requires more observation during nights with spot lights and possibly to capture animals to confirm the exact identity of the sub species.

4. DISCUSSION

The primate species of India vary in shape, size, population status, habitat requirements, and can be segregated into various groups such as primates of special status, primates which are still abundant, primates with uncertain population and those which are threatened with extinction. Present study reveals the status and distribution of four primate species namely bonnet macaque, lion-tailed macaque, Nilgiri langur and slender loris in the Shendurney Wildlife Sanctuary and adjacent areas. Of these the lion-tailed macaque and Nilgiri langur has got an endangered status, while the bonnet macaque is rather abundant South Indian species, and slender loris is not very common.

Bonnet macaques are quite adapted to the highly varied forest types of Peninsular India, It is found both in the jungles, country side and towns. It is more common in the rural and suburban areas (Roonwal and Mohnot. 1977). Bonnet macaque occupies all major habitats like the deciduous forests, road ways, farm fields, villages, cities. Kurup (1981) estimated a population of about 8450 bonnet macaque troops in the country side of the four southern states of India namely Andhra, Karnataka, Tamil Nadu and

During the present study the bonnet macaques were sighted from rural areas adjacent to the sanctuary, moist deciduous forests, and in evergreen forests. The distribution of bonnet macaque is more random and it is found in almost all types of forests. This can be seen in the peripheral areas of the sanctuary often becoming a minor pest.

The largest troop located in the rural town of Thenmala had 43 individuals. In the forest a troop of 32 individuals has been identified showing there isn't any considerable difference in the group size. Kurup (1981) has reported the average troop size of bonnet macaques as 26.2 , while in the present study it comes only to 15.08. Monitoring the demographic changes in the selected bonnet macaque troops reveals 23 births in the successive year shows the potentia1 viability of the species in the sanctuary.

According to Krishnan (1971) bonnet macaques are omnivorous feeding on leaves, young shoots. flowers and fruits, eggs of birds. grass hoppers and occasionally on lizards. Rahman and Parthasarathy (1975) reports the food and feeding of bonnet macaque as depending upon the resource availability and its distribution. Troop size in monkeys is an important factor in food resource utilization depending on the availability of the spatial and temporal distribution of food resource. The size and the structure of social group, predator pressure and population density may affect the foraging strategies of monkeys. Each factor has influenced the bonnets at various habitats.

During the present study the diet of the bonnet macaques consisted mainly of plant origin. Out of the 23 plant species exploited by the macaques six of them like *Knema attenuata, Cullenia exarillata, Mesua ferrea, Xanthophyllum arnottianum, Artocarpus heterophyllus,* and *Vateria indica* are found in the Kallar area. The most widely used species *Knema attenuata* has got the greatest important value index (IVl) indicating the relation between the relative abundance of the tree species with the feeding behaviour. Species like *Dillenia pentagyna, Aporusa lindleyana* and *Vateria indica* have got high ranking in the Kattalappara as seen in the PCQ sampling done in Kattalappara. These species were exploited extensively by the bonnet macaques relating again to the feeding habits with the resource availability.

Lion-tailed macaque is the most endangered primate species and has the most fragmented range of distribution of all the primates in Peninsular India.

This highly arboreal macaque is an endemic species confined to the wet evergreen forests. The lion-tailed macaque was distributed as a contiguous population from the southern Western Ghats to the state of Maharashtra. Over the past many centuries its distribution range in the north has shrunk to just north of Sharavathi river in Karnataka as most of the rain forests in the states of Maharashtra and Goa were lost. Similarly the low land rain forests in Kerala and Karnataka was wiped out, thus restricting the distribution of lion-tailed macaque to the higher elevation of the Western Ghats. Human activities in the past 100 years or so not only reduced the extent of the rain forest further, but also fragmented the remaining forests into numerous small isolated patches. Presently the lion-tailed macaque occur as numerous small populations (Kumar, 1995). Though its distribution now ranges up to Karnataka and Tamil Nadu state major population of lion-tailed macaques inhabit in the Kerala part of the Southern Western Ghats. Very few habitats like Silent Valley, Anamalai hills, Someswara Wildlife Sanctuary in Karnataka and north of Sharavathi river are having good data regarding the status and distribution of the species (Ramachandran, 1994: Kumar, *et al.* 1995).The recently conducted Population Habitat Viability Analysis (PHVA) Workshop on lion-tailed macaque assessed its highly fragmented habitat and the possibility of local extinction in many rain forest patches. (Kumar, *et al.* 1995).

The present study reveals the occurrence of nine troops with 131 individuals in and around the Shendurney Wildlife Sanctuary. This study throws light on the necessity of its conservation in this natural habitat. Maximum sightings were seen from the catchments of Umi Ar and Chendurny Ar, followed by the evergreen forests in the Rockwood area which is contiguous with the Kulathupuzha Reserved Forest. Varghese *et al.*, (1994) has also reported the sightings of a few troops of lion-tailed macaque in those forests. In the moist deciduous, and in the heavily disturbed areas the lion-tailed macaques are not found. Eventhough the sanctuary has deciduous forest patches in the low lying areas, the lion-tailed macaques are confined to the evergreen forests between the altitude 400 m to 1300 m which is contiguous with lhe Kulathupuzha Reserved Forest south of the sanctuary. As the low elevation evergreen forest has high plant species diversity (Pascal, 1988)the fairly contiguous evergreen patches of Shendurney Wildlife Sanctuary and adjacent areas provide a good habitat with high quanty for the highly endangered lion-tailed macaque.

Nilgiri langur is an endangered primate endemic to the Western Ghats. It generally inhabit the sholas and their range is continuous through out the monsoon forests in the Western Chats (Poirier, 1968: Kurup, 1975).Amore recently conducted wildlife census in Kerala provides the status and distribution of the Nilgiri langur in Kerala Slate (KFRI, 1993). The census revealed the existence of 348 troop of Nilgiri langur with an average troop size of 11.65 individuals. The present study in the Shendurney Wildlife Sanctuary estimates the Nilgiri langur population in 25 troops with 142 individuals having a mean group size of 5.68. According to Poirier (1970) who made a detailed study of the bisexual troop reports having an average of 8-9 individuals per troop. He could identify unisexual groups and in the present study reveals the occurrence of six solitary males in different areas. These solitary males live away from bisexual troops for a period of time and probably they may migrate into adjacent troops maintaining an interbreeding population.

Nilgirl langur can be considered as a vegetarian. but they may occasionally eat insects (Roonwal and Mohnot (1977).The present study reveals its strict vegetarian nature. All feeding observations confine to plant materials. Even though 70.37% of the feeding observations are on fruits, the feeding data is insufficient to test its frugivorous status in the sanctuary. According to Krishnan (1971) the main food of Nilgiri langur consists of leaves, flowers,buds. fruits, seeds, bark and sterns of various plants and the bulk of the diet being derived from shrubs and they prefer leaves for their food. However, the preferred food plants of Nilgiri langur change with the seasons Horwich (1972). Nilgiri Iangur troops were seldom found in Rosemala-Vilakkumaram areas probably due to disturbance from the Rosemala enclosure.

The slender loris *(Loris tardigradus)* is found in tropical rain forest, open wood land and swampy coastal forests of South India (Roonwal and Mohnot, 1977).But according to Parthasarathy (1984)the slender loris is not confined to the dense forest but found usually in open tree jungle. It also prefers to live in isolated groves and does not keep exclusively to the trees. Its distribution extends through Sri Lanka and Southern India probably north to Tapti river in India up to 1850 in altitude. In a number of places it has been recorded at about 600 m altitude inevergreen forests. This nocturnal primate is observed to live in shady places in the hollows of trees or in the leafy branches which are not exposed to predators. One sighting of slender loris in the present study area confirms its distribution in the Shendurney Wildlife Sanctuary.

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