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# AN ECOLOGICAL STUDY IN PERIYAR TIGER RESERVE WITH SPECIAL REFERENCE TO WILDLIFE

P.Vijayakumaran Nair
K.K.Ramachandran
V.S.Vijayan
P.S.Easa
P.V.Balakrishnan

KERALA FOREST RESEARCH INSTITUTE
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ABSTRACT

Studies on the distribution, ecological requirements and resource availability to selected mammals of Periyar Tiger Reserve was carried out for a period of about five years from 1977 to 1982. This sanctuary is located on the crestline of Western Ghats in Kerala State. The forest types in this high rainfall and undulating terrain consist of grass-lands, deciduous and evergreen forests. The study methods included recording population parameters and activities of animals sighted and collection of evidences of animals from systematically laid out sample plots. The grass production from different parts of the habitat was estimated by the harvest method. The reserve had a rich avifauna of 181 species. Almost all the families of birds reported from Kerala are present in the study area. A total number of about 800 elephants were estimated to be present in the study area based on the quantity of dung heaps counted from the sample plots. The overall density was about one elephant per square km., with an ecological density as nigh as two or three times this in some seasons in certain parts of the reserve. The proportion of various classes of individuals in the population and their sex ratio were comparable to that of healthy elephant populations elsewhere except in the proportion of adult male

elephants. Density of animals like sambar, gaur and wild boar showed extreme variation. Frequency distributions of the number of animals in groups of sambar deer and wild boar were constructed and comparisons made with the same in other populations. Fodder and water did not appear to be a limiting factor to the animals. Based on the habits and habitat use the herbivores could be classified into two groups, the first one consisting of animals like barking deer, sambar, gaur, cattle and elephants and the second group consisting of mouse deer and hare. The wild boar was not part of either of these groups. The distribution of arboreal animals like the Nilgiri langur, Liontailed macaque, Bonnete macaque, and Giant squirrel were examined. The availability of prey to carnivores and the competition among them were also studied. Two important suggestions towards scientific management are put forward, the first concerning the inadequacy of the present demarcation of the reserve into the tourism, buffer and core areas, and the second concerning the need for adopting different management strategies in the eight divisions proposed for the reserve.

## INTRODUCTION

An ecological study in Periyar Tiger Reserve with special reference to Wildlife was initiated in 1977 with a view to generate data for scientific management of the Periyar Tiger Reserve on ecological conditions, requirements and availability of resources to the wild animals. A preliminary report (Vijayan et al., 1979) deals with general status, distribution and habitat preference of different species of animals found in Periyar Tiger Reserve.

Detailed studies carried out subsequently on selected mammals, their distribution, ecological requirements and resources available to them form the subject matter of the present report. Since the preliminary report by Vijayan et al. (1979) is not readily available for reference and also because of the desirability of providing a complete picture relevant portions from the report has also been incorporated in this report.

The objectives of the study were to study the population of major wildlife in the reserve, to collect information on the general ecological requirements and. to assess the availability of resources inside the reserve to meet their requirements. The study was divided into two phases. During

the first year's phase of reconnaissance the habitat was surveyed. on foot and distribution of animals noted. Detailed studies on population, density and ecological requirements were carried out during the second phase.

Change of research staff, the very large size and difficult accessibility of the study area have imposed certain limitations on sample size and details covered. Studies on captive animals could not be carried out to the expected degree due to the animals dying because of disease, wild animals attacking them and theft of the captive animal.

This report is divided into four sections. The first introductory section describes the physiography, forest types and division of the study area. The second section of materials and methods is followed by the detailed section of results and findings. The last section deals with some of the aspects which need attention at the management level.

# AN ECOLOGICAL STUDY IN PERIYAR TIGER RESERVE WITH SPECIAL REFERENCE TO WILDLIFE

The Periyar Tiger Reserve is one of the most well known wildlife sanctuaries in peninsular India and was a hunting preserve of the Maharajas of the erstwhile Travancore. a masonry dam was constructed near Thekkady in 1895 creating a lake of about 26 sq.km. (Plate 1). Because of its scenic beauty and facilities for viewing animals from boats this place became a great tourist attraction (Plate 2).

## STUDY AREA

### LOCATION

The study area is located between 9°15' and 9°40' N latitude and 76°55' and 77°25' E longitude in the southern Western Ghats and. is generally known as the Periyar Plateau. This sanctuary is situated west of Madurai and East of Kottayam in the Idukki District of Kerala. It is also the catchment area of River Periyar from which the sanctuary gets its name.

### TOPOGRHPHY

The Western Ghats is about 50 km in width at the Periyar Plateu. A considerable portion is under cash crops and forest continuity is limited to few regions (Fig.1). Even

Plate 1. A view of Periyar lake with dry tree stumps

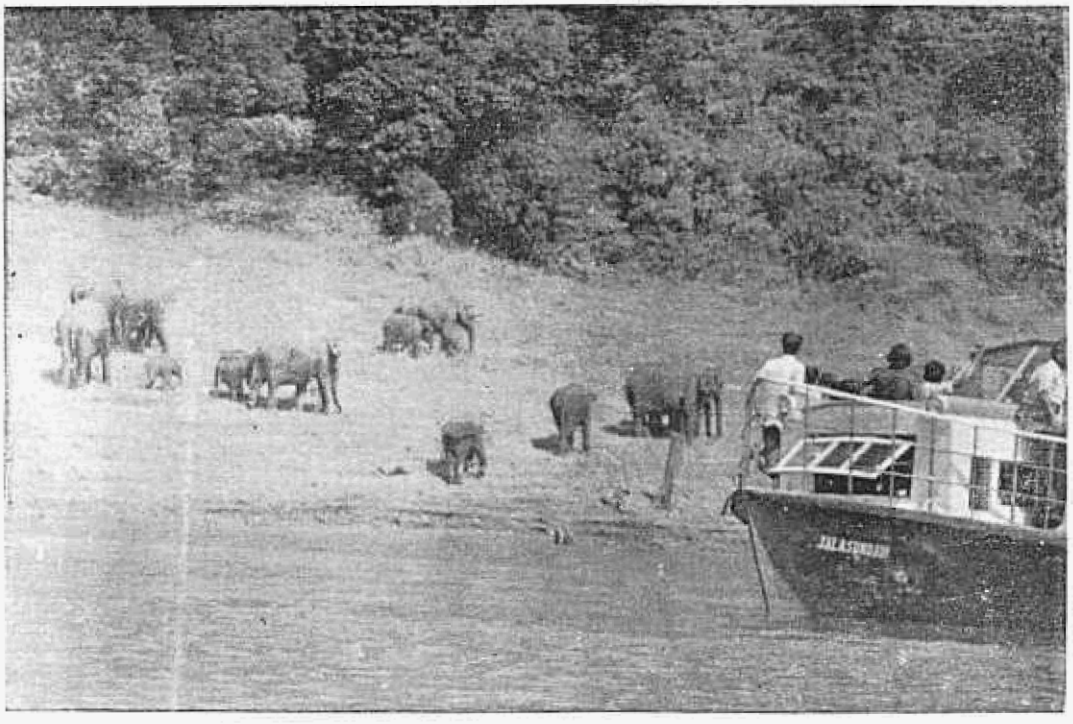


Plate 2. Tourists watching a herd of wild elephants from boat.

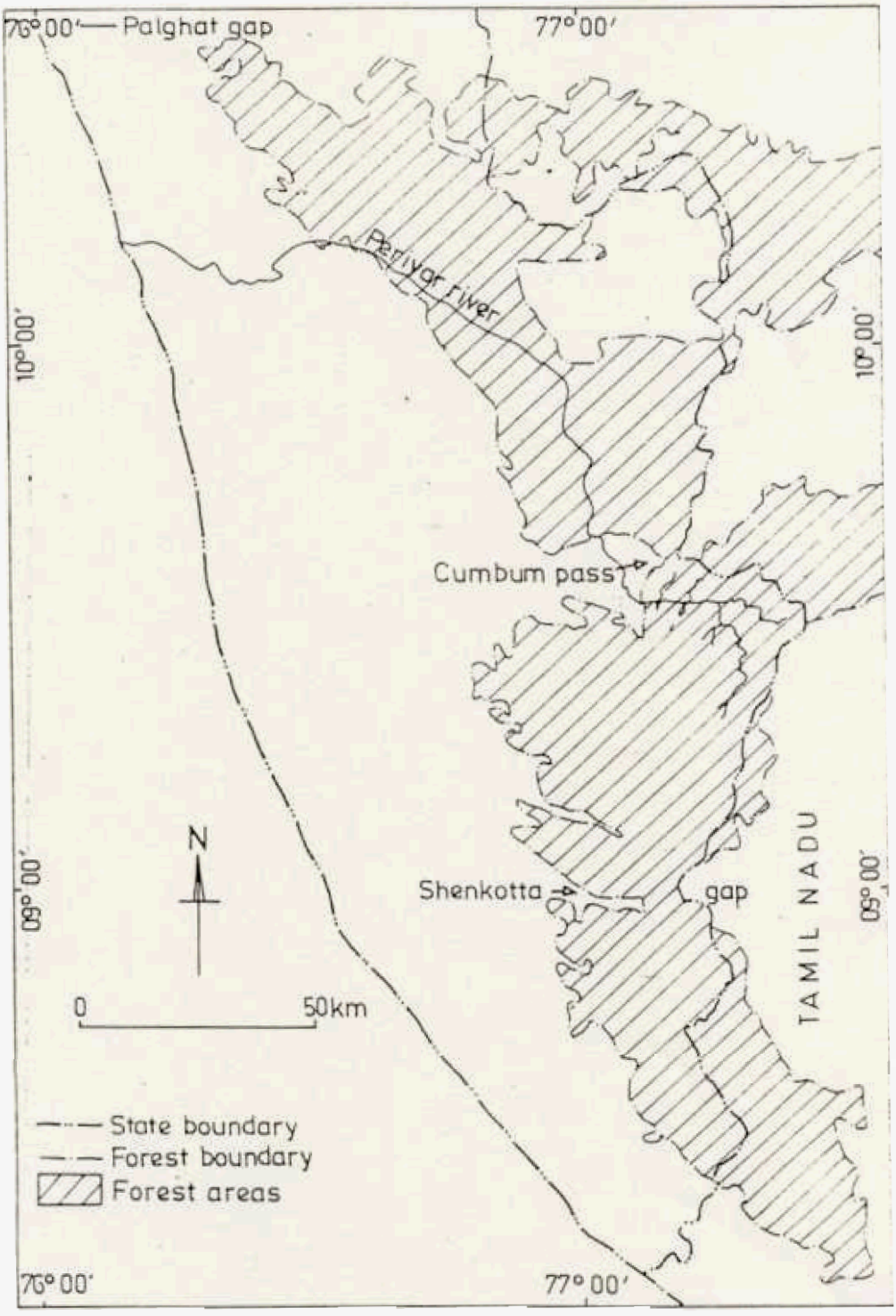



Fig. 1 Forests and important corridors of southern western ghats

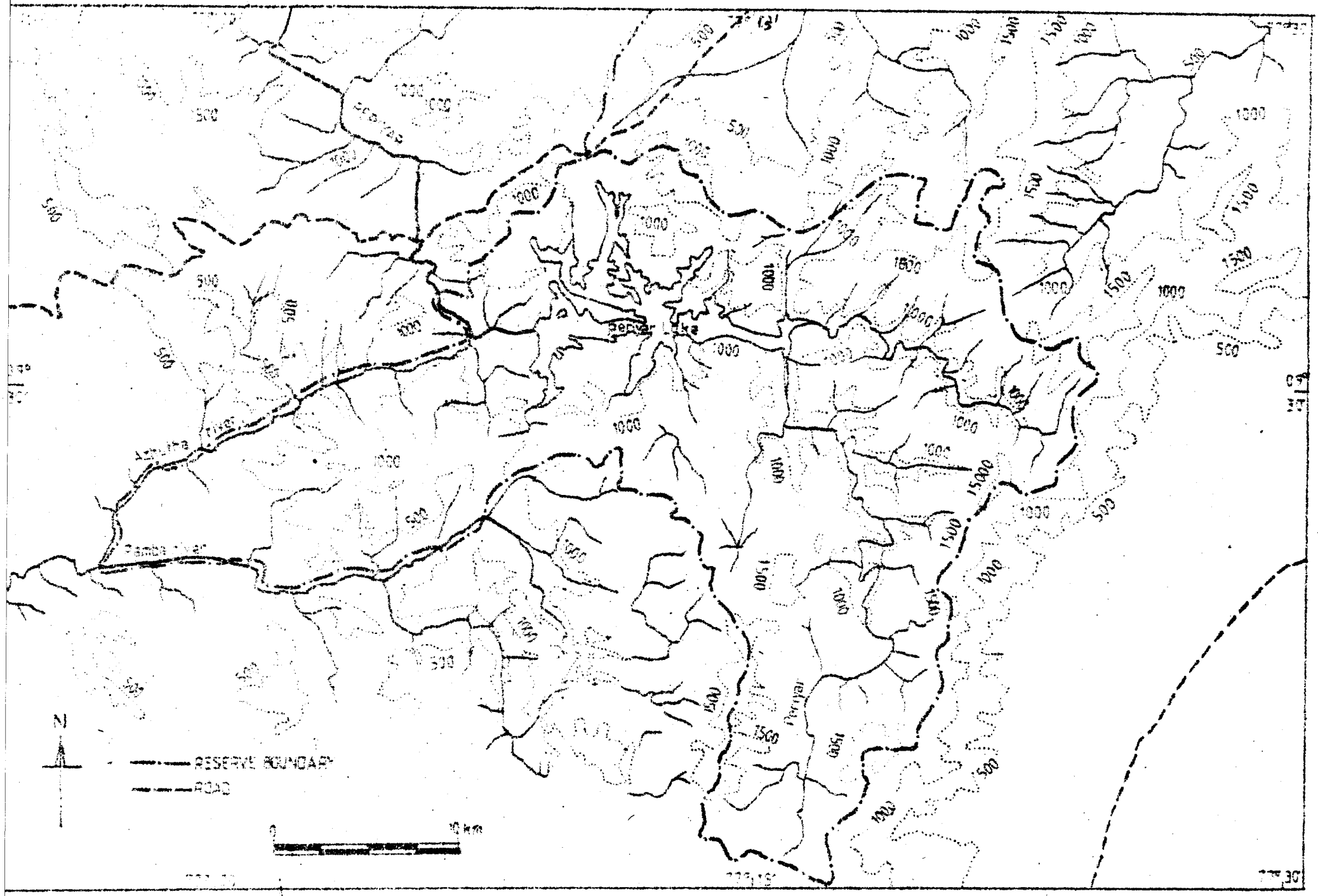



Fig 2 Topography and drainage pattern of the Panyar plateau

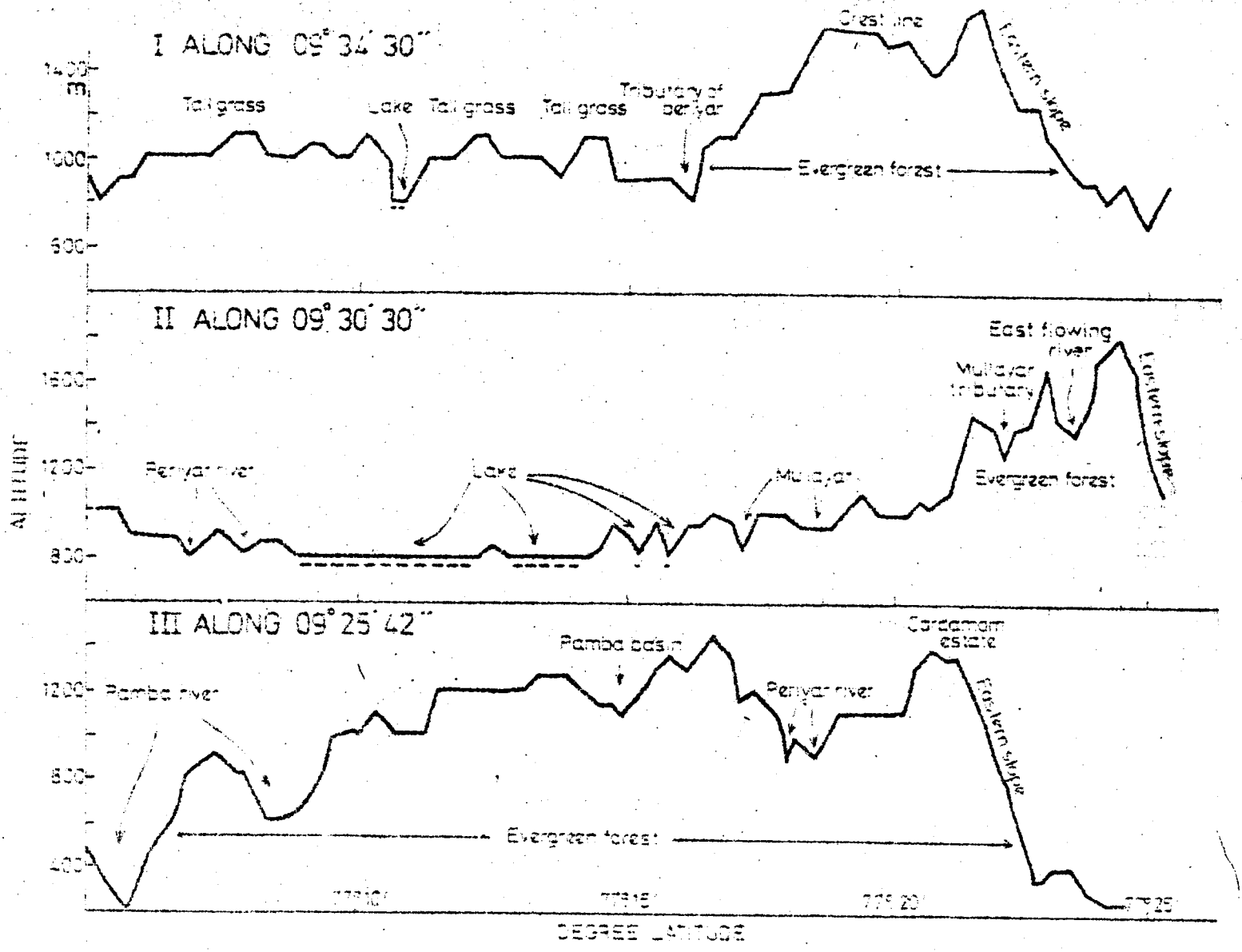



Fig. 3 Altitude profiles along three regions of the study area

though it is called a plateau it is actually a chain of hills separated by valleys, some times as much as 300 m deep.

On the eastern and northern sides of the plateau along the crestline at about 2000 m elevation runs the State boundary. The elevation drops to about 200 m on the other side of the crestline, Sriviliputhur and Sankaranayinar koi1 are towns located in the eastern plains, The Cumbum valley amidst the hills is a tongue cut by Suruliar, name given to the upper reaches of Vaigai River. The western regions are also high elevation areas and slopes down gradually to the coastal plains. Forested regions of Ranni and Kakki form the southern bound-ary of the plateau. The Periyar Plateau is mainly drained by the Periyar and Mullayar which join together near Mullakkudy. The Cumbum valley is drained by Vaigai river, the eastern slopes by Vaippar and the regions south of the Pamba Periyar Divide by river Pamba (Fig.2). The topography of the study area is described with the help of the altitude profiles shown in Fig.3. The elevation around the lake is about 800 to 1,200 m, the higher regions are grass covered hills. On the southern side of the lake is the Pamba Periyar Divide, a chain of hills about 1,200 m in elevation, the northern side draining to Periyar basin and the southern side draining to the Pamba basin. The remaining portion of the

study area, the north eastern and south western regions are formed by hills of about 1,500 m elevation and valleys of rivulets originating here. Tributaries of Periyar drain the western slopes of the crestline (Fig.3). Mullayar and Periyar flow through deep valleys amidst the hills (Fig.3) of the Periyar plateau.

This large continuous forest tract is extremely diverse from point of view of topography, vegetation diversity and accessibility. The division of the study area into tourism zone, buffer zone and core area first suggested by the Thekkady Development Authority, subsequently adopted in the Project Tiger management plan and also in our previous report (Nair, 1976; Nair, 1978; Vijayan et al., 1979) has been found to be inadequate as described in section four. The reserve is divided into eight regions based on accessibility, topographical features, natural boundaries, vegetation structure, animal density, nature of habitat improvement required and degree, of anthropic pressures,

## DIVISION OF THE STUDY AREA

### Sabarimala plateau

This area lies between rivers Pamba and Azhutha (Fig.4). The enclosed ridge is about 1000–1200 m in elevation and

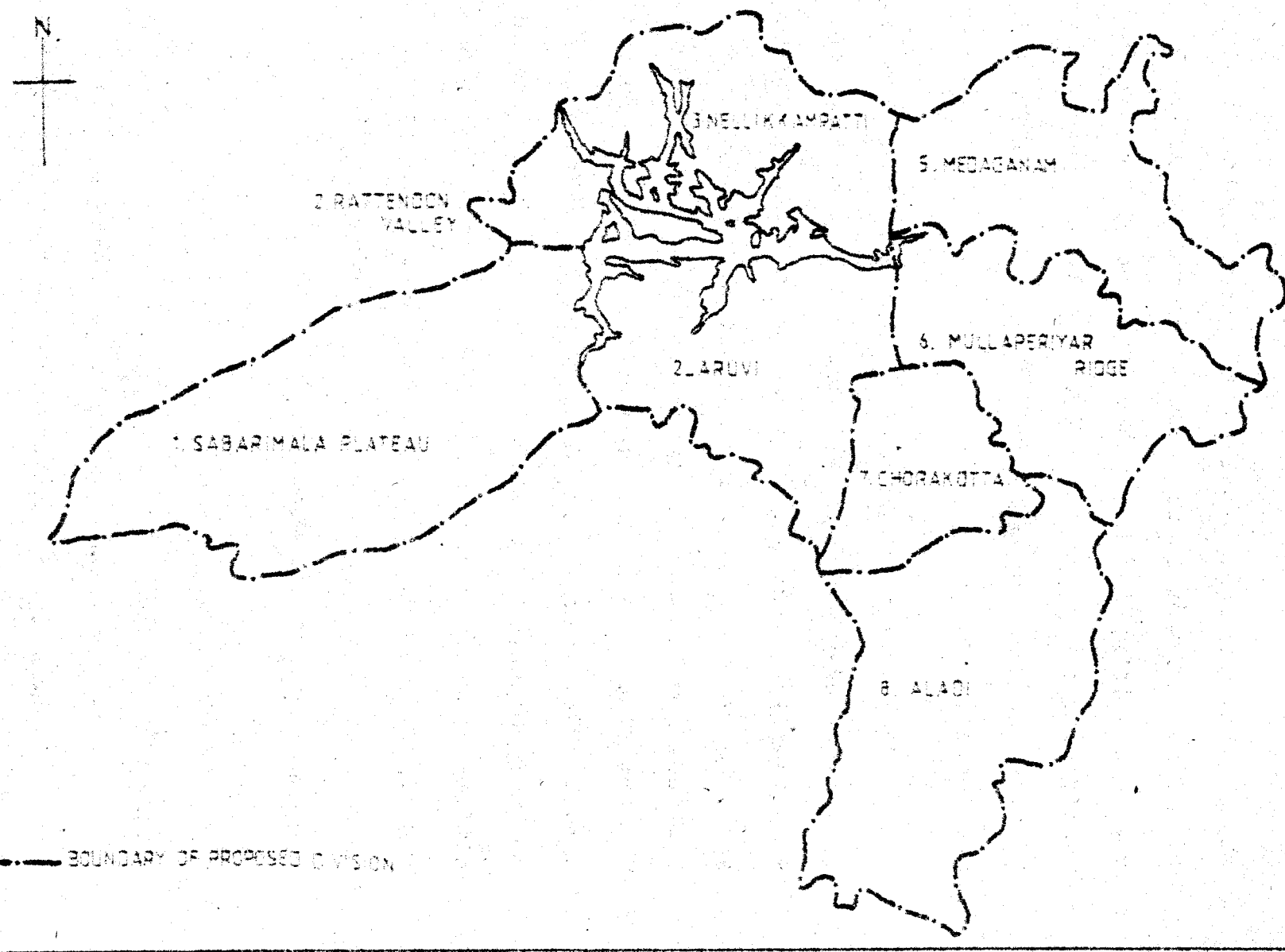



Fig4 The eight divisions of the study area

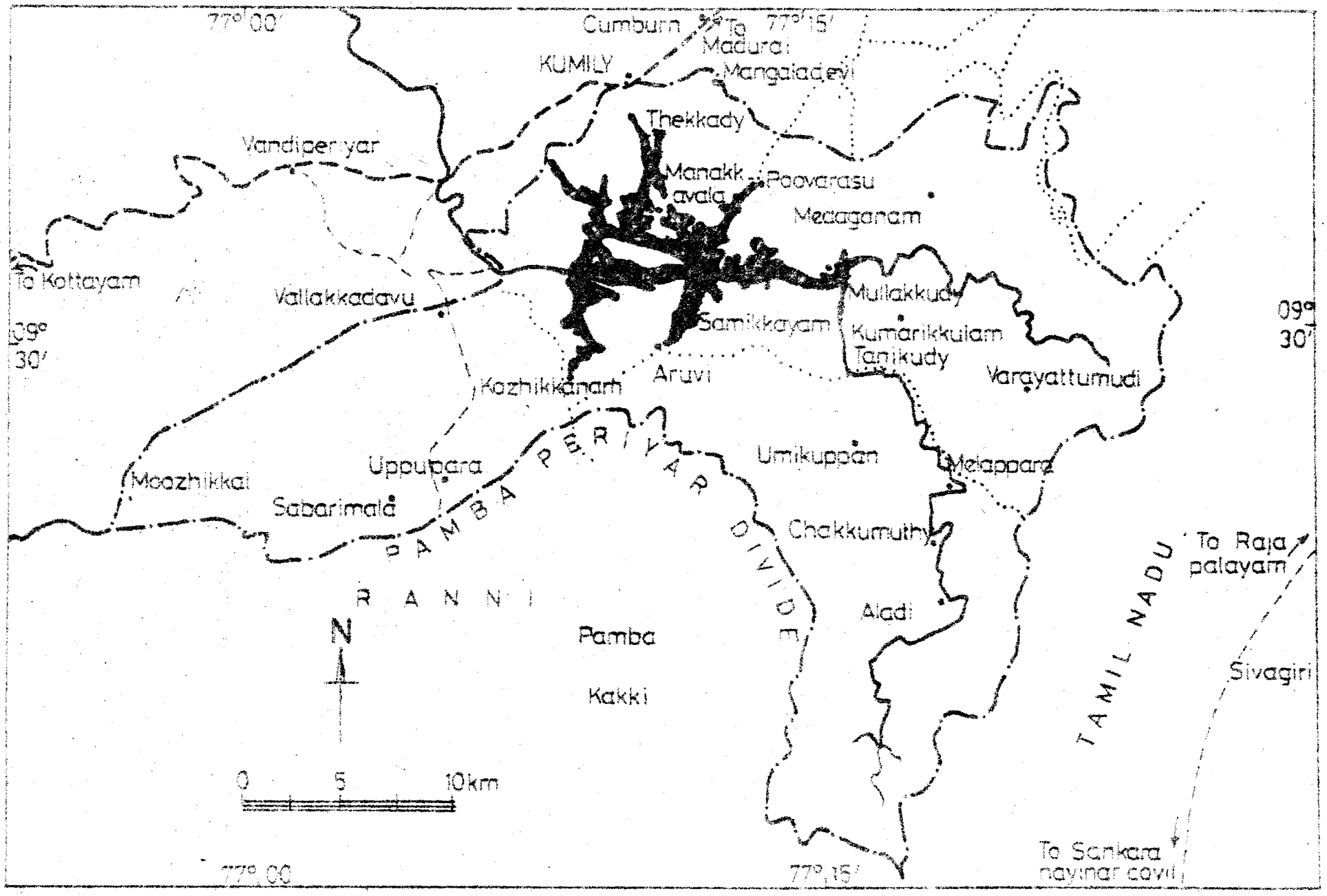



Fig 5 Important places and paths in the study area

consist of grassland most of which has been planted up with Eucalyptus. Either slopes of the ridge have semi-evergreen and moist deciduous forest. The Sabarimala temple is inside this area. Habitations in this region are Vallakkadavu forest colony, Sabarimala premises, Vanchivayal, Pamba valley and. Moozhikkal settlement (Fig.5). One of the pilgrims routes to Sabarimala temple also pass through this region.

Ratendon valley

Ratendon valley is between the Periyar lake and Vandiperiyar-Kumily road. The elevation of this area ranges from 900 to 1,000 m. It consists of semi-evcrgreen forest, Eucalyptus plantations and grasslands (Fig.6).

Nellikkampatti area

This area has grassland, Eucalyptus plantations, moist deciduous forests and semi-evergreen vegetation. Elevation ranges from 1,000 to 1,200 m. There is a jecpable road from Kumily to Manyaladevi temple. This area is disturbed. by illegal fuelwood collection, grass collection and timber cutting. There is a patn to Mullakudy via Poovarasu which was jeepable in earlier days. A path from the State boundary to Mullakkudy is used by people for entry into the sanctuary to collect timber and minor forest produce,

Aruvi area

This area has evergreen and semi-evergreen vegetation, reeds, Eucalyptus plantations and Grasslands (Plate 23). The elevation ranges from 1,000 to 1,300 m. The southern edge of this part is the Pamba-Periyar divide. The streams flow to the lake, This is a fairly undisturbed chunk of forest with occasional disturbance of reed and .cane cutting.

Methaganam area

This region is on the eastern edge of the Periyar Plateau and consists of moist deciduous forest, grasslands and semi-evergreen forest. Elevation ranges from 1,000 to 2,000 m. A jeepable road from Melmanalar estate to Vellimalai and Aruna estates passes through the north-eastern border of this area. This area is highly disturbed,

Mullaperiyar ridge

This region between Mullayar and the path to Sivagiri contain grasslands, semi-evergreen and evergreen forests at an elevation of about 1,200 to 1,500 m, There is minor forest produce collection by people. The river is at about 1,100 m elevation here. The Lakshmipara cardamom estate is inside this area.

Chorakotta area

This region has grasslands, semi-evergreen and

evergreen forests at an altitude of 1,000 to 1,600 m. Ummikkuppam and Melappara estates are inside this area. Disturbance limited to minor forest produce collection and fishing.

Aladi area

The region lies south of Inchipara Todu and contain a wide stretch of evergreen fbrest. The Periyar divides the ridge of about 1,500 m into two parts. . The eastern part slopes steeply to Tamil Nadu and on the western side are the evergreen forests of Ranni Division. The forests on the upper reaches of Periyar are mostly inaccessible and is one of the least disturbed evergreen forests left in the western ghats.

CLIMATE

The temperature ranges from 15 to 31$^{o}$C. March and April are warmer months. Annual average rainfall is about 2,000, mm With the peak in July (Fig.7).

HISTORY OF THE FORESTS

The general trend in colonising forests in western ghats by people seem to be - occupation of accessible level wet areas first and moving on to surrounding areas as the population increase. The first attempt to document the history of Kerala forests seem to be made at the beginning of

nineteenth century by Ward and. Connor **(1827).** From evidence of abandoned buildings inside forest they conclude that many forest areas were under cultivation and were subsequently abandoned. due to disturbance from wild animals and withdrawal of gun licences to people.

A significant event in the history of forests of the high ranges was the introduction of tea cultivation. This was only a few sq. kms. towards the end. of the last century but steadily increased in extend, eventually occupying almost the whole of high ranges by the middle of the present century.

The Periyar Plateau was getting well connected with the outside wcrld by the turn of the century (Bourdillon, 1863). At that time Kumily was a small station. There were Cardamom collection centres as far away as Melappara. Bourdillon does not provide any first-hand information about the upper reaches of Periyar River. Ile gives a description of the grasslands, large scale grazing by cattle coming from the eastern side and forest fires made by the graziers. Decision had already been made by 1893 to construct a dam across Periyar to provide irrigation to the Cumbum valley, He also described the present submerged area of the lake as having marshy vegetation, sandy river bed and. patches of forest in between hillocks.

The dam was completed by 1895. Most of the trees were not removed, as it was not economical- to extract them resulting in the present landscape of the lake filled with dry stumps (Plate 1). Since the construction was at a slow pace the magnitude of disturbance would have been of a smaller scale. Mannan, Uraly, Paliyan and Arayan tribes were living inside the 'forest even before construction 'of the dam. They were staying near Poovarasu, Thanikkudi, Navikayam, Melappara, Ummikuppan, Vanchivayal, Pamba valley and Moozhikkal. These people indulged in small scale cultivation but they mainly subsisted on fish, honey, tubers etc. from the forest. Some of these tribes perfected techniques of fishing in hill streams to a high degree. Each group's operations were limited to a particular area. These people have also been employed by the forest department for collecting minor forest produce. The tribals were moved out of the reserve after declaring the area as a wildlife sanctuary.

In 1899 the forest around the lake was declared as a reserve forest. The Maharaja of the erstwhile Travancore State appointed Mr. C.H. Robinson in 1933 as the first game warden to constitute and maintain the sanctuary. In 1934 a sanctuary was constituted known as Nellikkampatti game sanctuary. In 1936 zoo bred spotted deers were introduced in one

of the islands in the lake, The animals did not survive. In 1950 more areas were added to the sanctuary to constitute the present Periyar Tiger Reserve of 777 sq. kms. In 1978 the area was declared- as one of the areas for protecting the endangeredi tiger under the Project Tiger.

There are about 20 tea and cardamom estates on the crestline and along the north–eastern boundary of the sanctuary. There are four cardamom estates inside the core area of the sanctuary - Lakshmipara, Melappara, Naduthottam and Ummikuppan, The last one is maintained by the tribals.

There are rest houses at Thekkady, Tanikudy, Mullakudy, Manakkavala and Sabarimala. Creation of Thekkady Development Authority, Kerala State Tourism Development Corporation's involvement in tourism, blasting of dry stumps in the boat route, tiger census by staff and students of Union Christian College, Alwaye (Varghes, 1981), strengthening of the dam and increase in disturbance from eastern and. northern sides are some of the recent developments.

**FOREST TYPES**

Chandrasekharan (1973) classifies the forests of the reserve into evergreen, deciduous, and grassland types (Fig.6). The evergreen forest occupy an area of 305 sq. kms.,

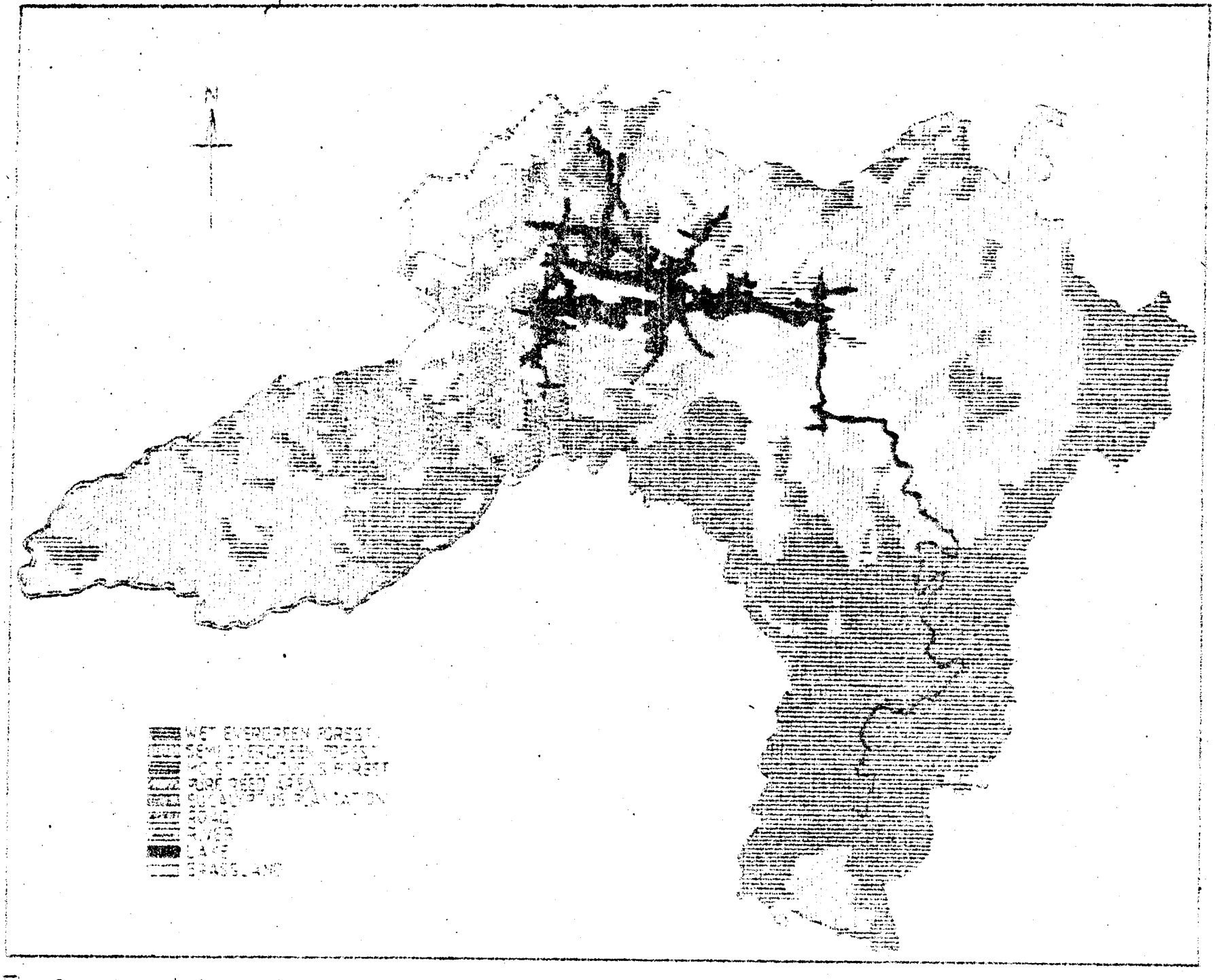



Fig.6 Vegetation types in the study area ( based on Chandrasekharan, 1973)

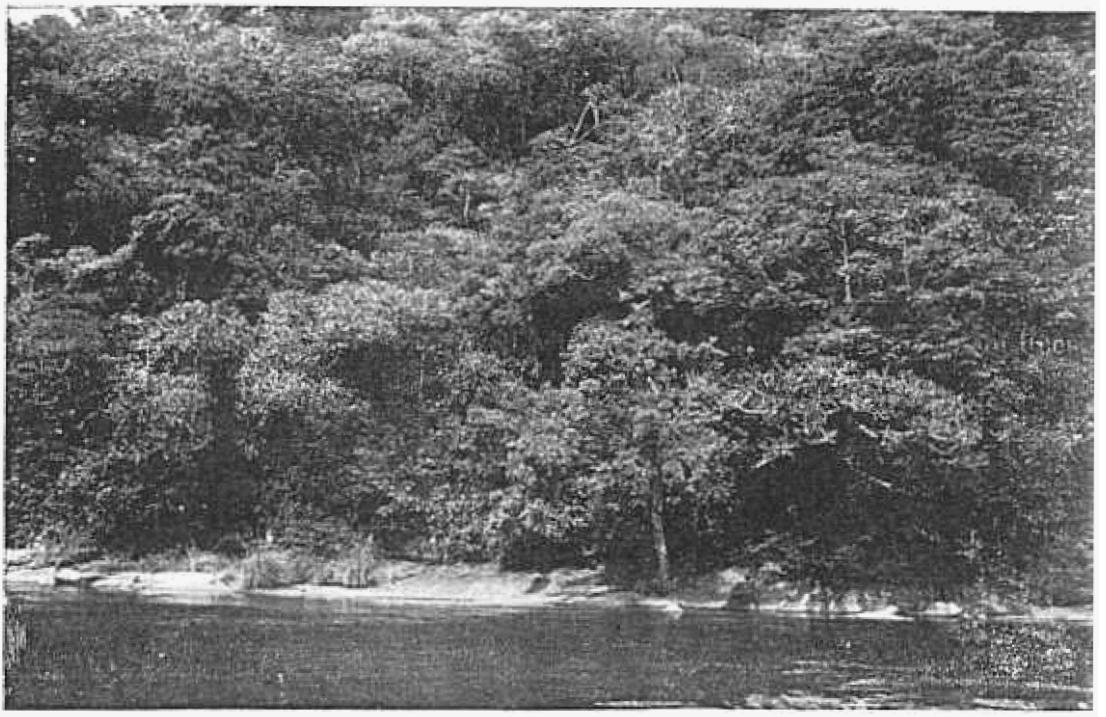


Plate 3. A typical stand of evergreen forest, upstream Periyar river

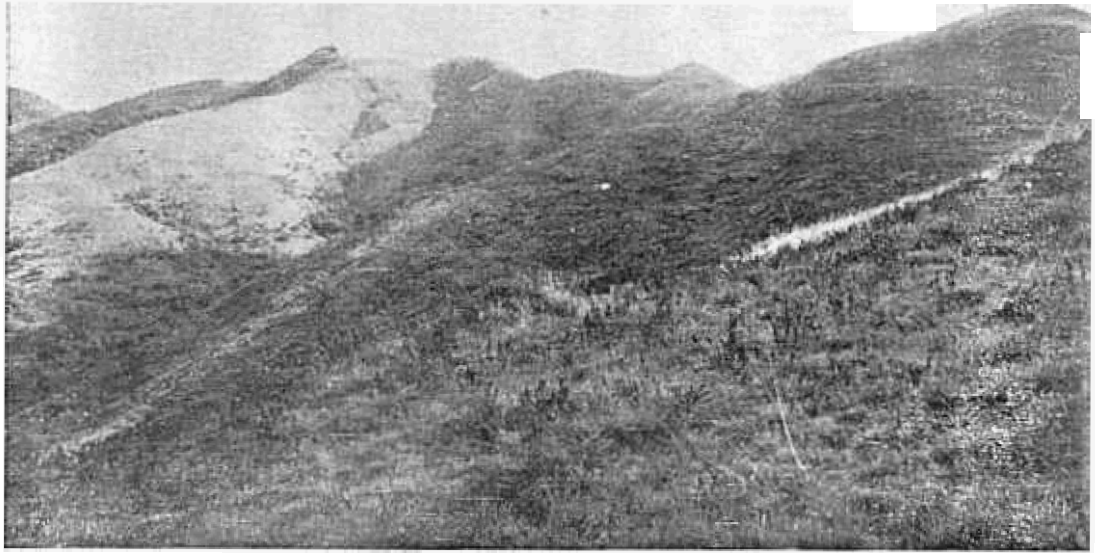


Plate 4 View of grassland interspersed with *Phoenix humilis* and fire resistant trees

semi-evergreen 275 sq. kms., of moist deciduous 98 sq. kms. and grassland 12 sq. kms. The spatial distribution of different types of forest have already been described.

In evergreen forest the trees are high, canopy is almost closed and is made predominently of soft-wood species. Common species found are Mesua nagassarium, Elaeocarpus tuberculatus Canarium strictum, Evodia lunu-ankenda, Nephelium lonqana, Cullenia exarillat, etc. , Reeds are found in wet areas. Undergrowth consist of Strobilanthus sp., Psychotria sp. , Laportea crenulata, Curcuma sp., Clerodendron sp. etc. Various climbers (canes, Acacia sp,, pepper) are also present. Plate 3 show typical stands of evergreen forest in the reserve.

Deciduous forest is present only in few areas. Main trees are Tectona grandis, Dalbergia latifolia, Lagerstroemia lanceolata, Pterocarpus marsupium, Terminalia bellerica, T aniculata, T. chebula, Bridelia retusa, Emblica officinalis Randia dumetorum Grewia tiliaefolia Bombax sp., Anogeissus latifolia etc. Undergrowth consist of Lantana camara, Eupatorium odoratum, Zizyphus sp. etc. Barnbusa arundinacea has flowered during 1970-77 and is gradually getting established in moist areas.

Plate 5. View of a sample plot in the Vazhukkappara region.

Plate 6. View of a sub plot after the fire in the Vazhukkappara plot

There are three types of grasslands. Hill tops like Kumarikulam, Chaverkuzhy, Kathiramudi have short grass of Heteropogon contortus and other species. The elephant grass, Cympopogon sp. growing totwo meteres occupy vast regions in the reserve. Amidst these are fire resistant ;trees like Anogeissus latlfolia, Bridelia retusa, Emblica officinalis, Careya arborea, Kydia calycina, Grewia tiliaefolia etc. These were probably wooded regions earlier and has been reduced to grassland due to frequent fire (Plate 4). Marshes and lake shore has succulent grasses like Panicum sp.

# MATERIALS AND METHODS

## RECONNAISSANCE

The investigators camped in various places inside the reserve and the area around each camp was surveyed intensively during November 1977 to December 1978. Each investigator accompanied by a local helper went in different directions and an average distance of 15 km. was covered on foot by each party every day. As the observer walked: through the forest the following details were recorded.

i) species of animal sighted both on ground and above
ii) time of observation
iii) activity of the animal at the time of sighting
iv) size of troop, herd or pack, whenever possible
v) droppings
vi) spoors (pugmarks were measured and traced wherever possible), and
vii) habitat where observation was made.

Frequency of direct and indirect evidences were taken as indication of abundance of the species concerned. Habitat preference of each species is indicated by the frequency of direct and indirect evidences in different nabitat types.

ANIMAL DENSITY STUDIES

Estimation of animal number was carried out from direct and indirect evidences, Population parameters of the groups of animals sighted were recorded. Thirty sample plots of 100 x 100 m each were systematically laid out as shown in Figure 8.

Each sample plot was 100 x 100 m and the boundaries were marked with stakes. Inside this plot 30 equidistant sub-plots were marked with numbered stakes. Plates 5 and 6 show a plot and a sub-plot. The entire area of one hectare was to be sampled for elephant dung and gaur dung. For other animal.; an area witnin three meter radius of the sub-plots were sampled. A description of the 30 sample plots is given in Appendix I.

The plots were cleared of all pellets/dung and visited after 30 days for recording the pellets/dung accumulated during the period. Readings were taken in March-April (dry season) and October-November (Net season).

Records of sightings and herd composition of elephants, gaur, wild boar, sambar deer,barking deer, were maintained. Photographs of lone elephants were taken to confirm identity, The aging criteria used of elephants were as given by Eisenberg and Lockhart (1972).

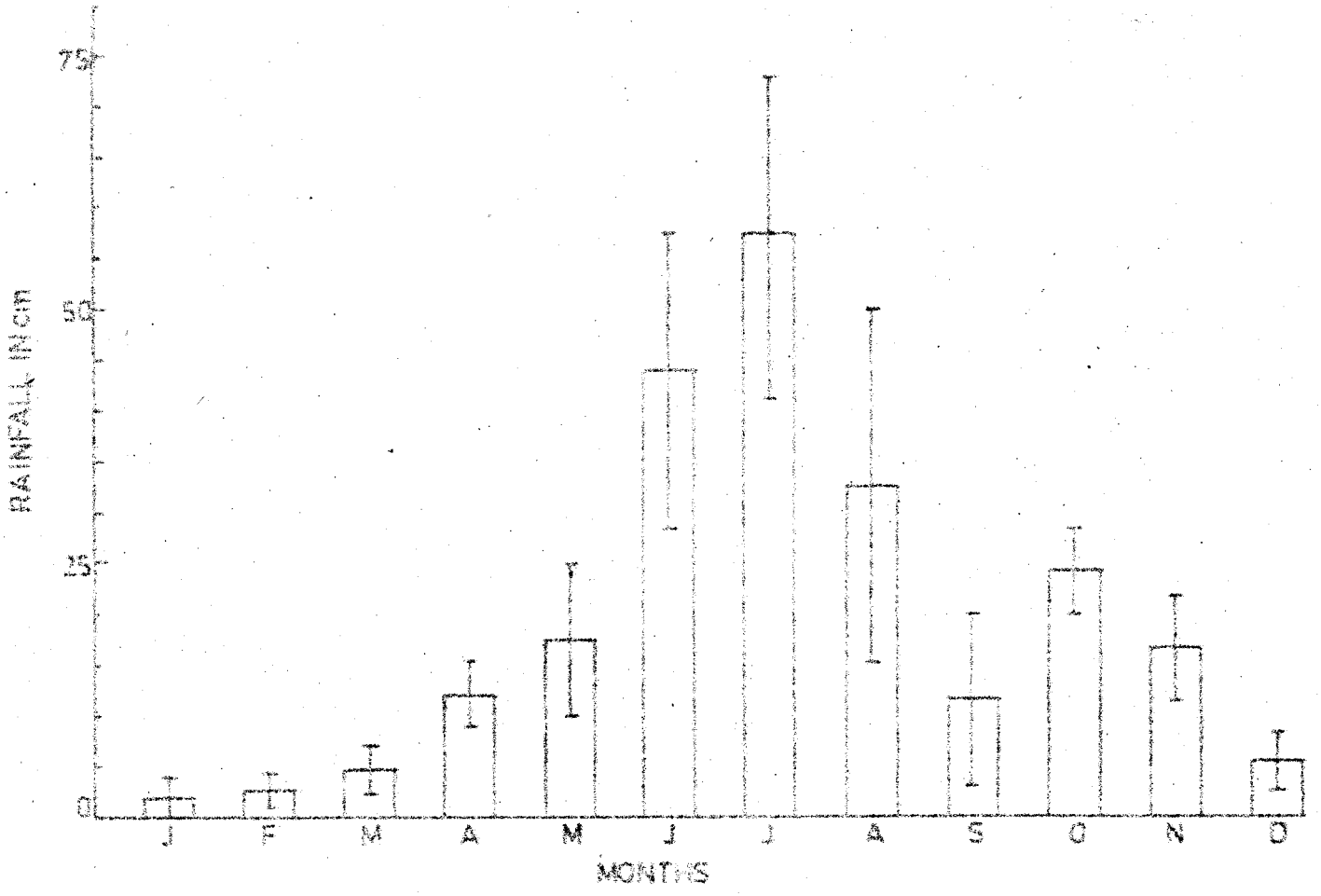



Fig.7 Mean monthly rainfall at Thekkady.(Based on data from 194 to 198 )

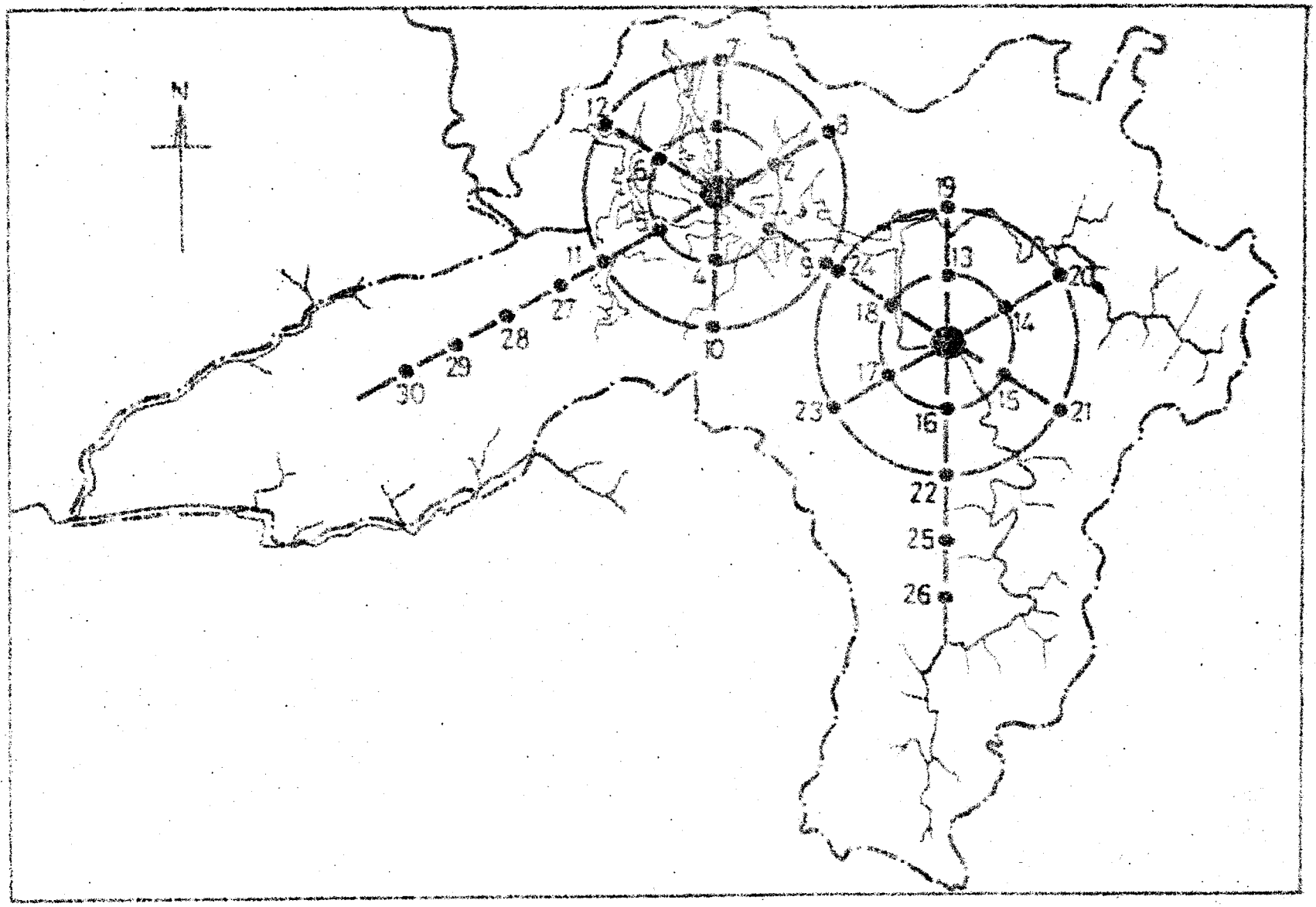



Fig. 6 Layout of the sample plots in the study area

Decomposition of pellets and dung

This data was required because the plots were visited only once in a month and allowance had to be given for decomposition during this period. Pellet/dung were marked in different types of vegetation and decomposition after one, two, five, ten and thirty days were noted. This was done once during dry season and rainy season.

The results of decomposition studies described below justified an interval of 30 days for recording the dung accumulated in the dry season.

Decomposition of sambar pellets, hare pellets and elephant dung were examined. The rate of decomposition was different during wet and dry seasons. During the rainy season the initial few days were very important. Jungle fowl,earth worms, dung beetles etc. sometimes completely destroyed the pellets. Such activity was more in marshy areas and in the shade of trees,

In the wet season during the initial few days the sambar pellets are very susceptible to disintegration. After this period the surviving pellets do not disintegrate appreciably for about a month. But in the dry season one-third of sambar deer pellets disappeared in shady areas and two-third in the open or marshy areas,

Plate 7. The captive sambar deer used for the studies

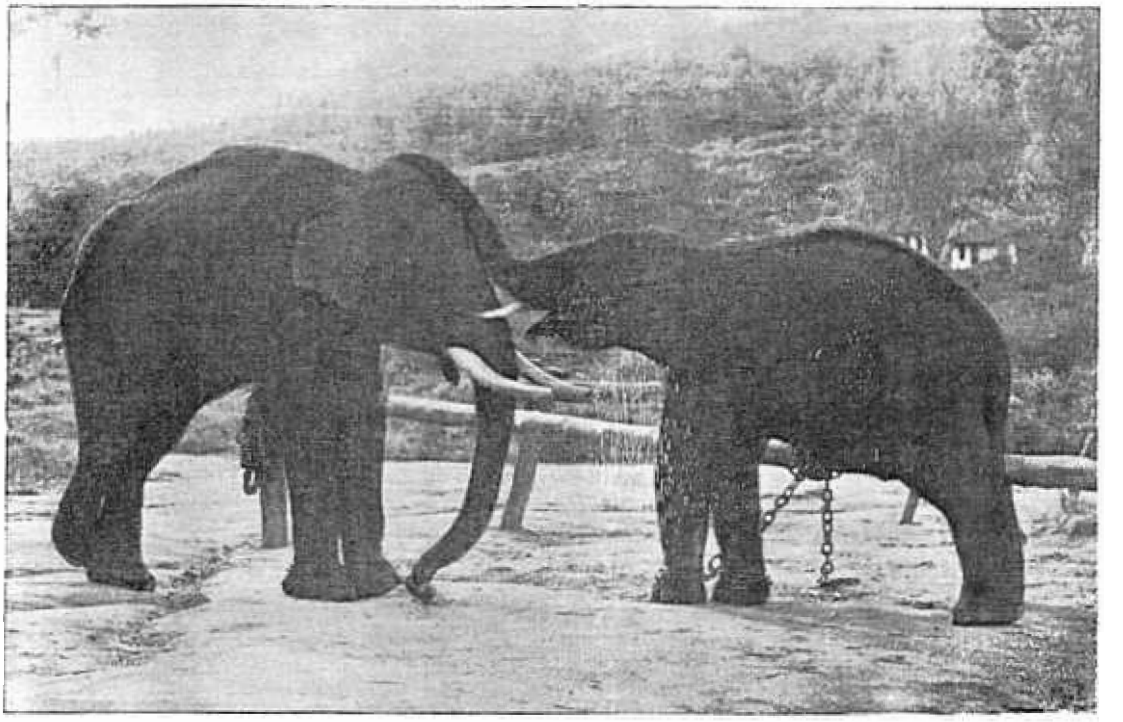


Plate 8. Two of the captive elephants from which basic data had been collected.

About half of the elephant dung marked in the field for observations decomposed completely within 10 days in the rainy season. But there is not much decay for elephant dung in the dry season, Nearly always the dung is identifiable even after a month.

In the rainy season there was fast decomposition of hare pellets, A majority of the pellets broke down before one month, In dry season hare pellets did not decompose within one month.

Feeding trials and age determination

The feeding trials were conducted on captive sambar deer (Plate 7). Age and dung size measurements were carried out on captive elephants in elephant camps (Plate 8) at Karalai and Varagaliar.

## RESULTS

The tropical warm climate, high elevation (about 1,000 m ). heavy rainfall (about 2,000 mm ) , undulating terrain, extensive grasslands, marshes, rivers and thick-forest are highly favourable for wild animals. In general the evergreen areas with high tree density contained less terrestrial animals. Animals like elephant, gaur and sambar were few in evergreen areas like Aladiand Sabarimala region. Elephant, sambar, barking deer and gaur are distributed almost throughout the habitat. Hare seems to be limited to the grassland area. Wild boar seem to have an unequal distribu-tion, it being more abundant near marshy areas and. lake shore.

The status, distribution, population details and food requirements of various animals found in the reserve are given in this section. Availability of fodder is also examined in the light of the requirements.

### AVIFAUNA

As would be expected in a tropical climate with diverse kinds of vegetation occurring side by side, a rich avifauna is present in the reserve. A total of 181 species of birds have been recorded from this reserve (Appendix **11).** When compared to the whole of Kerala about 46 percent of the bird species

found in the State are present at Periyar, Excepting a family of ocean birds (Procellariformes) and a family of ducks and swans (Anseriformes) all bird families found in the State are recorded from Thekkady. But the proportion of species in most families is less than that the whole state except the passerines (Appendix **II).**

Of the 181 species of birds identified, 154 (84%) are resident, **3** (2%) local migrants, 16 (9%) winter migrants and **9** (5%) are of uncertain nature,

The most commonly present birds are the pond heron, green pigeon, Jerdons imperial pigeon, Nilgiri wood pigeon, rose ringed parakeet, blossom headed parakeet, bluewinged parakeet, Malabar grey hornbill, small green barbet, crimson throated barbet, golden backed wood pecker, grey drongo, common myna, jungle myna, the southern grackle, tree pie, orange minivet, malabar small minivet, gold fronted chloropsis, yellow browed bulbul, south Indian black bulbul and the Nilgiri quaker babbler,

Common winter migrants are greenish warblers, wag–tails and rose finch. The nearest breeding ground for all these species is Himalayas, some of them go beyond the Himalayas (Ali, 1969).

The great Indian Hornbill, found in the reserve is a protected species under the Indian Wildlife Act (Schedule IIA). A total of 87 pairs of.these birds have been recorded from the reserve. The white backed vulture is very rare in the reserve.

ELEPHANT

The Periyar Plateau has one of the major populations of elephants in Peninsular India. The Asiatic Elephant uses a large area. It may travel several kilometers in a day. It is a social animal, the herd size varying from a few individuals to about 80 individuals. Based on limited observations and extrapolation with the details in African Elephants it is presumed that large herds are composed of smaller units which break up into its constituent units during the lean season when food and water is scarce to rejoin again-in the next season. Regarding the movement pattern of individual herds many details are not known. It would be interesting to know whether there is any preferred locality for a particular herd or a particular range or movement pattern. The behaviour and movement patterns of the male elephants are also not known in detail. It is generally assumed that males are driven away from the group on reaching sexual maturity by the female elephants. The male elephants do not seem to permanently

associate with any herd after mating. From the behaviour of a phalanx of cow elephants leading a charge with the young ones in between adults a matriardial leadership pattern is suspected.

At Pcriyar elephants are found to use the lakeshore, the grassland, the deciduous forest and to a lesser degree the evergreen forest, It is not clear whether there are any high steep mountains obstructing elephant movement inside the evergreen part. The remaining portions form a continuous range. In other words it is not known whether elephants could move from lake areas to the evergreen forests and then to the eastern region's, The connections of elephants found deep inside the evergreen forest with the rest of the area also remain obscure, Vancuylenberg **(1977)** gives the average defecation rate as 15 times a day for the Asiatic elephant. The total quantity of 'dung produced in the reserve is estimated from the sample plots. This divided by the monthly average dung production of one elephant gives an estimate of the population.

Estimation of population

The population is estimated from the quantity of dung in the sample plots. Decomposition rate is very high during the rainy season and hence the data during the dry season is

employed for the estimation. During the month of April a total of 297 dung heaps were counted from the 22 sample plots. Out of the total area of 777 sq. kms., 26 sq. km. is lake, 10 sq. km. is residential area, 305 sq. km. is evergreen forests and 163 sq. km. constitute the Sabarimala plateau. During the dry season there seem t0 be only few elephants in the evergreen region. An area of 273 sq.km. seems to be available as elephant habitat during this season. The number of elephants in the reserve is calculated by

$$\frac{\text{Area in ha} \times \text{dung production per ha}}{\text{Monthly defecation rate of one elephant}} = \frac{273 \times 100 \times \frac{297}{22}}{450},$$

This comes to about 800 elephants for the reserve. Since the animals were concentrated mainly in areas of Ratendan valley, Nellikkampatti, Aruvi and Chorakotta area the ecological density is **about** three elephants per sq. km. in this season for the above areas.

Herd composition and sex ratio

During the period from October 1977 to February 1982, 134 herds of elephants were observed (includes only those herds which were fully visible) (Appendix IIIA). Out of this 134 herds, 15 (12%) were solitary individuals (total number of

Plate 9. A solitary elephant tusker — Curly ear near Padikkayam.

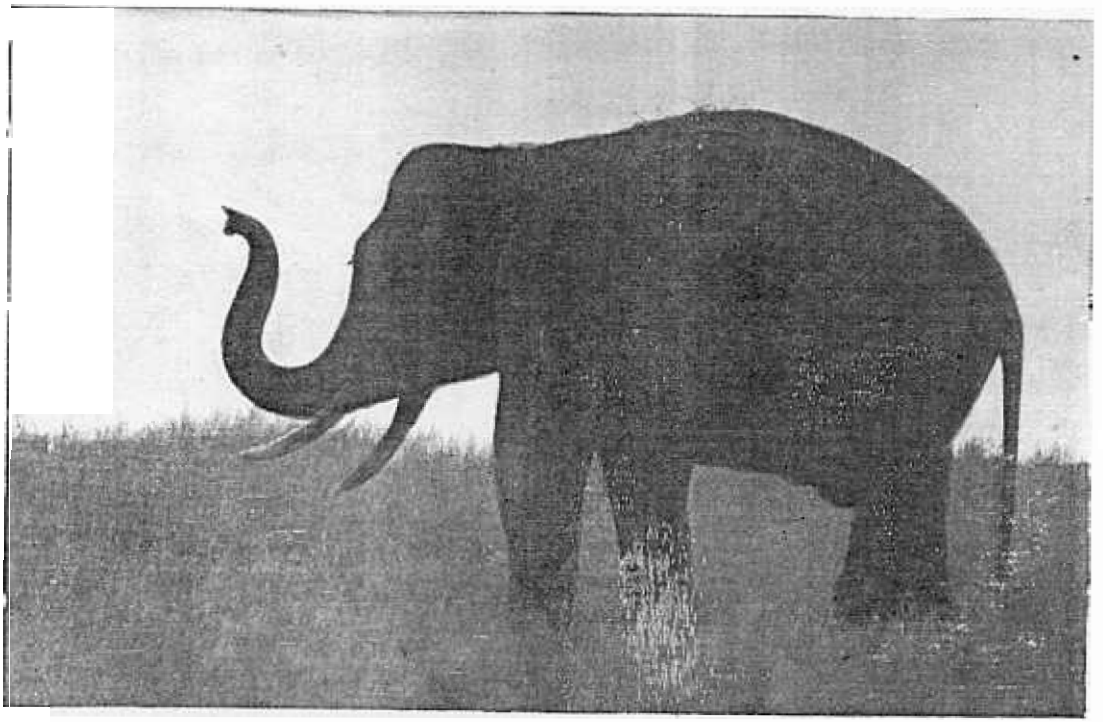


Plate 10. Another view of the same elephant near Lakeshore at Kavalappara

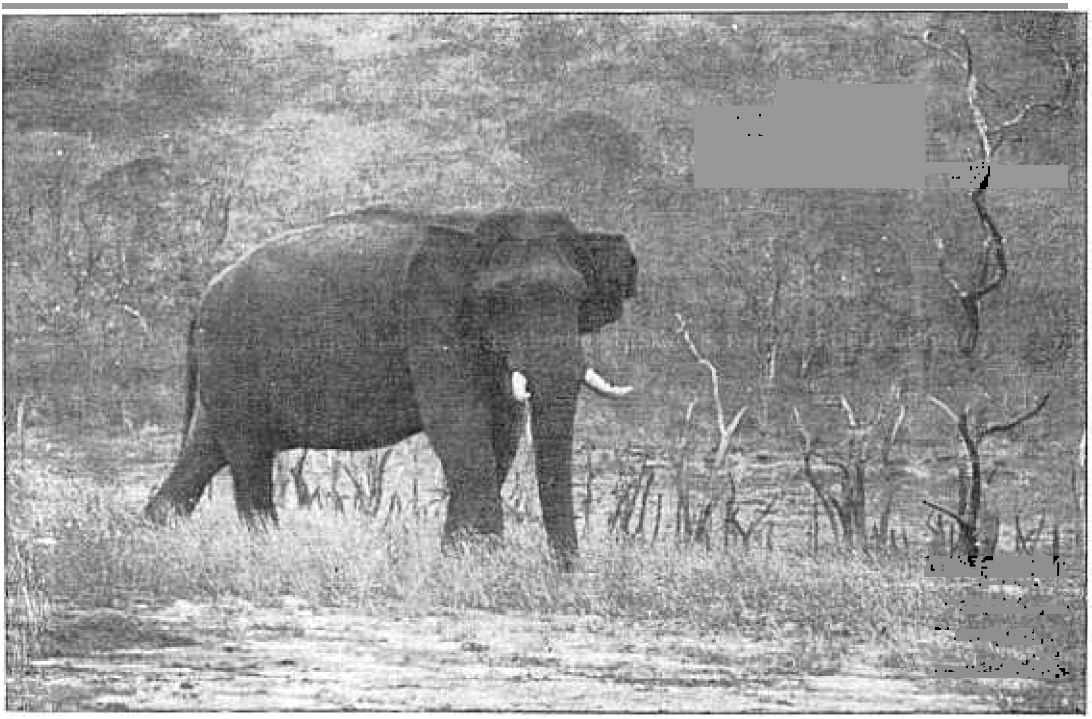


Plate 11. A big tusker with up-turned tusks, seen near Padikkayam area.

Plate 12. A solitary tusker with slender tusks seen near Edappalayam.

individuals in all groups together was 1,292). Corresponding proportion of adult male elephants in Eandipur and. Wilpattu National Park are much higher at 26% and 30% respectively (Fig.9). The proportion of solitary elephants in North Bunyoro (Laws et al., 1976) is not provided as it is based on aerial counts. At Periyar there seems to be two types of herds frequently seen consisting of 3 to 11 individuals in the first type and 17 to 60 individuals in the second. type (Plates 13, 14). The-herd composition follows more or less the same pattern as in the Bandipur population, In contrast to this the elephants of Wilpattu have a continuously decreasing pattern of frequencies. In African elephants both these types are found (Fig.9). The bimodal distribution is characteristic of undisturbed areas (Laws et al , 1976). Elephant populations of Bandipur and Periyar are of this kind. Elephant population of Wilpattu is example of habitat where ther is disturbance and food scarcity.

The herd composition of 49 herds, details of which could be accurately recorded show interesting patterns when compared with those of other populations. The animals are classified into calves (less than 14 months), juveniles (14 to 40 months), sub adults (40 months to 12 years in the case of females and 40 months to 15 years in the case of males) and

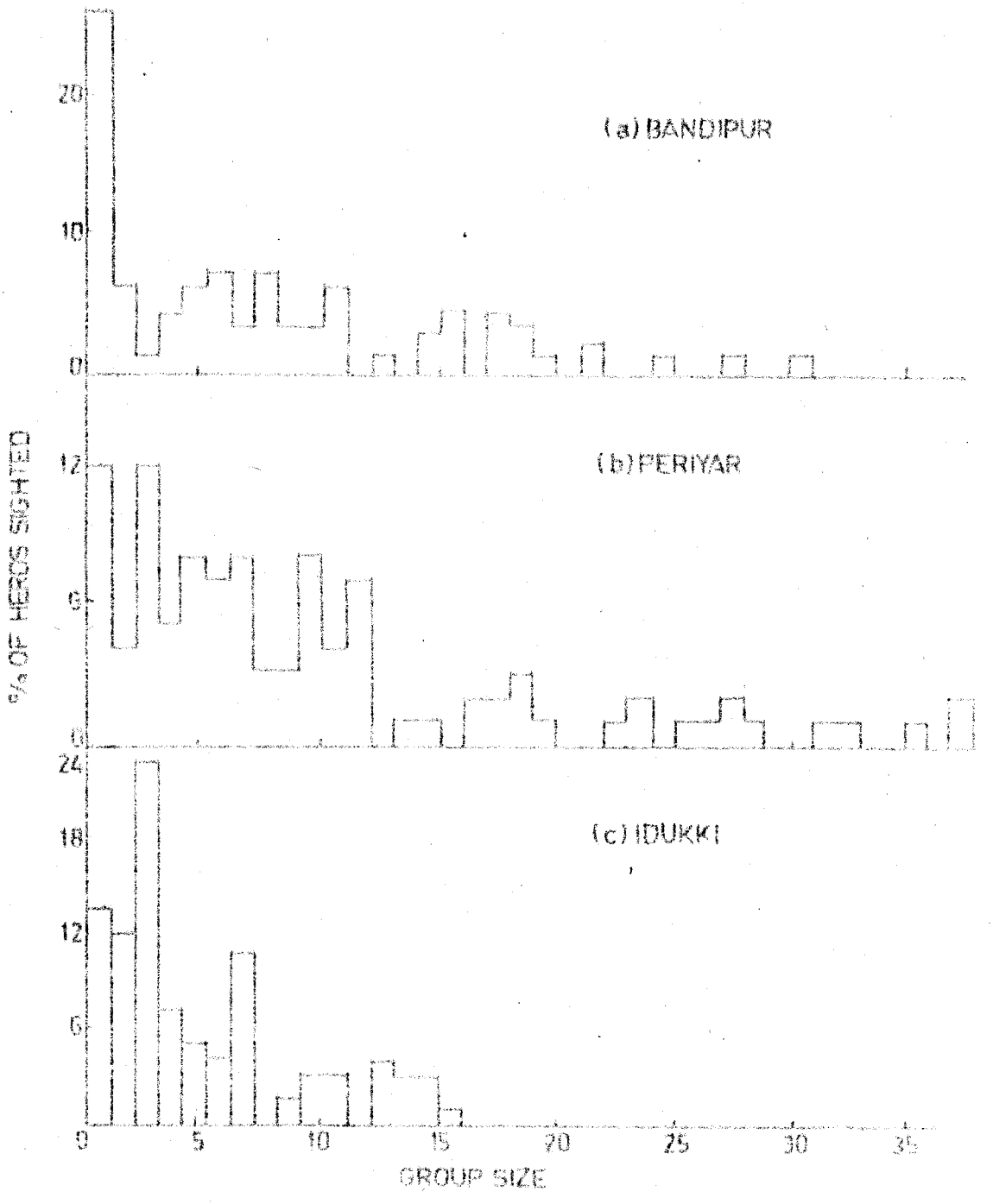



Fig. 9 Group size distribution of elephant herds sighted

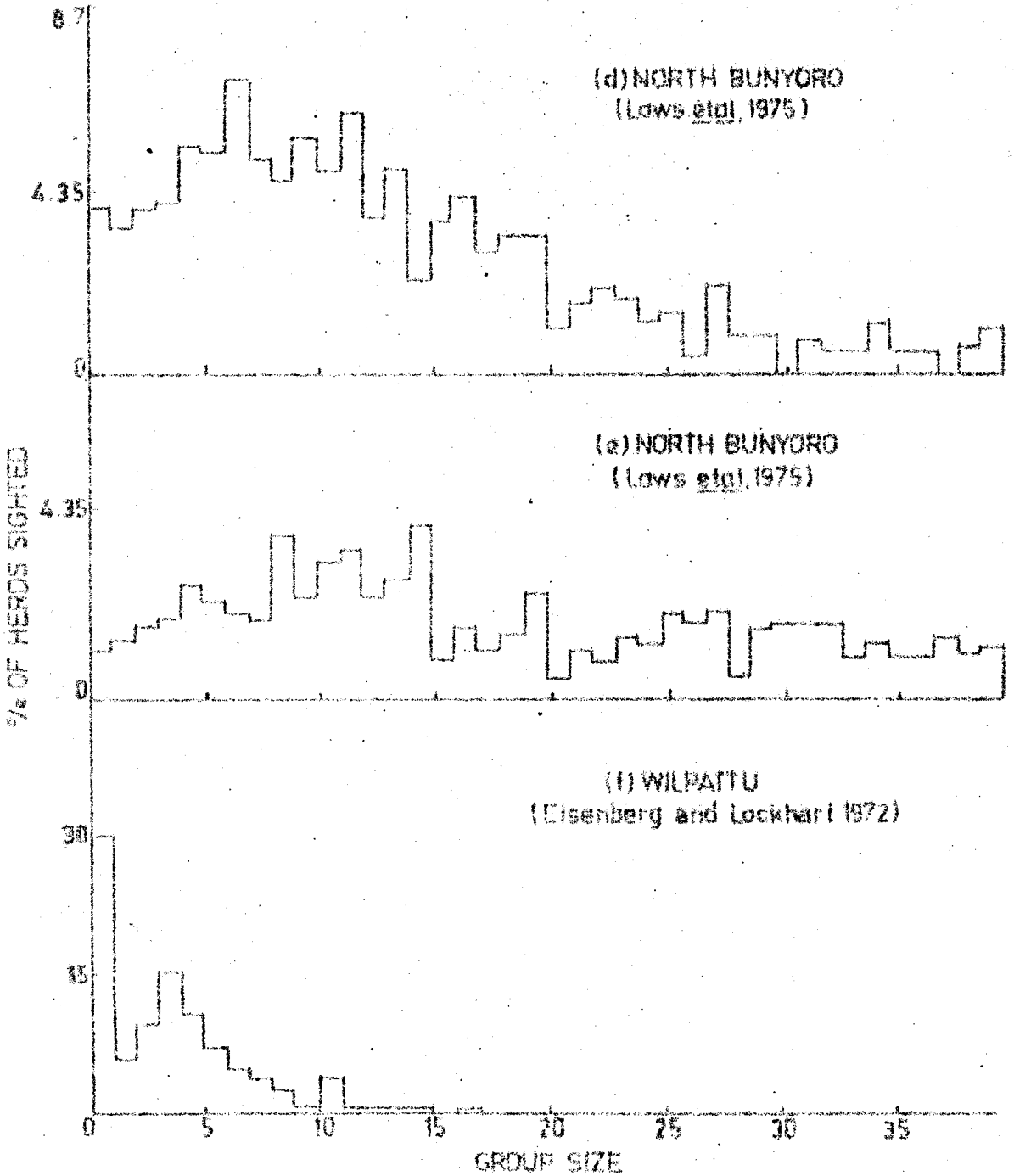



Fig. 9 Distribution of group sizes of elephant herds in different populations

Plate 13. A small group of elephants on the lake shore.

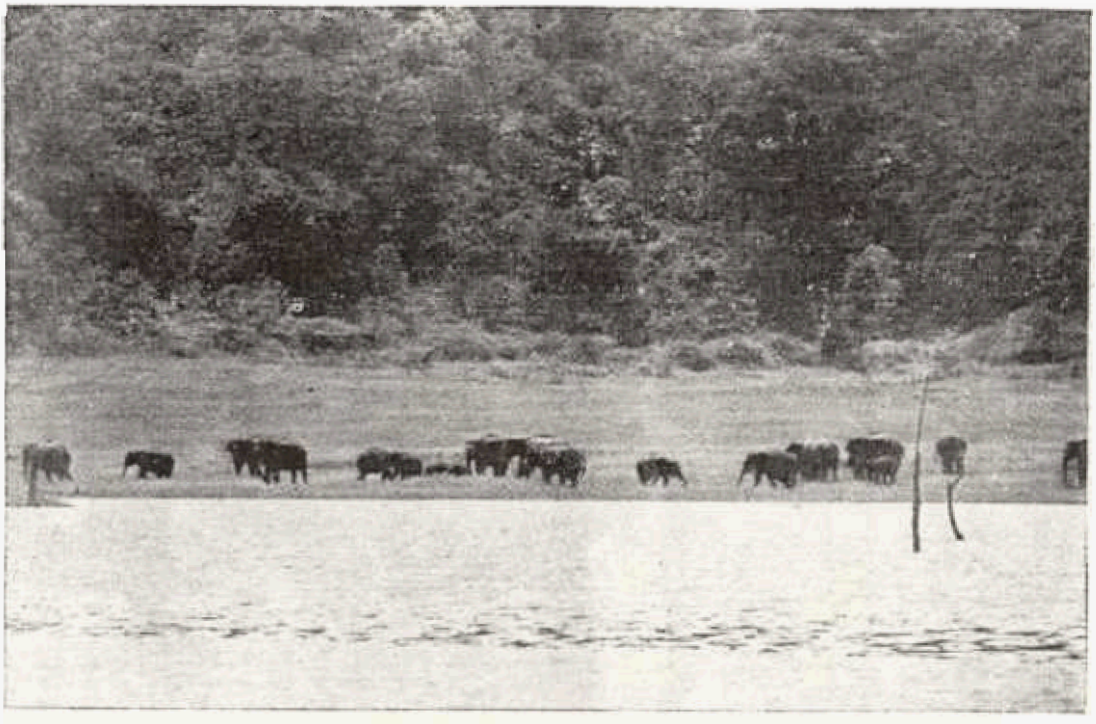


Plate 14. A large group of elephants on the lake shore near Mullakkudy.

adults (above 12 and 15 years in the case of females and males respectively). This age categorisation is similar to the one used by Eisenberg and Lockhart (1972) for studies in Wilpattu National Park. Table 1 and Fig.10 give details of herd composition. The propoition of calves in the population was 11.8%. The corresponding figure for Bandipur and Wilpattu populations were 8.4% and 7% respectively. Proportion of calves in the African elephants was considerably higher (18.2%). In the case of juveniles the Periyar and Bandipur elephants are comparable with 10.2% and 8.4% of individuals. The proportion of juveniles in the Wilpattu National Park and African elephants was considerably higher, about 20% and 23% respectively. Proportion of subadult males were similar for the three populations of Asian elephants compared to that of African elephants, This trend was applicable to the subadult females also. The proportion of adult females seem to be higher in Feriyar and Bandipur populations with 60% and. 55.5% respectively. Corresponding figures for the Wilpattu population and African elephants are 33% and 41.7% respectively. The proportion of adult male elephants seen along with herds were one percent at Periyar compared to 6.3%, 16% and 8.3% in Bandipur, Wilpattu and African populations. At Periyar the lower number of tuskers seen could be due to poaching of tuskers for ivory, But the fewer number of tuskers do not seem to

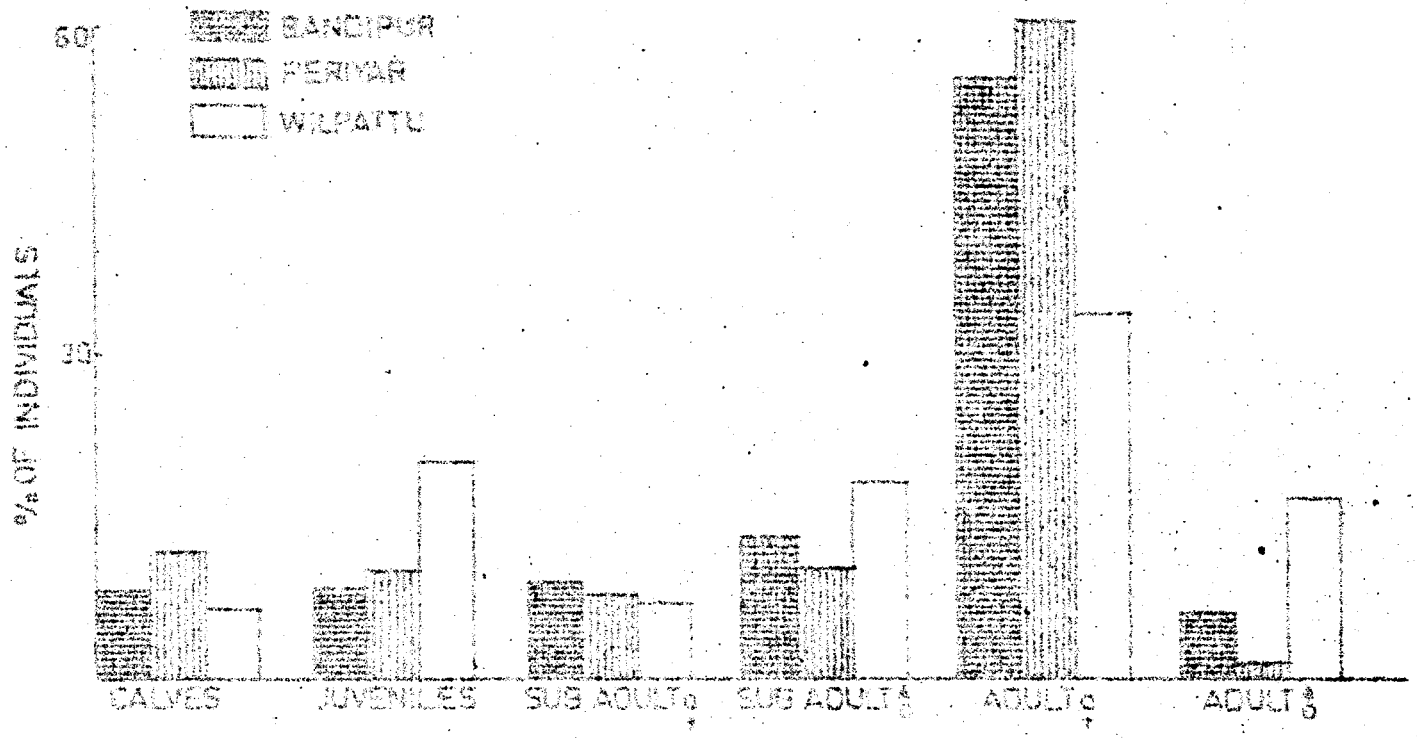



Fig 10 Age class distribution of elephants in populations of Bandipur, Periyar and Wilpattu (Wilpattu data from Eisenberg and Lockhart, 1972)

affect the population growth as shown by a normal number of calves. A large proportion of makhnas in the population is ruled out as described later. This probably means that the animals classified as subadult males are sexually functional. Flower (1943) do note that elephants may propagate their species several years before they attain their full growth. At Periyar the intensity of biotic disturbance was probably at its height during the study period. If a drastic reduction in the number of male elephants occurred during this period the result in terms of number of calves born will be apparent only after a couple of years, the gestation period in elephants being of this order,

The proportion of young (calves + juveniles) to adult female, subadult female to subadult male and adult female to adult male are shown in Table 1. The young to the adult female ratios are not significantly different among the populations ($P < 0.05$). The sex ratio between subadult male and subadult females is not siqnificantly different from 1:1 or among the three populations ($P < 0.05$). There is significant difference in the sex ratios between both adult male to adult female when compared to other populations ($P < 0.05$). In Wilpattu for every two adult female elephant there is an adult male, whereas this number in Bandipur and Periyar is 8.8 adult

female for one adult male and 57 adult females for one adult male. When due allowance is given for the solitary nature of the adult male elephants and that the above figures are based on males seen with herds, these figures do not seem to be too alarming but the shortage of adult males in Periyar population is quite obvious.

Solitarx elephants

The number of solitary tuskers sighted in the study area was fewer compared to other populations as mentioned earlier. Presence of large number of makhnas in the population also do not seem to be the case. Eisenberg and Lockhart (1972) is of the opinion that makhnas are not difficult to be noticed in a herd because of the male elephants habit of protruding his penis, especially while moving from one habitat to another. At Periyar solitary tuskless elephants were not encountered. These show that makhnas are not frequent at Periyar. Careful records of sightings of solitary elephants were kept to facilitate identification of individuals. The details are given below. Based on these records from 1979 to 1982 we conclude that there are only about nine tuskers (adult) in the study area. Out of these only four tuskers (Nos.6 to 9) were seen during the year 1981–82.

| Sl. No. | Location of first sighting | Year | Peculiarities | Plate NO. |
|---|---|---|---|---|
| 1 | Manakkavala | July 1979 | Small, tusk one feet, notches in ears | Nil |
| 2 | Mullakkudy | Mar 1979 | Big, right tusk tip broken | Nil |
| 3 | Chorakotta | Apr 1979 | Big, tusk symmetrical | Nil |
| 4 | Paravalavu | 1979 | Big, stump tail, ear and trunk no pigment | Nil |
| 5 | Kumarikulam | Apr 1979 | Big, tusk up turned | Nil |
| 6 | Edappalayam | 1981 | Small, slender tusk | 12 |
| 7 | Padikkayam | Feb 1982 | Big, tusks up turned | 11 |
| 8 | Deer Island | May 1979 | Big, curled ear, asymetric tusk | 9, 10 |
| 9 | Padikkayam | 1979 | Big; symmetric tusk, stumpy tail | Nil |

Elephant density

Quantity of dung in the sample produced varied with locality of the plot and season. This shows that the habitat

is-not uniformly used. Out of the total area only a part is used extensively by the elephants in the dry season. The overall density at Periyar was about one elephant per sq. km with an ecological density as high as three elephants per sq. km. Eisenberg and Lockhart (1972) estimated a numerical density in Wilpattu National Park which has a much less rich vegetation and water availability at about 0.12 elephants per sq. km. whereas the ecological density was as high as 1.0 to 1.2 elephants per sq. km. due to more use of some habitats during dry season. The situation in Bandipur seems to be comparable with that in Periyar.

Movement patterns

Eisenberg and Lockhart (1972) show that movement pattern of elephant herds in the Wilpattu National Park is highly dependent on availability of water. The herds move more widely in rainy season from the river beds and ponds to other parts, one herd covering as much as 100 sq. km. in both seasons together.

In the Bandipur National Park elephant move away to the wet areas during summer Nair and Gadgil, 1978). From the fact that elephants are seen more or less throughout the year in the study area it appears that there is no mass movement from one area to the other (Fiqs.11, 12). It is not known

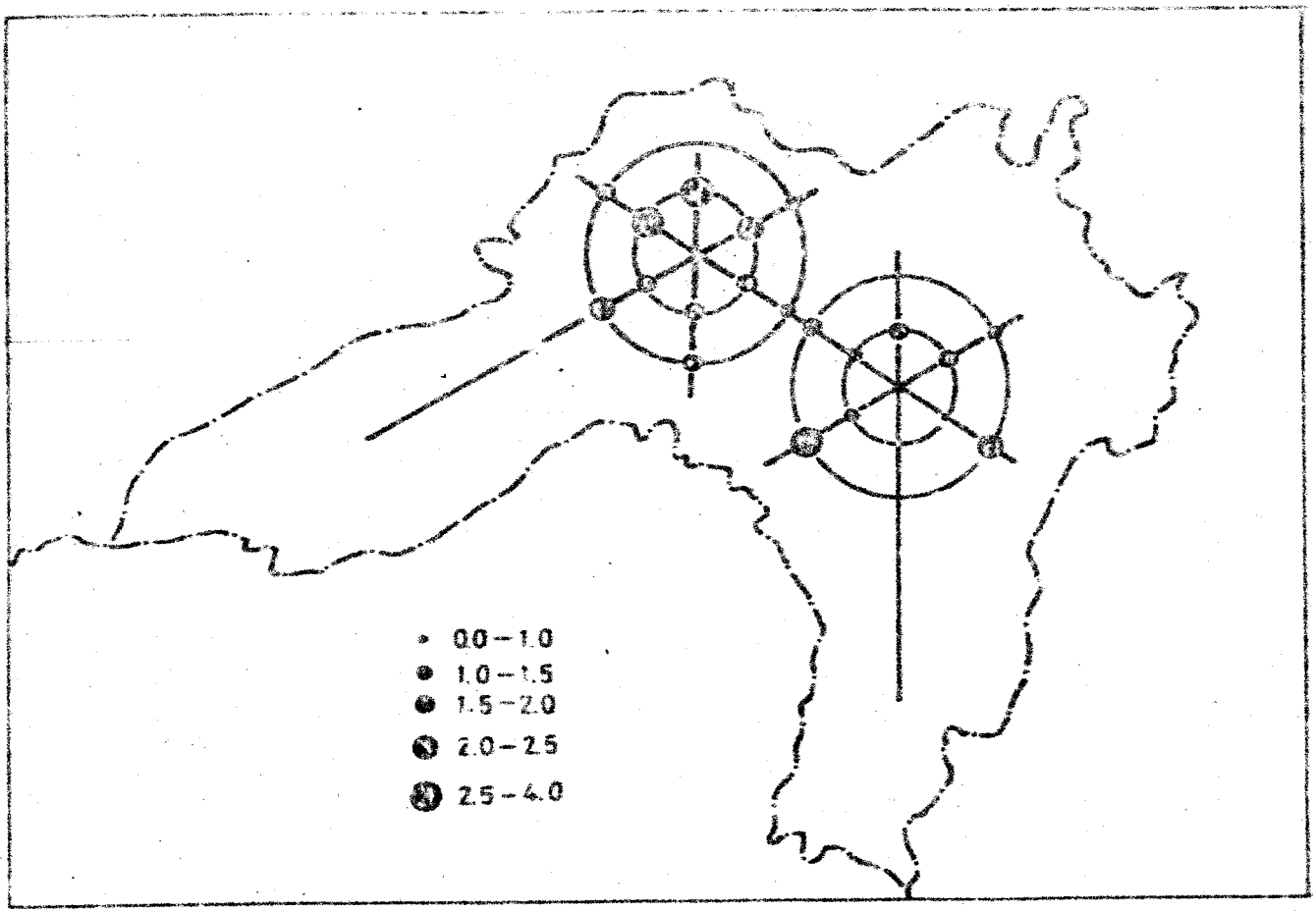



Fig. 11 Concentration of elephants in the study area in the dry season.

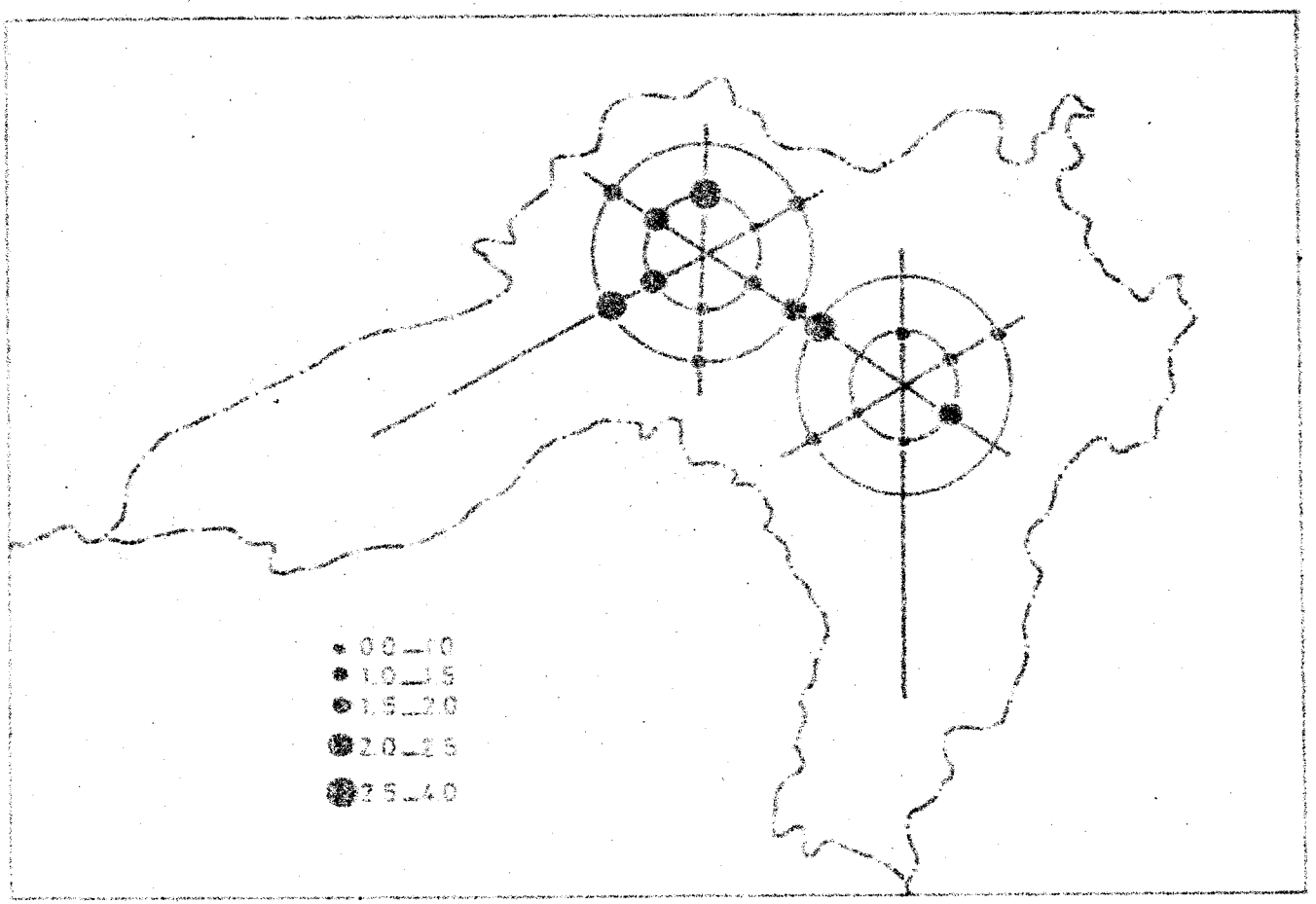



Fig. 12 Concentration of elephants in the study area in the wet season.

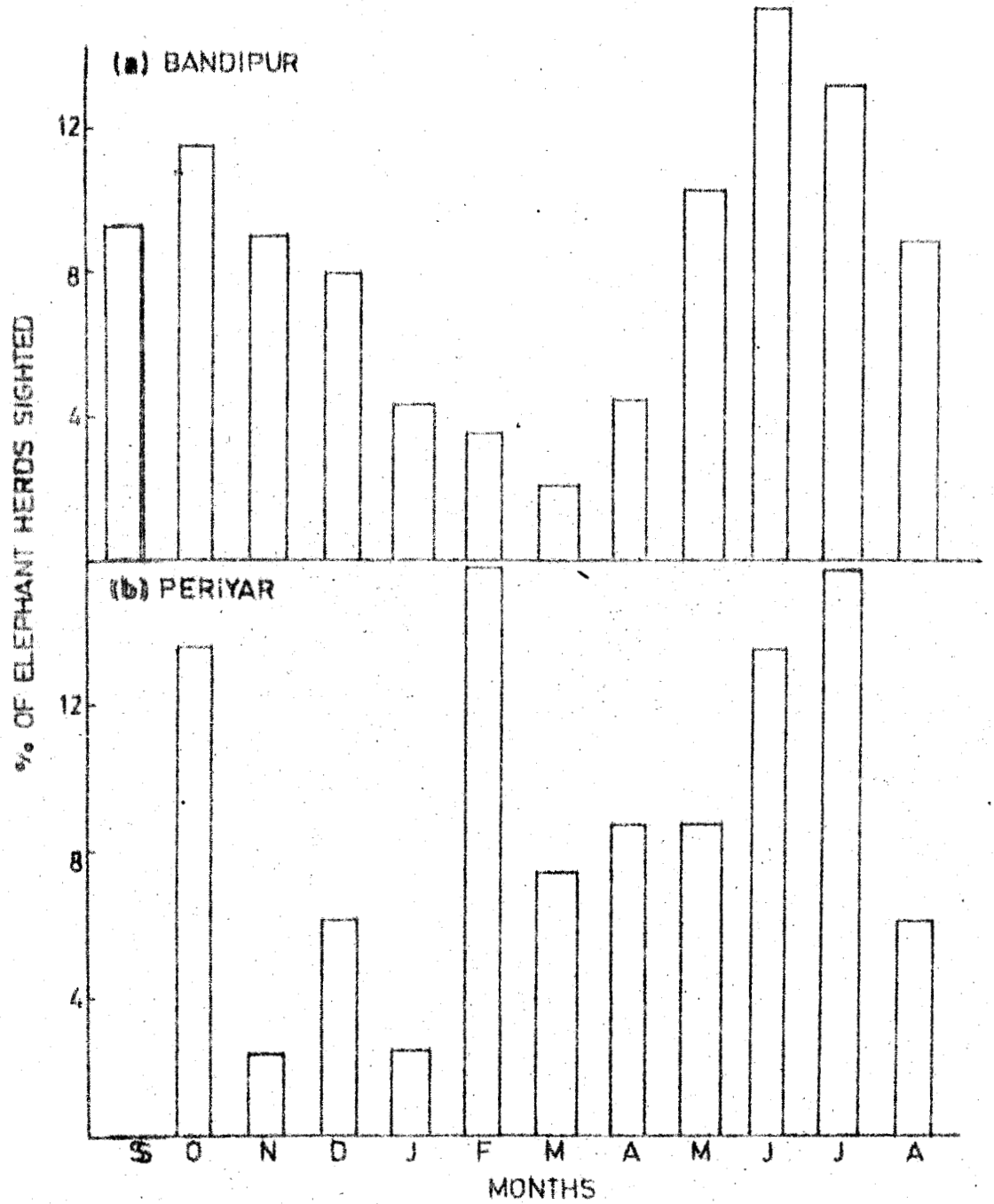



Fig. 13 Elephant herds sighted in different months in Bandipur and Periyar. Bandipur data from Johnsingh, 1980.

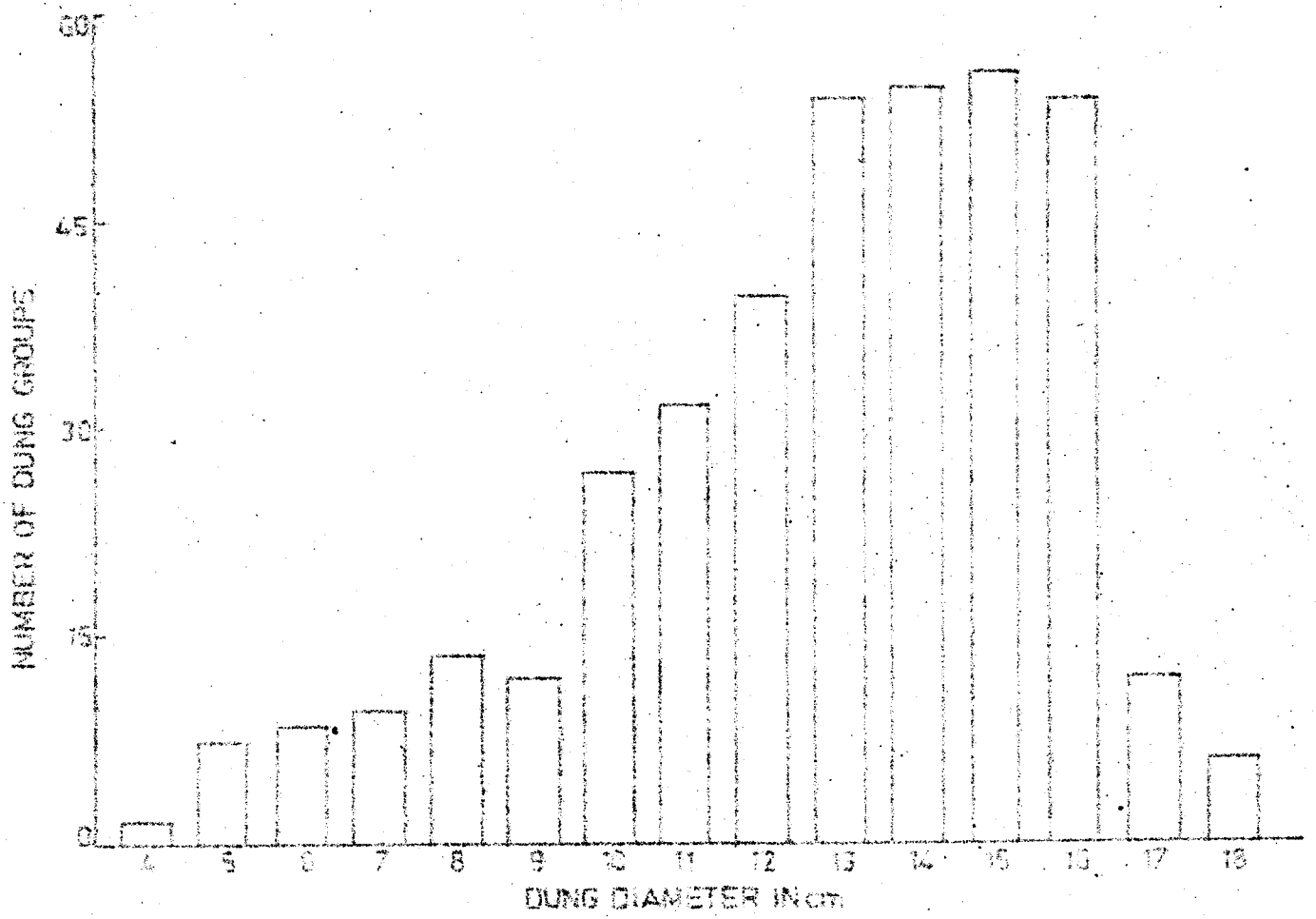



Fig. 14 Distribution of size of elephant dung diameter in the study area

whether elephant herds occupy overlapping ranges or wander over the entire continuous habitat in a random fashion. Nair **(1978)** groups the elephants of the reserve into three groups as given below.

i) Group of docile and sickly elephants around the lake
ii) Group moving from lake to Sabarimala areas
iii) Group of panicky elephants going to the eastern side.

Our studies,do not suggest any such demarcation into groups based on movement or temperament. Elephants have been sighted almost throughout the year around the lake. Fig.13 show distribution of elephants during different months.

Feeding habits and food requirements

Elephants feed on a large variety of plants. Their specialised trunk and thick tongue enable them to feed even on thorny plants. Grass seems to be their major food. item. It employs the trunk for collecting bunches of grass. The mud clinging to the grass is removed by beating on the legs or belly. In the lakeshore they have been observed to wash the muddy plants in the lake before placing in mouth. Elephants feed a great deal on bamboos and reeds and the method employed is bending the stem, splitting and placing it in mouth. Bamboo saplings are uprooted and eaten with the underground

stem. Young shoots of bamboos are also eaten. Bark of many plants are eaten by elephants. The bark is chewed out from smaller branches and the core discarded, From large trees bark is pulled out either after making a gash in the stem or by pulling loose ends. Fruits of trees like mango and jack are also eaten. After feeding for a while on a particular plant the elephants seems to shift to other species of plants. An adult elephant consumes about 250–350 kg of green fodder (Krishnan, 1975).

**GAUR**

The gaur or the Indian bison comes under the genus **Bos** to which animals like the domestic cow and the yak belong. Gaur is distributed almost throughout the Western Ghats (Plate 15).

Gaur is a very shy animal. It is usually found in groups of 2 to 20 individuals. Bigger herds are reported in Kanha and. Bandipur in favourable seasons (Schaller, 1967; Krishnan, 1975; Johnsingh, 1980). The herds as indicated by Schaller do not seem to have a permanent composition. This would indicate that the herds are only casual assemblage of individuals. There do not seem to be a clearcut leadership pattern or hierarchical structure in the herd which in any way wouldn't be well developed in temporarv associations. The **bulls**

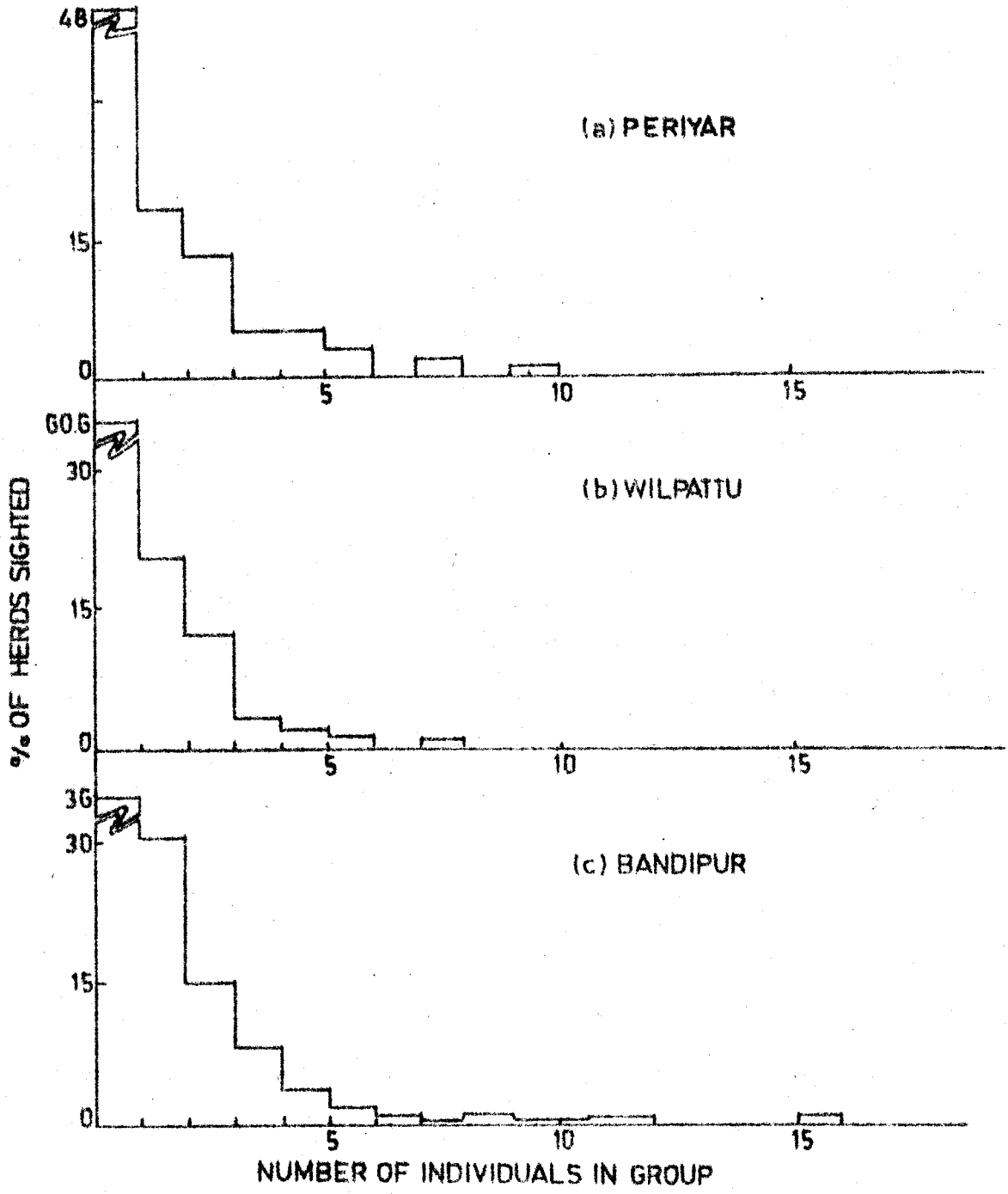



Fig. 15 Distribution of group sizes of sambar deers sighted.

are described as joining different herds as they move around.

In the study area Gaur has been sighted at locations like Edappalayam, Kavalappara, Chakkappara, Aruvi, Poovarasu, Panamkala oda, Ottamaram. Kattumadumottai, Kumarikulam, Varayattumudi, Chaverkuzhi etc. in different types of vegetation.

The male-female ratio, calf to adult or age structure could not be worked out accurately. The Gaur is a widely ranging animal, sometimes migrating to adjacent areas when food becomes scarce (Krishnan, 1975; Johnsingh, 1980). It is not known whether there is any such movement to adjacent areas by these animals in Periyar or how far and how long they stay in a particular locality.

The total number of Gaur in the sanctuary cannot be estimated accurately from indirect evidences at present due to the very scanty population which is slowly getting established after the last rinderpest outbreak in 1974.

Rinderpest seem to play an important role in regulation of Gaur populations, The population builds up at a rapid rate and the animals become numerous in large herds readily seen in sanctuaries. An outbreak of a contagious disease like rinderpest almost wipes out the population and the whole process

repeats. The periodicity of rinderpest occurrence is not known.

Food requirements

Gaur is described as both a grazer and a browser preferring green grass when available but otherwise consuming coarse dry grass and large variety of forbes, leaves and fruits (Schaller, 1967; Krishnan, 1975). Most of the fodder species described by Krishnan (1975) like Hibiscus lampas, Grewia aspera, Grewia hirsuta, Desmodium pulchella, Emblica sp. Cordia myxa Zizyphus trinervia, Zizyphus xylopyrus Similax zeylanica, Gmelina arborea, Terminalia bellerica and Bambusa arundinacea are present in the reserve. The Gaur in captivity is reported to consume about 20 kg of green fodder a day. In the wild it visits water bodies at least once during hot days.

SAMBAR

Sambar is the largest of the Indian deers and is found almost throughout the Western Ghats. This animal is usually found in deciduous and semievergreen forest with good undergrowth. Unlike the spotted deer they do not require vast open areas. They can be seen grazing in forest patches during dawn and dusk. They stay inside dense thickets during rest of the day.

Sambar deer is usually found singly or in small parties (Plate 16). The members of the group as in the case of Gaur seem to vary day by day. The stags are not permanently attached to the hinds and they occasionally form small groups.

Two factors, dense cover and water influences the distribution and abundance of sambar (Johnsingh, 1980). In the study area there were small groups of animals in every hillock or valley. They are not very conspicuous and because of their non gregarious nature and dispersed distribution one tends to make an underestimation of their number. The largest group seen consisted of ten individuals (seven does and three fawns).

Sambar is an important prey species in the sanctuary. Wild dogs can often be seen chasing them to water and killing in water. For other carnivores like panther and tiger also they form an important prey species.

Population density

The Sambar deer seem to be very unevenly distributed in the reserve. Some areas have very high concentration of these animals. Four study plots contained as much as about 75% of the pellets collected. Appendix IIIB lists their sightings during the study.

Plate 15. The Gaur or Indian Bison



Plate 16. A small group of Sambar deer.

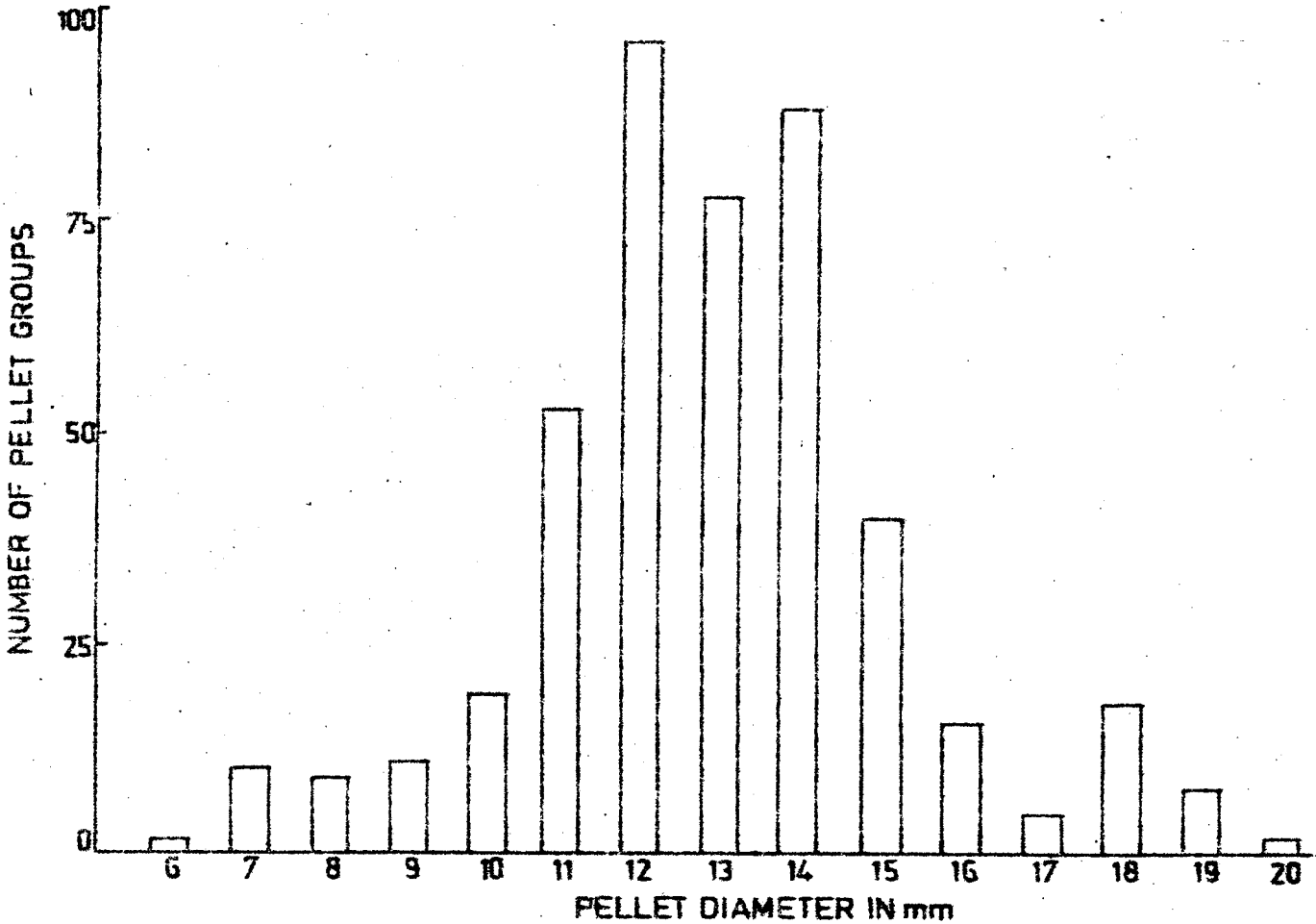



Fig. 16 Size distribution of sambar pellets in the study area

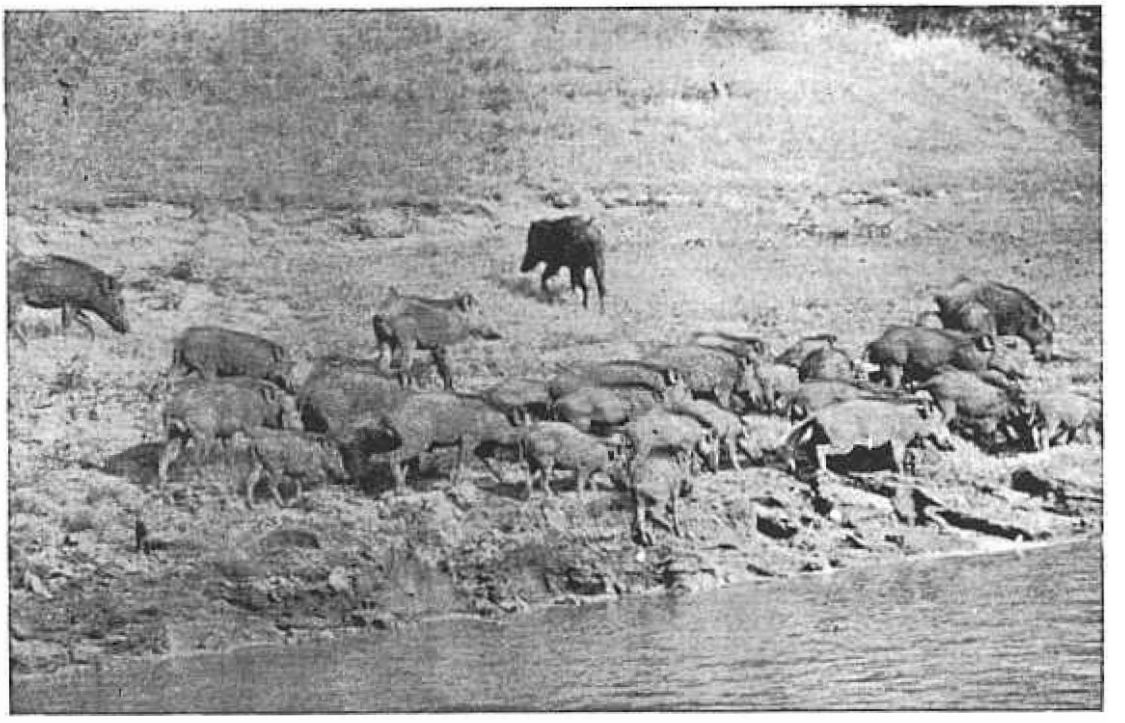


Plate 17. A large sounder of wild boars near the lake shore.

Plate 18. A Nilgiri langur jumping, Tanikudy region.

Herd composition

The frequency distribution of number .of animals in sambar groups seen is shown in Fig.15. All the three places examined show remarkable similarity with the solitary individuals occupying 30–50% of the total. The group size rarely exceed eight individuals. Johnsingh (1980) found a density of 4.2 Sambar/sq. km. in wet season and 2.25 Sambar/sq. km. in the dry season in his focal study area at Bandipur. The density of sambar in the Kanha National Park was estimated to be 1.6 to 2.3 animals/sq. km. (Schaller, 1967). The density of sambar in the Wilpattu National Park was estimated at 1.17 animals/sq. km. (Eisenberg and Lockhart, 1972).

Sex and age distribution

Attempts were not made for determining age of sambar deer during the visual observations. The sex could be identified for larger individuals. Out of 104 individuals accurately sexed **33.65%** individuals were males. giving a male to female ratio of 1:2. The age distribution of animals as indicated by the pellet size is shown in Fig.16. All age categories seem to be represented. Sambar stags were seen in velvet during the months of March, May, June, August and December. This rules out a particular season for shedding antler.

Behaviour

Eisenberg and Lockhart (1972) report 60% of the all sightings as solitary individuals. The young belong to the hiders category in which the fawn rests in thickets the mother goes to it periodically for nursing (Eisenberg and Lockhart, 1972). The movement pattern, of these animals are not known in any habitat, Eisenberg and Lockhart (1972) are of the opinion that the animals are non territorial and many animals come together in overlapping area of home range. According to Eisenberg and Lockhart (1972) the general pattern of the Sambar feeding activity is to browse in the forest during the morning hours, to rest during mid-afternoon in shaded secluded spots and to emerge to graze in the open scrubland during night. They also describe the animals using consistent trials and fawning in the month of November.

Food requirements

Sambar deer also is a browser and grazer. According to Schaller (1967) young grass constitute their major forage during the rainy season. Browsing is resorted to when grass is scarce. Their nipping the emerging leaves of Panicum, repens in marshy areas is particularly notable. Small groups of sambar can be seen grazing on the lake shore and grass land. In captivity sambar deers are given 2.6 kg of green leaves and 3 kg of grass daily according to Nair (1983). Fruits of

.Emblica officinalis, Zizyphus jujuba, Randia dumetorum, Terminalia bellerica, T. chebula also are eaten in large quantity when available. The thickets of Lantana camera and Bamboosa arundinaceae provide them shelter and fodder. They visit water holes almost every day, sometimes at night.

**WILD BOAR**

The wild boar, one of the most widely distributed. non ruminant ungulate in peninsular India is also one of the least studied animals (Plate **17).**

These animals are seen in sounders ranging from a few to about sixty individuals. In some seasons larger sounders of 80 or more individuals can be seen, The significance of such aggregations seen only on few occasions is not clear. Lone animals can also be frequently seen. The sightinys of pigs in the reserve show that they are seen mostly around the lake, and sounders ranging from six to eleven individuals were most well represented. In the Wilpattu National Park (Eisenberg and Lockhart, 1972) the highest frequency after the single individuals are groups of four individuals; sounders consisting of four to fifteen individuals were most common, there being fewer groups on the upper margin (Fig.17). The high incidence of solitary individuals, mostly males suggest the possible existence of elaborate social structure.

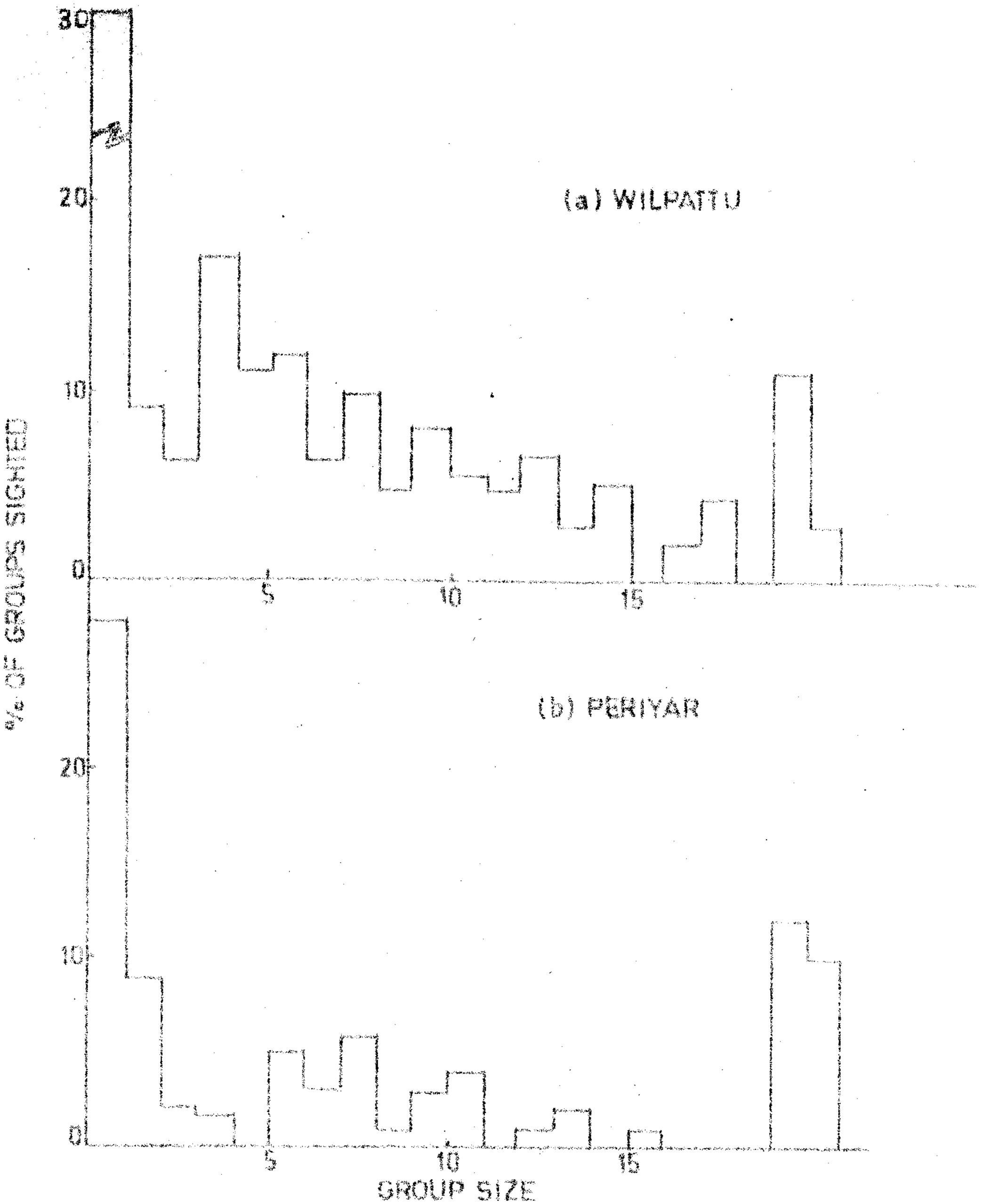



Fig. 17 Distribution of groups of wild boar in Wilpattu and Periyar (Wilpattu data from Eisenberg and Lockhart, 1972).

Legend, Fig: 18

Names of plants

1. Centella asiatica
2. Mimosa pudica
3. Stachytarphyta indica
4. Desmodium heterophyllum
5. Borreria sp
6. Unidentified species
7. Urena lobata
8. Grass

9, 10. Unidentified species

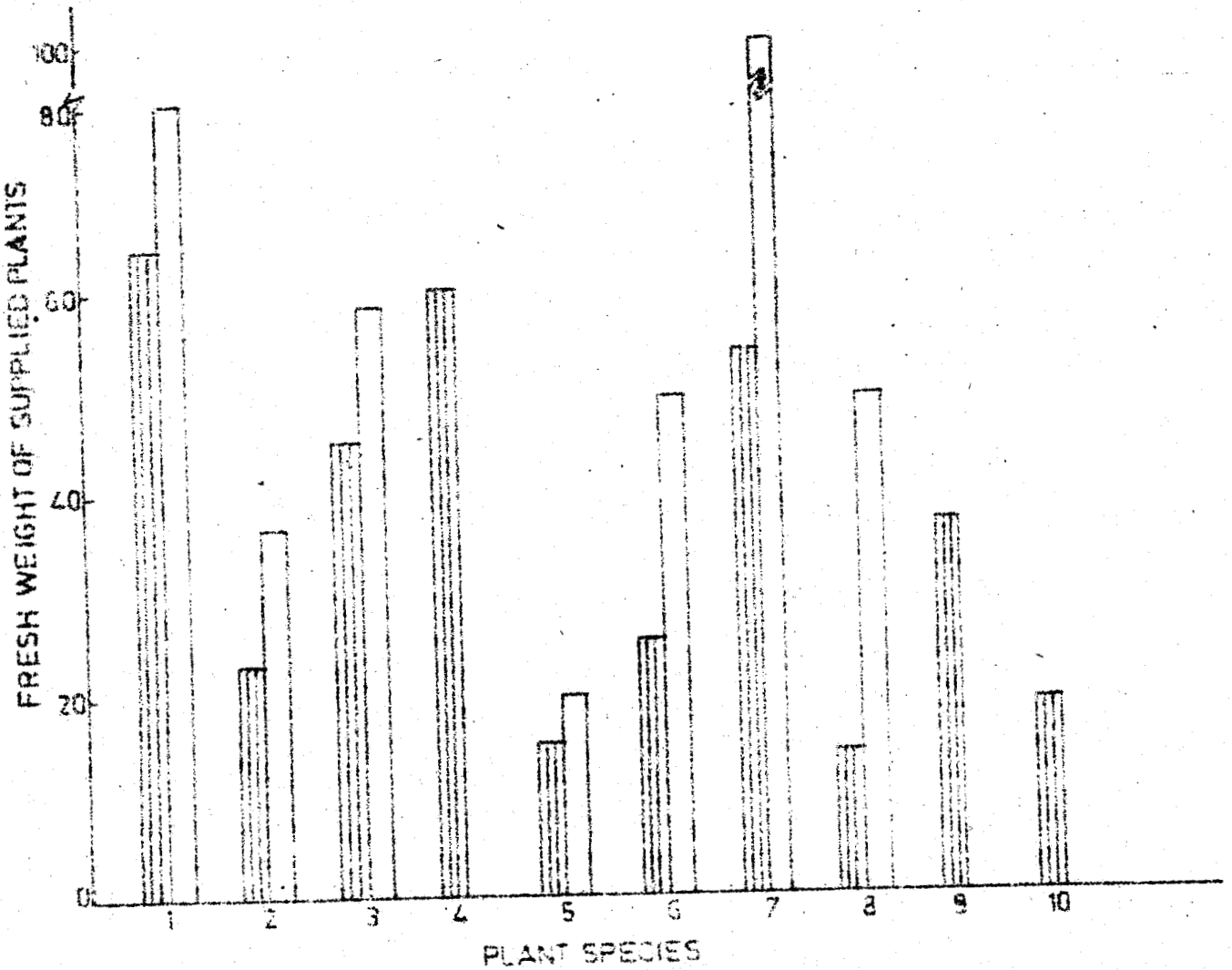



Fig. 18 Results of feeding trials of sambar deer

wild boar sighted during the study is listed in Appendix IIIC.

Opinions vary about the ranging pattern of the wild boar. Eisenberg and Lockhart (1972) found them to be migratory in the Wilpattu National Fark while Johnsingh (1980) considers them to have a fixed home range in Bandipur. In our study area there do not seem to be any migration as indicated by sightings almost throughout the year. In many places they are highly nocturnal, but at Periyar, especially in the tourism zone they could be observed feed-ing almost throughout the day.

Our observations indicate that the members of a particular sounder are fixed and also that the adult males are solitary, probably joining the herds only for mating. A case of wild boar feeding on caracass of their own species also was there. At Periyar they can be approached close and they move away only at very close distance. When approached very close they make threat displays. Flocks of jungle mynas can be seen accompanying elephants, wild boar and other grazers for catching the insects displaced.

On 12th June 1979 a female wild boar was seen coming out of water with a dead Ophiocephalus fish of about 30 cms length. It ran with the fish for about 10 m towards the shore with the fish in its mouth. It started feeding on the fish from oneend after placing the feet on the other end.

Food requirement

Wild boars mostly live in open habitat, grass or scanty bush jungle, sometimes in forest. They are omnivorous living on a variety of roots, tubers, insects and carrion. The tubers in marshy areas seem to be an important food item in Periyar Reserve. They were seen feeding on tadpoles of Rana curticeps which appear in large quantities in some seasons in the lake.

**SMALLER MAMMALS**

The barking deer, mouse deer and the black naped hare are included in this section. These are all very shy animals and occupy a habitat at the edge of the forest.

The barking deer is described as a solitary animal which hides the young ones in thickets till they are mature (Eisenberg and Lockhart, 1972). A captive barking deer kept by us was fatally attacked by a wild male one. This probably shows that the males are territorial, actively keeping off other males. Nature of the male female bond is not known. Barking deer was recorded. in areas like Chevlod, Manakkavala, Ottamaram and Thekkady. Because of difficulty in distinguishing the pellet from that of sambar and mouse deer detailed computations are not attempted. Table 1 shows the categories

of pellets obtained.

Mouse deer is a small solitary deer, nocturnal in habit with striped colour pattern suitable for this purpose (Efsenberg and Lockhart, 1972). We have record-ed a case of wild dogs ki ling a pregnant mouse deer. Eisenherg and Lockhart' (197 ) suspect a consistent home range and having social interacti ons at least in the breeding season. The frequency distribution of pellet size was symmetrical. Mouse deer droppings were observed mostly in Chevlod and Ottamaram plots.

The black naped hare also is not very active during the day time, hiding in grass during day. They seem to prefer forest edge, Their droppings are very common in rocky areas. The frequency distribution of hare pellet size is shown in Table 1. Observations on other animals like porcupine, mongoose and rats are limited.

Food requirements of smaller mammals.

The barking deer lives in thick jungle and comes out to graze in the outskirts of forest or in open clearings (Prater 1971; Rarrete, 1977). The barking deer mostly browse on tender leaves, depending to a large degree on fallen fruits (Barrette, 1977). Species like Randia dumetorum Zizyphus xylopyrus Melia composita the fruits of which this

deer is known to feed are present in the reserve.

The mouse deer or the Indian Chevrotain is a small deer found in areas of thick undergrowth. They feed on herbs and shrubs on the forest floor, eat number of fallen fruits like that of Terminalia bellerica, Gmelina arborea and Garuga pinnata. They are mostly nocturnal.

The black naped hare is mostly nocturnal animal hiding amidst grasses during day time. It lives in grassland near open or rocky areas, They feed mostly on grass.

## AVAILABLITY OF FODDER

Regarding availability of grass, it is abundant in the grassland! in hill tops, savannah areas, lakeshore and marshes. Of these the grass in regions other than lakeshore and marshes is mainly Cymbopogon sp which is palatable only in young stages and get burned in the summer. During summer because of this reason grass may be scarce, The evergreen forest where the canopy is not closed also contain grassand is available almost throughout the year.

Attempts were made to estimate the grass production on grassland, marshy area and savannah areas, The grass production is quite high in the grassland areas as shown by

harvesting experiments shown below. The grass production at the end of the growth season is about 700 tonnes,/sq. km. About 20% of grass produced is consumed by herbivores. This means that the animals depend upon other plants and grass in the .deciduous and evergreen areas a great deal. One set of readings corresponding to beginning of growth season were taken at the end of May and beginning of June. During this period the Edappalayam site areas outside the trench burned, inside did not. Manakkavala site no burning and Thanikudy site outside an6 inside burned.

Of the different sites Edappalayam had the maximum grass production followed by Manakkavala and Thanikudy. The three sites had different grass species, Edappalayam and Thanikudy predominently elephant grass and Manakkavala predominently Panicum sp. characteristic of marshy regions near lake. Edappalayam and Thanikudy had more or less similar grasses.

At Edappalayam at the beginning of the growth season no direct comparison was possible as the regions outside the protected part burned. Total grass and herbaceous vegetation had a dry weight of 196.31 $gm/m^2$ inside trench and 205.22 $gm/m^2$ outside. In the ungrazed regions Cymbopogon sp. accounted for 98.69% of the total weight. But in grazed regions only

for 85.82% of the total, Species Cymbopogon sp, and Dcsmodium sp, seem to be heavily grazed whereas Desmostachya bipinnata Cyperus sp., Eupatorium odoratum etc. where more in grazed areas. Total grass production at Manakkavala in ungrazed areas accounted to 711.8 gm/$m^2$ and 592.72 gm/$m^2$ in grazed areas. On the whole the species diversity seem to be less in the marsh compared to other areas, Panicum repens accounted for 93.89% of the total dry weight in grazed areas and 95.46% in the ungrazed areas. Bambusa arundinacea flowered in 1970 to 1977. It is getting established in many areas. In the evergreen parts there are vast areas containing reeds. These are also fed by elephants. These probably along with wild plantain, cane, wild palms constitute plants eaten by elephants in the evergreen forest. Shrubs were not enumerated for species or animal feeding (due to marking and sampling difficulties).

Coming to trees there are very few trees the elephants directly feed upon, bark of Grewia tiliaefolia is eaten by elephants. The number of these trees in the forest seem to be very few, The deciduous areas have Lagerstroemia lanceolata 'I'erminalia chebula, Bridelia retusa, Emblica officinalis, Randia dumetorum, Careya arborea Dillenia pentaqyna etc. Elephants hardly feed on any of these. Fruits of most of these trees are eaten by sambar, barking deer etc. Enumeration

of these trees or their phenology was not done, Regarding; the numerous evergreen trees no particular tree seems to be particularly extensively fed by elephants. Concerning the feeding of arboreal animals like giant squirrel, flying squirrel, bonnet macaque, liontailed macaque and Nilgiri langur, their feeding habits were not invest3gated in detail,

**Elephants**

Elephants occupy a variety of habitats and their food requirements are very diverse. They feed on a large variety of grasses, sedges and trees. The tall Cymbopogon sp. of grass found in grasslands of Periyar is eaten only in tender stages. Panicum repens found in large quantities in the marshy areas are preferred by elephants. Many of the species described by krishnan (1975) as fed by elephants like Themeda sp., Grewia aspera, Hibiscus lampas, Acacia concinna, Acacia intsia, Acacia ferruginea, Cordia myxa, Phoenix humilis, Emblica sp,, Ficus sp, etc. are present in the reserve. Reeds and bamboos are found in large areas and extensively fed bv elephants.

**Sambar**

The feeding preference of captive sambar in the lake shore habitat was quantified by cafeteria trials (Berwick, 1974) where plants from the lake shore was fed to the animal and the left over analysed after feeding. Equal quantities of

different plant species found in the lake shore was also supplied and fraction left after feeding quantified.

Based on the observations made during the study, sambar deer appears to spend a great deal of time near the edge of forest. The extensive lake is a preferred habitat and the food consumption pattern here was examined. Five sample plots of one metre by one metre was marked. All plants above ground were harvested, separated, weighed and fed. to the captive sambar. After an hour the plants left over is weighed species-wise. Allowance was given to natural wilting of plant species by correcting the left over plant weight by decrease in weight due to wilting of control plants kept nearby. Weight decrease result from two factors - feeding by animal and through wilting during the one hour period. In order to calculate the wilting rate of different plants, known quantities of these plants were kept as control and the rate of weight decrease due to wilting calculated. Using this factor the weight of the left over plants were corrected. to get their weight at the beginning of the experiment.

The limited area sampled contained only about 10 species of annuals and grass, but shows an interesting consumption pattern. Grass constituted the bulk of the plants harvested (83.9%), Mimosa pudica (8.9%) and Centella asiatica (1.87%) comes next. The animal consumed maximum amount of grass (45.5%)

followed by Mimosa pudica (2.05%) and Centella asiatica (1.2%) (Fig. 18). The animal did. not consume any species totally. During the study period grass was the most important food item for the animal. When equal quantities of plants were supplied the animal consumed all the grass supplied and consumed a larger proportion of other plants. This means the animal has a natural tendency to eat grass compared to other plants and augment the diet with the latter when the former is scarce, Feeding trials on elephants were not carried out due to non-availability of suitable captive ones at the study site.

Competition among herbivores

The herbivores considered are elephant, gaur, sambar deer, cattle, wild boar, barking deer, mouse deer and hare. Ten biological factors such as degree of tree usage, degree of usage of shrubs, browsing, grazing dependence on underground tubers, need for water, diurnal/nocturnal nature, preference for open habitat and sun tolerance are considered, Elephants feed extensively on trees, sambar deer and barking deer feed on fallen fruits. In using the shrubs also elephants top the list with its ability to break the stem and to feed from considerable height. Most of the animals considered are capable of both grazing and browsing. Only wild boar and

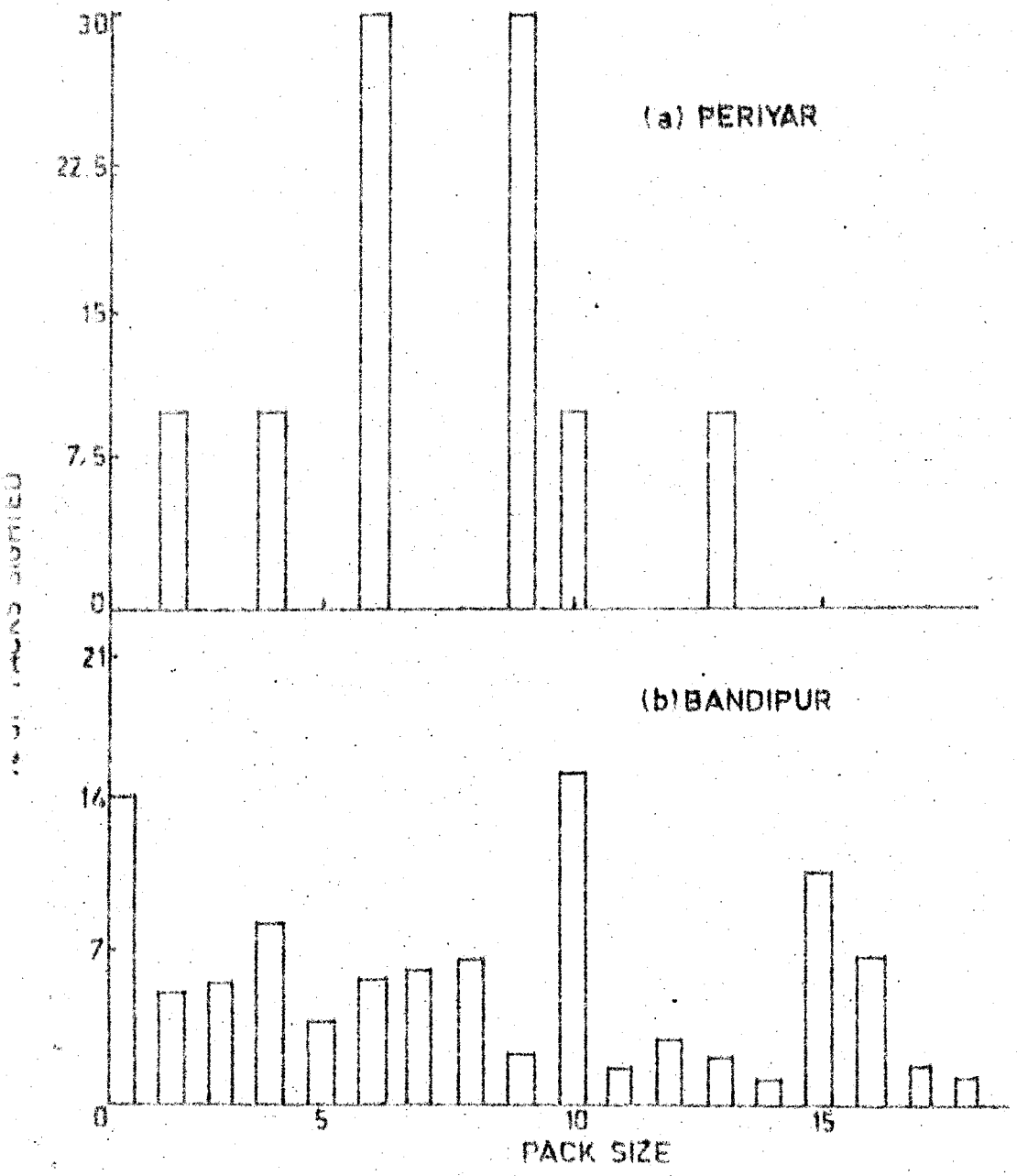



Fig 19 Pack size of wild dogs in Periyar and Bandipur (Bandipur data from Johnsingh, 1980)

elephant are able to dig or pull out under ground stems and tubers. Need for water is more or less similar among the animals, wallowing animals like the wild boar, sambar and elephants needing it more than small deers like barking deer and mouse deer. Most of the animals were active during day time, the mouse deer and barking deer are more active during dawn and dusk. Elephants, hare and mouse deer have been found to be active during considerable part of the night also. Sun tolerance was rated maximum for cattle and least for the solitary deers. Hare was an animal of the open habitat. Other animals preferred mostly a habitat with open areas and cover.

A similarity matrix of similarity in habits and habitat use of the above herbivores was prepared from subjective values assigned to each of the parameters. Clustering by the hierarchical method (Cody, 1974) show animals like the barking deer, sambar, gaur, cattle and elephant forming one group and animals like mouse deer and hare forming another group. The wild boar is not in either group and stands out alone having the least overlap with the rest of the animals.

**ARBOREAL ANIMALS**

The Indian giant squirrel, Flying squirrel, Bonnet macaque, Nilgiri langur and the Liontailed macaque are the major arboreal mammals.

The Indian Giant Squirrel

This squirrel, Ratufa indica is found, in deciduous to evergreen vegetation. These animals build large globular nests of twigs and leaves on smaller branches of tall trees.

This squirrel is seen almost throughout the sanctuary. They feed on a large variety of fruits, barks, leaves and seeds. Their extensive feeding on teak seeds is particularly remarkable. Tney have been observed to feed on jack fruit, Terminalia paniculata (fruits), Bombax malabarica (seeds), Persea macarantha (flowers), Pterocarpus marsupium (bark) etc.

Flying Squirrels

Petinomys fuscocapillus, the small Travancore flying squirrel has been observed in the Thekkady region. This animal is mainly nocturnal in habits. It is active during' dawn and dusk also.

The Liontailed Macaque

This black monkey, Macaca silenus is limited to the evergreen forests of Western ghats - Nagercoil District to North Kanara ($8^{\circ}$ - $15^{\circ}$N and $75^{\circ}$ - $80^{\circ}$E) (Karr, 1973; Green and Minkowski, 1997; Kurup, 1979; Johnson, 1980). It is diurnal in habits and is one of the most arboreal macaques, normally remaining in the topmost canopy. Because of its shy

nature, its black colour, its habit of living in dimly lit lonely forests it is seldom seen (Roonwal and Mohnot, 1977).

This endemic endangered arboreal macaque has beer, located in evergreen forests where human disturbance is minimal. They are recorded in Melappara cardamom estate, Elatheri, Koilmala, Ponvarai, Pachakanam, Aldi, near the eastern border and near the Pachiar estate. A lone monkey was seen near Sabarimala temple. A troup of seven individuals were sighted in the Poonkavanam area. Their number is on the decline in the Pachakanam area as described by Kurup (1978). A troup of 32 liontailed macaques were sighted near the Melappara cardamom estate.

Green and Minkovsky (1977) feels the name lion monkey' - the translation of its Sanskrit name 'Sinhalika' is more apt for this 'handsome animal with its full almost white lion like facial ruff'.

The characteristics of the forests in which these macaques are found. has abundance of Cullenia exarillata trees. This kind of vegetation is found in the eastern and north eastern border of the reserve. Green and Minkowski (1977) has observed that the liontailed macaques feed on c. exarillata and Artocarpus heterophyllus almost throughout the year. Species preference for other species vary between different

moth of the year. Other important species for the animal are Tetrastigma sulcatum, Litsea wightiana, Loranthus elasticus etc.

Macaques are very important in biomedical research and their preservation is essential. Due to widespread destruction of evergreen forests the liontailed macaque is highly endangered. Periyar has one of the most extensive evergreen forests harbouring this monkey. The exact number, troup size and spatial distribution in this reserve has not been thoroughly investigated (Green and Minkowski, 1977; Kurup, 1975) so far, due to the extreme difficulty in approaching this area and rugged nature of the terrain,

The Bonnet Macaque

This medium sized macaque has a distinct bonnet of long dark hair above the forehead. They feed on a large variety of fruits, leaves, shoots, insects, grubs and spiders (Prater, 1971). Those found in the natural forest were very shy and smaller in size compare6 to the ones found near human habitations.

Bonnet macaques have been found in Melappara, Elatheri, Ummikuppan, Anchuruli, Thanikudy, Vaikkappadappu, Koyilmala, Pachiar estate etc,

The Nilgiri Langur

The Nilgiri langur, Presbytes johnii is commonly found almost all over the reserve (Plate 18). This animal is wary arboreal coming to ground only occasionally. They feed on a variety of plant leaves, fruits and seeds. They move in a single file through the trees,each animal passing over the same branches as preceding ones as described by Roonwal and Mohnot **(1977).** They have been reported. to feed on plants like Pterocarpus marsuplum, Grewia tiliaefolia, Da1bergia latifolia, Artocarpus hirsuta etc. (Roonwal and Mohnot, 1977). Group size vary from three to thirty five individuals and the home range is proportional to the group size ranging from a few hectares to few sq. km. (Poirier, 1970; Horwich, 1972). The males play relatively minor role in the protection of the group and in the social development of the infants (Poirier, **1979).**

**CARNIVORES**

Under this animals like the sloth bear, the otter, tiger, leopard and the wild dog are described.

The Sloth bear

The sloth bear, Melursus ursinus is present in the reserve. It is a mostly nocturnal animal feeding on a variety of fruits, ants and termites (Schaller, 1967;

Prater, 1971). They dig up the termite mounts with their powerful claws. Sloth bears were recorded from places like Manakkavala, Medaganam, Mullathode, Ottamaram,Mulakupara, Chaverkuzhy, Vaikkappadappu, Chorakkotta, Koyimala, Pulikkayam, Kozhikkanam, Edappalayam etc. This animal seems to prefer available paths in the forest as indicated by droppings and foot prints. They consume fruits of wild mango Zizyphus jujuba, Syzygium cumini, Cassia fistula, Cordia myxa, etc. when available. A charred body of. sloth bear was observed in March 1978 at Chamikayam medu in the burned grassland.

**The Common Otter**

The common otter, Lutra sp. is present in the lake and upstream of Feriyar in good numbers. They are seen in packs ranging from a few individuals to about 15 animals. They are carnivores and feed mainly on fish in the lake. A territorial habit is suspected as Packs are separately seen near adjacent areas.

Tiger

Tiger, Panthera tigris is found in major forest types of India - thorn, dry moist, semievergreen and evergreen. The wide geographical distribution of tiger implies a great adaptability to different environmental conditions and indeed the only requisites for its survival appear to be some form of

vegetative cover, water supply and sufficient prey (Schaller, 1967).

The Periyar wildlife sanctuary has been declared as a project Tiger area in 1978. No details are available regarding the previous number of tigers in the reserve. Varghese (1975) estimated a total of 30 tigers (11 males, 5 females, 8 subadult males, 3 subadult females and three cubs) in the reserve. By 1981 the number of tigers had increased to 38 with 16 adult males, 10 adult females, 8 subadults and 4 cubs (Varghese, 1981). These studies are based on analysis of pugmarks, This method has several shortcomings. During the reconnaissance period about 25 to 30 tigers were estimated based on spatial distribution of indirect evidence. Detailed studies were limited to the herbivores in the subsequent period,

Tigers were sighted at Edappalayam, near boat landing, Nanakkavala and Thanikudy. Fug marks were seen in areas like Ummikuppan, Melappara, Thanikudy, Manakkavala, Panankala oda, Poovarasu etc.

Tiger is adapted for stalking its prey rather than running it down. Regarding kills made by tiger a total of four kills were examined. Out of these three were domestic

cattle in the forest and fourth a sambar stag. In all these cases the tiger shifted the caracass about 200 meters each day. This habit of carrying the caracass to a safe place could be due to pressures during evolutionary stages to save the prey from Leopard, wild dog and scavengers. The feeding nearly always started- from the rump portion.

Schaller (1967) has reported tiger preying on gaur. Elephant calves also seem to be attacked by Tigers (Johnsingh, 1980). No instance of either these cases were found from the reserve. A tiger needs about 70 kg. of meat a day (Johnsingh, 1980).

The Project Tiger scheme envisages protection of the habitat to provide ideal conditions for wild animals. Mehra **(1980)** gives a review of the attempts of conservation of this important species.

Leopard

Only very limited details could be collected on Leopard (Panthera pardus) from the study area. It is possible that many of the Leopard's foot prints were mistaken for that of the tiger due to difficulty in recognising the pugmarks of Tiger and Leopard. Panther, like the tiger stalk its prey by biting at the throat first. The feeding usually starts from the abdominal region (Schaller, 1967).

The wild dog

The Indian wild dog or dhole (Cuon alpinus) is a pack hunting canid found throughout the forests of India, This animal is one of the most poorly understood animals in our forest. Since the dhole lacks the killing bite of large cats the process of killing larqe prey may appear gory and repugnant to the human observer (Johnsingh, 1980). In many instances they have been accused of causing decline in prey animals due to wanton killing.

A detailed study conducted by Johnsingh (1980) has brought to light several interesting details about their life. Somn of these are pack regulation by emigration, breeding by one female, mortality of pups ana adults, sex ratio favouring males, coursing after and disembowelling the prey, using dens for whelping, pups staying near the den till they are around 10 weeks old, smaller hunting range when pups are in the den, co-operative caring for the lactating bitch and pups, avoidance of strong packs when pups are present, leaping and landing on four legs while looking for prey and holding the large prey by the nose etc. He also snowed that the wild dogs aarry meat in their stomach for the pups, they are territorial, do not have the habit of scraping the ground with hind feet and that they seldom kill around the den.

In our study area the pack size ranged from 2 to 14 individuals (Fig.19). At Kanha the pack size was two to 12 animals (Shaller, 1967). Johnsingh (1980) is of the opinion that herd size will be small in areas where food is scarce. wild dogs were sighted in areas like Manakkavala, Edappalayam, boat landing, Thanikudy, Melappara, Paravalavu, Medaganam, Cheriyakanam, Nellikkampatti, Anchuruli etc. The main prey of wild dog in the reserve seems to be Sambar deer. Often the wild dogs can be seen chasing the deer to water and biting them to death by swimming beside it. This probably is an easy way of making the 'sambar defenceless. On land the powerful limbs and antlers of stags is a formidable weapon. One wild dog was found dead presumably from injuries sustained during hunting. Near the habited areas in the reserve people used to take away deer killed by the wild dog. Johnsingh (1980) is of the opinion that in these cases where the kills have been stolen the wild dogs attempt one more kill the same day.

Availability of prey and competition among carnivores

At Periyar the sambar deer constitute a major prey species for the wild dog, leopard. and tiger. Spotted deer is not present in Periyar. The wild boar form the second prey species. We have recorded cases of wild clog hunting on barking

deer and mouse deer, Evidence of tiger feeding on porcupine was inferred from the presence of porcupine quills in the droppings of the tiger. Detailed studies on the prey predator relationship conducted recently (Johnsingh, 1980) (Fig. 20) showed that smaller carnivores like the wild dog kill smaller animals like the spotted deer, Animals like tiger killed Gaur and Wild boar in addition to killing sambar deer or spotted deer.

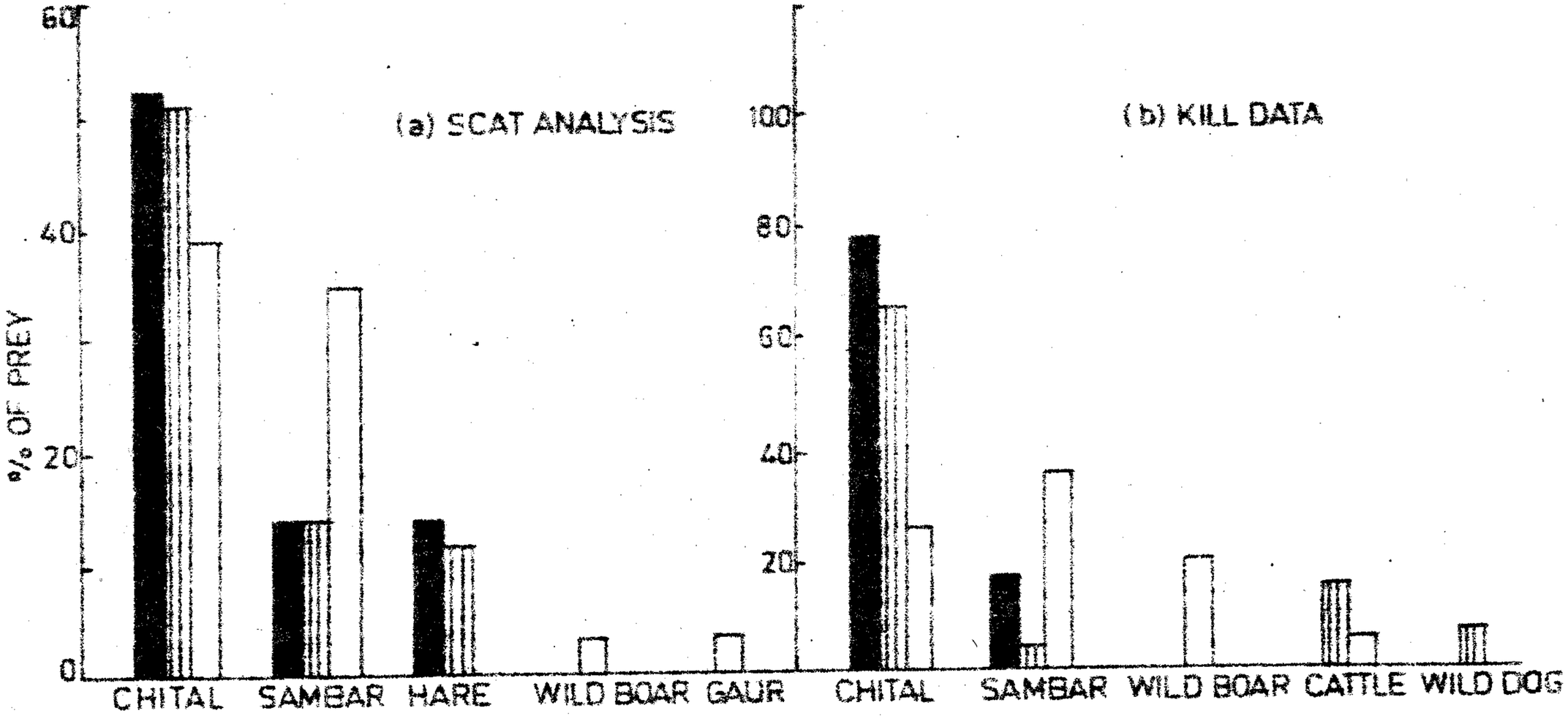



Fig. 20 Comparison of prey preference of tiger ■, leopard ■ and wild dog □.

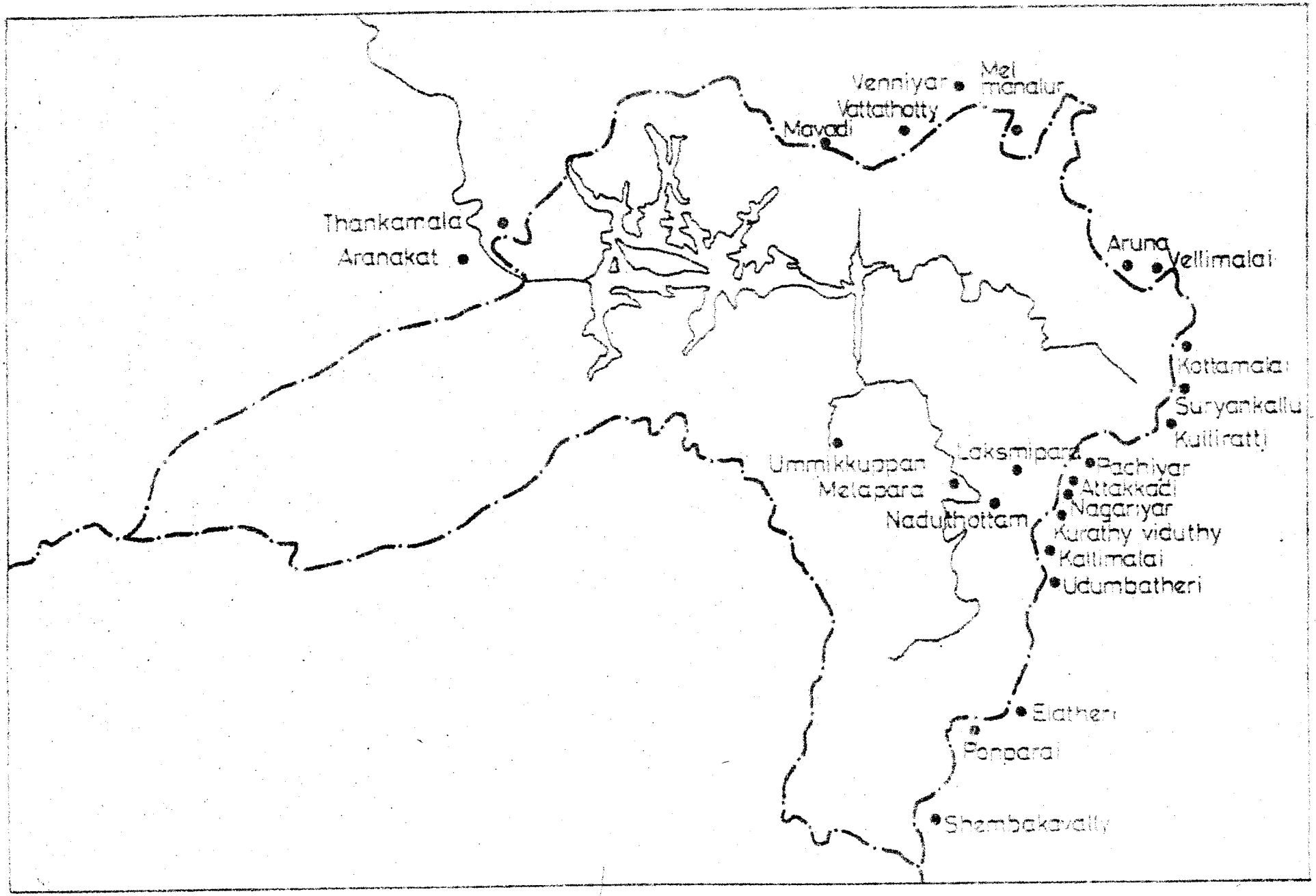



Fig. 21 Estates in and around the study area

## CONKLUSION AND RECOMMENDATIONS

In India wildlife management is part of the forest management. Regular working plans hardly mention any detail on wildlife. Data regarding animals in dense forest is scarce and till date there is hardly any management plan based on sound scientific grounds for any wildlife sanctuary in India.

A disadvantage of working based on a management plan is that unless the plan had been written after a thorough investigation its utility becomes very much limited. A management plan should be subjected to discussion at a wide level before acceptance, as this is a vital document. Again, the prescriptions of the management plan must be strictly adhered to. There is frequent change of managers in wildlife sanctuaries in our country and. changes introduced by subsequent officers have sometimes defeated the initial purpose.

Management of wildlife is a subject over which there is considerable difference of opinion. One school believes that given the natural conditions the wild animals would. take care of themselves (Sankhla, 1983) while another school believes that timely intervention by managers is essential (Petrides, 1983). For the Periyar Tiger Reserve an optimum policy between these two extremes seem to be the choice. A

natural system may protect itself if left to itself without disturbance. Intervention by managers will often become necessary to prevent the human disturbance to the system.

At Thekkady, so far because of the apparent lack of access to forest a policy of non-intervention has been adopted with limited patrolling and habitat modification, But the basic assumption that the forest is inaccessible is no more valid. There is large scale wood-cutting, animal poaching, minor forest produce collection, fire, tourism, private estates and forest plantations in the reserve. Intervention by managers is essential to offset the ill effects of these.

**BACKGROUND DATA**

In the case of most of our wildlife sanctuaries no accurate basic data exist. The present study though limited in extent will provide data useful for scientific management. Few suggestions are put forward for the management of Periyar, on the light of our study and experience, keeping in mind the facilities available to the managers and limitations imposed by topography, vegetation etc.

## ASPECTS REQUIRING INTERVENTION THROUGH MANAGEMENT

### Fishing in the lake and streams

The Periyar lake is rich in fishes. The amount of fish caught is increasing at a fast rate. Without some kind of regulation, over fishing is very likely to occur within the next few years.

At present it is mostly the tribals evicted from the forest who indulge in fishing. The fish caught goes to the hotels in the nearby town to whom most of the tribals seem to be in monetary debt. This way the hoteliers are able to exploit the tribals. Attempts at banning fishing was not successful basically because the people involved in it do not have alternate means of sustenance. Methods used for fishing include ankling, using dipnets, thrownets, gill nets and using explosives. The last method is resorted to by workers camping inside in connection with work in estates or forest and is the most damaging. Regarding fishery potential the lake and the streams seems to be very rich. The following suggestions are put forth.

i) Only traditional bamboo rafts should be used for fishing

ii) Only Mannans and Paliyas, tribals traditionally engaged in this should be allowed to do the fishing

iii) The fish caught has to be sold only through a co-operative society to be formed and functioned under supervision of local forest officer

Only nets of large pore size should be allowed and a record should be kept of all the fish caught.

Minor forestproduce collection

Important minor forest produce here include camphor, cane, cardamom, honey, thatching grass and cinnamom bark (Plate 19 to 24). At present there is large scale destruc-tion to forests due to illegal collection of these. It is extremely difficult to control entry of people into such a vast area. Collection of honey, cardamom and camphor has not reached an alarming scale yet. Cane collection is very intense and is wiping out the plants from many areas. Cinnamom bark collection is at an alarmingly large scale, in most of the regions all the trees have been debarked, some-times after hacking them down. During summer 1981 a team of as many as 200 people could be observed involved in this. This has risen to such levels mainly because of the feeling of security generated to the poachers through lack of patrol by the protection staff.

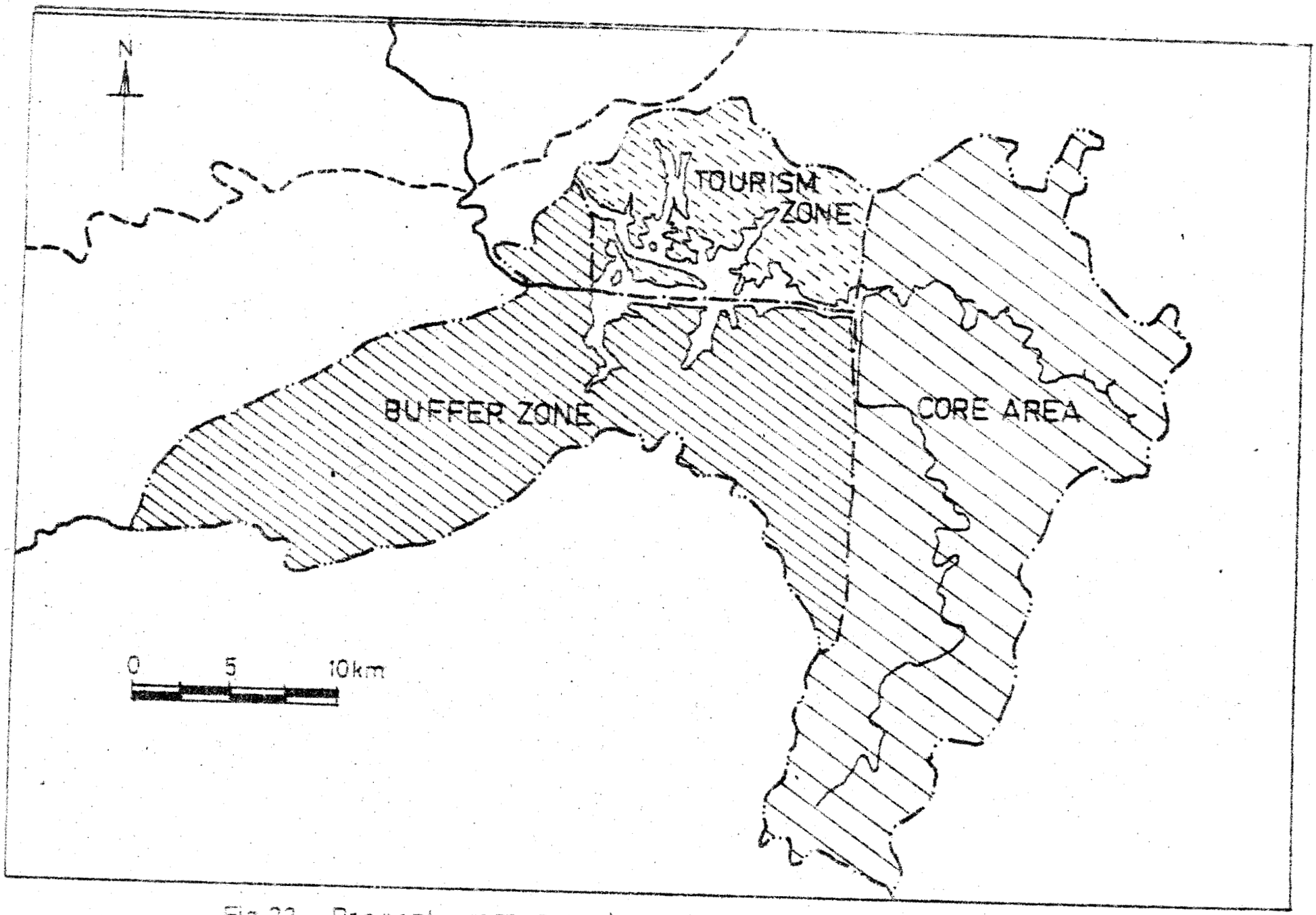
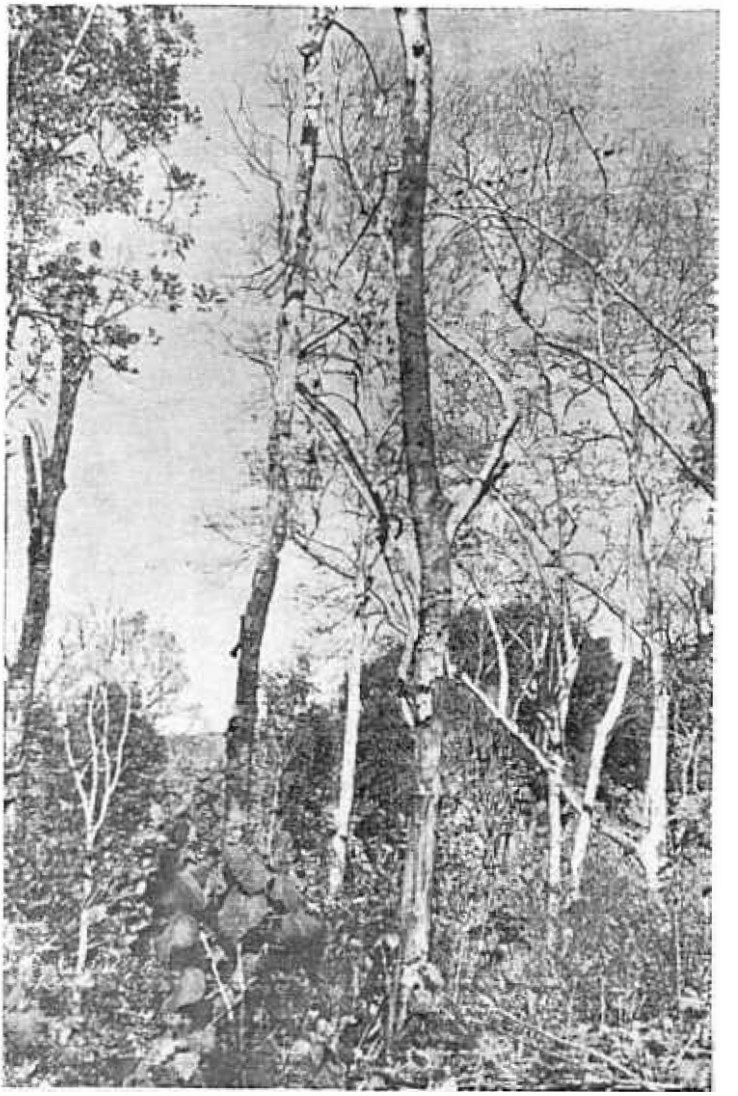



Fig 22 Present management zones of Periyar Tiger Reserve

Plate 19. Cinnamom trees felled for debarking.



Private estates

There are four private estates inside the sanctuary. Eviction of these were one of the prime objectives of the Project Tiger. Lack of continuity of management policy is probably the reason for this inaction, Workers brought to these estates from outside regularly set fire to the forest enroute. There are several estates bordering the reserve (Fig.21).

Habitat management

Water do not seem to be a scarce resource in this high rainfall tract. But construction of ponds in vayals and near tourist bungalows would facilitate better viewing of wild animals.

Almost all the qrassland burn every year. Estate workers, fishermen and minor forest produce collectors set fire to the forest, There is difference of opinion as to how the fires affect forest. While it kills the tree saplings it seems to help tender grass to come up early. It should be examined by detailed studies whether unpalatable grass come up in areas subject to repeated fire, Merits of early burning also need to be subjected to study.

Cattle grazing is not a severe problem yet at Thekkady. About 150 cattle graze near Thekkady and about an equal number

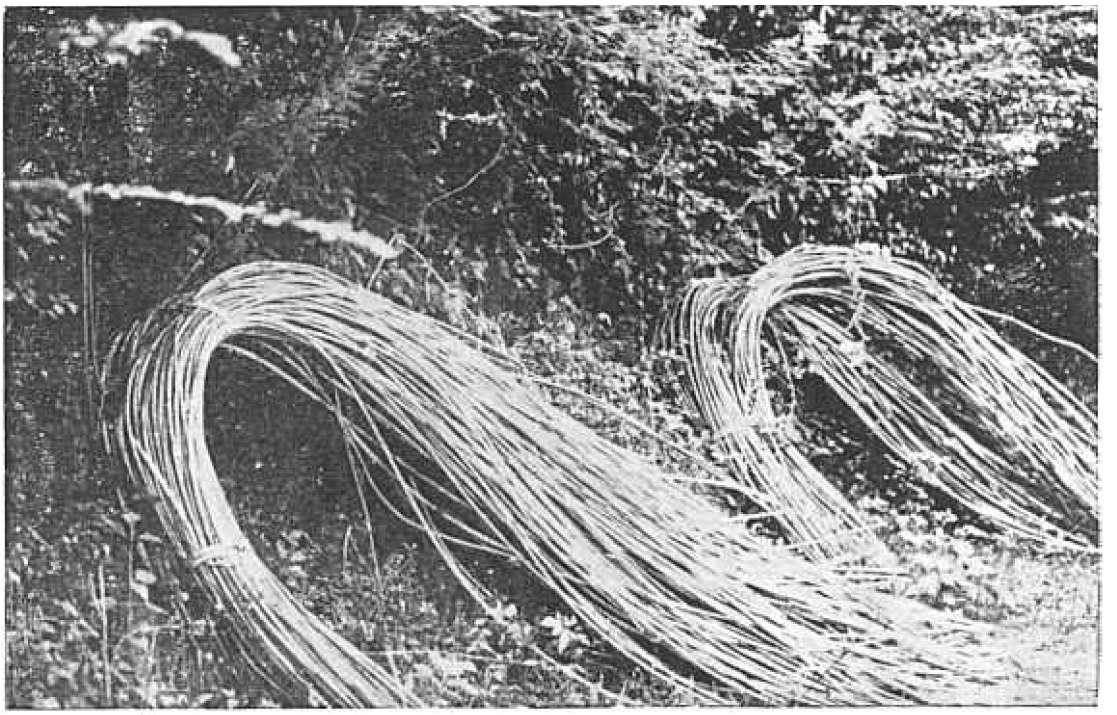


Plate 21. Cane from Shembagavally areas stacked for transportation

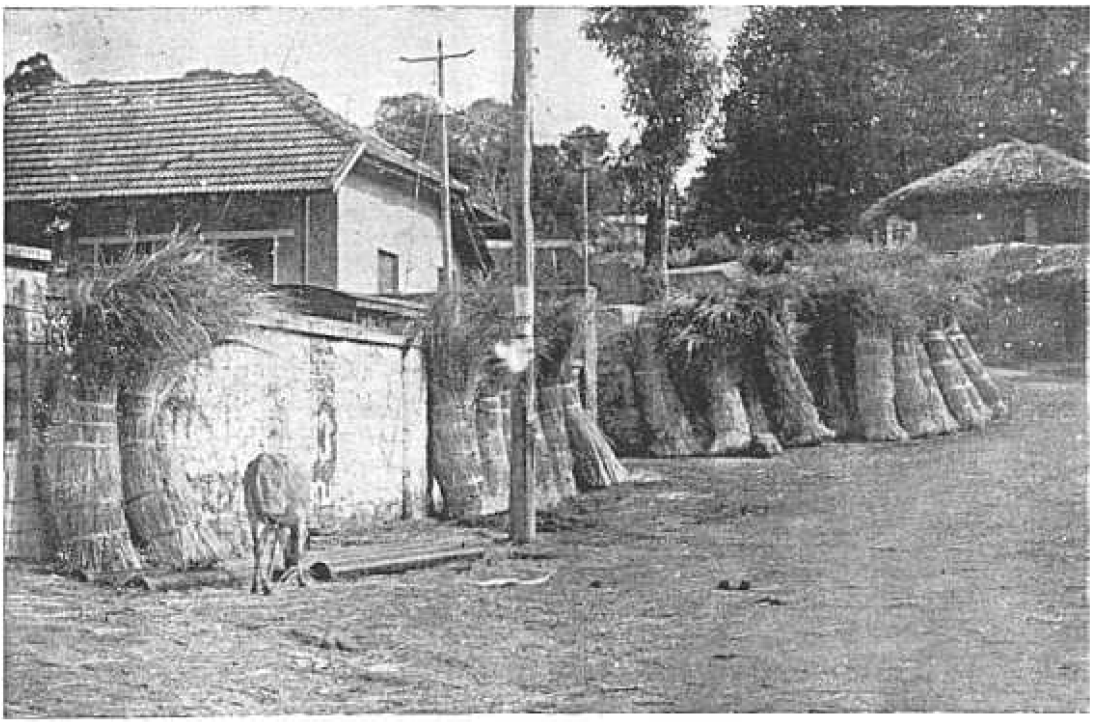


Plate 22. Thatching grass collected from the reserve.

near Vallakkadavu region (Plate 24).

Introduction of plants and animals

Thilapia and some other fish has been introduced in the lake. Attempts were made to introduce spotted deer. This may be worth attempting again under more guarded conditions in deciduous areas like Poovarasu, Thekkady etc. Introduction of crocodiles which are believed to have been present in Periyar into the lake may also be considered. Nilgiri Tahr may be introduced in its earlier range like Varayattumudi.

Forest plantations

The Eucalyptus plantations in the grasslands is largely successful. Fire has done considerable damage to the plantations (Plate 23). There is regeneration of other species of trees in the Eucalyptus plantations. It would be worthwhile to keep some of these plantations without cutting to observe the change in habitat. Its outcome may be valuable, it may be a means for converting grasslands to tree forest.

Tourism

About 50,000 tourists visit Periyar every year. Mostly excursions from schools and colleges. The facilities for viewing animals and staying at Thekkady are inadequate. There is not enough public conveyance between Kumily and Thekkady. The number of boats available are not sufficient. Many boats

are in repair for several months. 'Construction of a road 'of 20-30 kms. along lake edge also may be contemplated. There is scope for introducing several salt licks. Feasibility of constructing a boat channel connecting Edappalayam and Manakkavala should be examined.

F'uelwood

There is heavy demand for fuelwood for the Kumily town. This is at present illegally cut from the forest. We have counted a daily /average of about 80 bundles being braught to the Kumily town. Each bundle weighs about 25 kg. dry weight. Annual loss from the forest to Kumily town alone would be about 750 tonnes of fuelwood, costing about 3 lakhs of rupees at the rate prevalent at Kumily Rs.10/bundle) . Most of this fuelwood goes to the hotels. There are a large number of people making a living in this way. Supplying fuelwood at reasonable cost through government depots would be a practical way of checking this.

Protection of the wild animal

Sambar, Gaur and wild boar are occasionally shot by minor forest produce collectors for meat. Almost alwavs kill of wild- dogs around the lake are snatched away by people. There are incidences of shooting lephants for tusk. This can be prevented only by intense patrolling of forest, The present

practice of camping of changing groups of armed police or forest personnel in bungalows for brief periods for patrolling may do more harm than good. Demonstrated fast access to the problem areas alone may be sufficient to check the activities of the poachers.

Present administrative set up

The Field Director, Project Tiger, is stationed at Kottayam, about 100 kms. away from the reserve. There is a wildlife Preservation Officer, Assistant Field Director and Assistant Wildlife Preservation Officer at Thekkady, In addition to these there is a Range Forest Officer for Project Tiger, Research Range Officer, Flying Squad Range Officer also stationed at Thekkady. The sanctuary is divided into two ranges,Vallakkadavu and Thekkady. Vallakkadavu range is divided into for beats, Sabarimala, Vanchivayal, Moozhikkal and Pamba valley. Thekkady range is divided into five beats, Edappalayam, Thekkady, Kozhikkanam, Medaganam and Melappara Therefore one Guard has to patrol an area of about 100 sq. km. Recently the number of guards have been increased (Fig.21)•

Suggested. chanqes in forest administration

There is at present too large an area under each beat. The Range headquarters are located at Vallakkadavu and Thekkady.

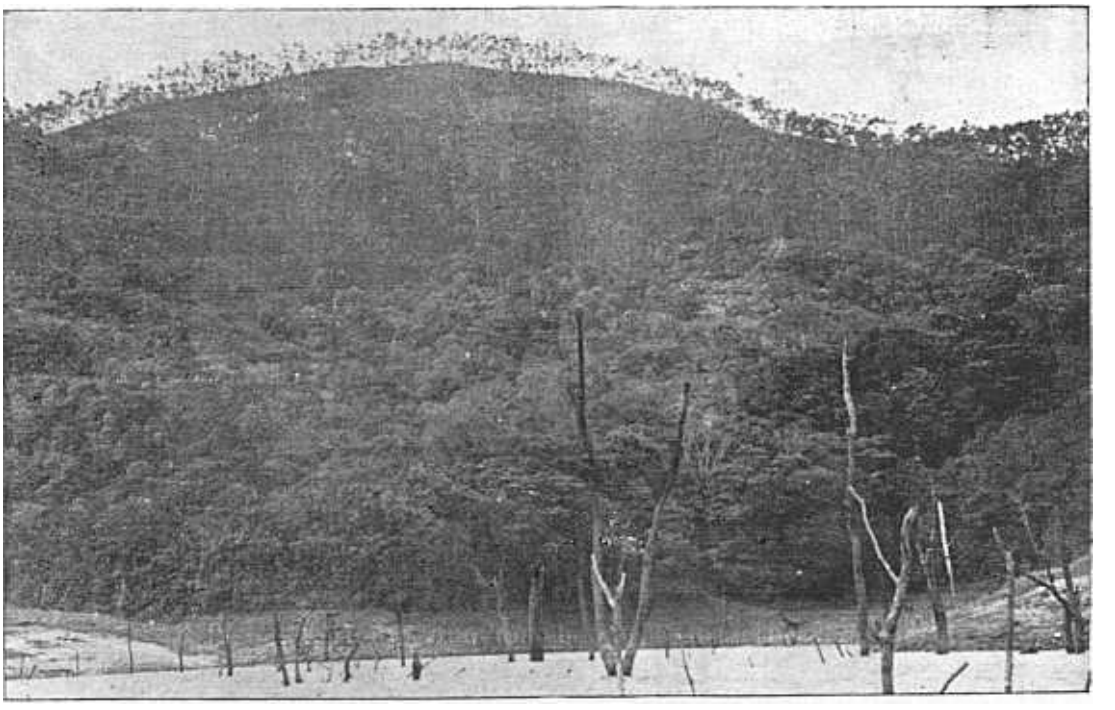


Plate 23 View of *Eucalyptus* plantations on hill top.

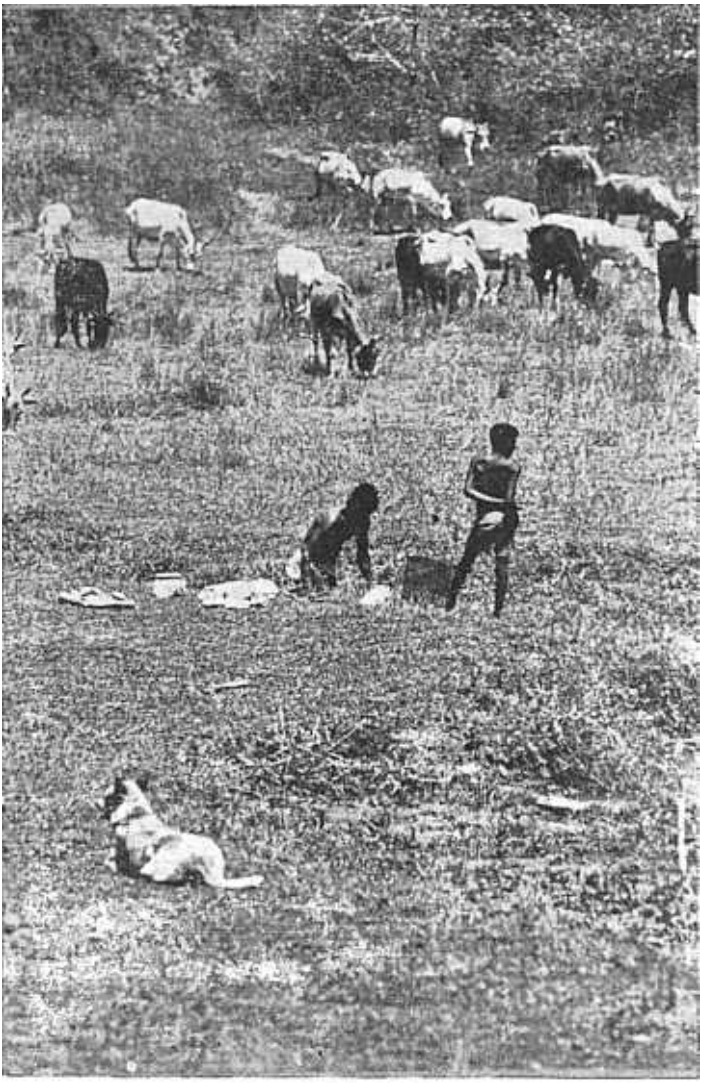


Plate 24. Cattle from Kumily grazing near Thekkady.

The Sabarimala plateau is one range now. We do not know the extent of movement of animals from Thekkady to the Sabarimala region. The question of including more areas or deleting some areas from the sanctuary can be examined on the basis of need for forest continuity. The Thekkady range is about 500 sq. km, in area and has five beats. There are practically no roads inside. The accessibility is limited through the lake.

The concept of division into core area, buffer zone and administrative zone (Nair, 1978) does not seem to have been done properly. The major portion of the present core area is evergreen forest which is well known for its luxurient vegetation but few animals, The Thekkady range can be divided into two regions.

(1) Evergreen forests for management with occasional patrol and less interference without calling it the core area,

(2) Intense management of areas around the lake (Area No.2, Fig. 4) with intense patrolling, construction of roads, bridges etc. This area should be divided into compartments of manageable size and made accessible,

Area No.2 is the most important from view of tourism, animal density and habitat diversity. This region has the maximum amount of disturbances also. Several roads will have to be constructed. But unfortunately the region in question is topographically one of most formidable nature with large perennial rivers. Only black topped roads are durable here because of the heavy rainfall and slope. Thanikudy will have to be connected to Mullakkudy by road and Mlappara can be linked to Thanikudy. Several roads branching from this are essential for effectively patrolling the reserve.

Table 1 Proportion of different classes of individuals in elephant herds of Bandipur, Periyar and Wilpattu

| Location | Total | Calves | Juveniles | Sub adult males | Sub adult female | Adult female | Adult males | Proportion of adult female to young | Proportion of sub-adult male to sub adult female | Proportion of adult male to adult female |
|---|---|---|---|---|---|---|---|---|---|---|
| Bandipur | 238 | 20 (8.4%) | 20 (8.4%) | 20 (8.4%) | 31 (13%) | 132 (55.5%) | 15 (6.3%) | 1:3.5 | 1:1.55 | 1:8.8 |
| Periyar | 380 | 45 (11.8%) | 39 (10.2%) | 28 (7.3%) | 36 (9.5%) | 228 (60.0%) | 4 (1.0%) | 1:2.7 | 1:1.29 | 1:57.0 |
| Wilpattu* | 61 | 4 (7.0%) | 12 (20.0%) | 4 (7.0%) | 11 (18.0%) | 20 (33.0%) | 10 (16.0%) | 1:5 | 1:1.1 | 1:2 |

*Data from Eisenberg and (1972)

Calves = 14 months, Juveniles = 14 to 40 months, Sub adult male = 40 months to 9 years, Sub adult female = 40 months to 7 years, Adult male = 9 years, Adult female = 7 years.

Table 2. Pellet/dung size of different animals

| | Elephant in cm. | Mouse deer in mm. | Barking deer in mm. | Sambar in mm. | Hare in mm. |
|---|---|---|---|---|---|
| 3 | | 3 | | | |
| 4 | 21 | 21 | 4 | | |
| 5 | 4 | 27 | 10 | | |
| 6 | 5 | 2 | 8 | 2 | 3 |
| 7 | 6 | | 6 | 11 | 3 |
| 8 | 14 | | 2 | 10 | 15 |
| 9 | 12 | | 3 | 12 | 27 |
| 10 | 27 | | 1 | 14 | 28 |
| 11 | 32 | | 2 | 53 | 20 |
| 12 | 40 | | | 97 | 13 |
| 13 | 54 | | | 78 | 13 |
| 14 | 55 | | | 88 | 16 |
| 15 | 56 | | | 40 | |
| 16 | 54 | | | 16 | |
| 17 | 12 | | | 5 | |
| 18 | 6 | | | 12 | |
| 19 | | | | 5 | |
| 20 | | | | 2 | |

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APPENDIX I

Description of the sample plots

| Plot NO. | Location | Vegetation | Terrain | Under-growth | Common animals | Biotic disturbance | Other details |
|---|---|---|---|---|---|---|---|
| 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 |
| 1 | Chevlod near Thekkady | Marsh, deciduous | Gentle, slope | Thick, ele. grass | Sambar, Barking deer | Nil | Near Thekkady tourism centre |
| 2 | Panamkala oda | Elephant grass with sparse Terminalia paniculata and teak copices | Crest of a hillock | 2m ele. grass | Slephant, sambar, Gaur and Porcupine | Annual fire, wood cutting | |
| 3 | Kadukkappara | Moist deciduous and elephant grass | Gentle slope near lake edge | Lantana thickets extensive | Sambar, Elephant, Barking deer | Nil | High density sambar deer |

Appendix I contd.

| 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 |
|---|---|---|---|---|---|---|---|
| 4 | Chakkappara | Semi-evergreen | Fairly plain | Lantana & Strobilanthus | Gaur, Elephant, Sambar, Porcupine | Nil | Oneside marsh |
| 5 | Kavalappara | Elephant grass | Gentle slope | Elephant grass | Gaur, Elephant; Hare & Sambar | Annual fire | Heavily grazed by wild animals |
| 6 | Edappalayam | Savannah wood1and | Level ground | Elephant grass 2m | Elephant, Sambar, wildboar | Annual fire | Near tourist bungalow |
| 7 | Kokkarakandam | Marsh & moist deciduous | Level ground | Thickets | Sambar, barking deer, wildboar | Wood cutting, Grazing by cattle | Grazing by cattle |
| 8 | Poovarasu | Elephant grass, few trees | Level ground | | Gaur, elephant | Anual fire | Wood cutting very much disturbed area |

Appendix I contd.. ..

| 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 |
|---|---|---|---|---|---|---|---|
| 9 | Chettichi vayal | Semi–evergreen | Steep slope | Reeds, lantana, grass | Elephant, Sambar | Nil | |
| 10 | Aruvi | Semi–evergreen | Slope | Psychotria profuse regeneration | Elephant, Gaur, Sambar | Nil | Clear Elephant track |
| 11 | Damsite | Elephant grass | Slope | 2m elephant grass | Elephant, Sambar & Porcupine | Annual fire | |
| 12 | Anchuruli | Semi–evergreen | Plain | Lantana, Strobilanthus | Elephant, Sambar, Barking deer and Porcupine | Nil | |
| 13 | Kumarikulam | Short Grass | Slope | Strobilanthus & Phoenix | Elephant, Hare, Sambar, Gaur, Barking deer | | Path to Mullathode poachers route |

Appendix I contd..

| 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 |
|---|---|---|---|---|---|---|---|
| 14 | Vaikapatappu upstream | Semi-evergreen | Gentle slope | Nil | Elephants, Sambar, Gaur | | Cane and Cinnamom collection |
| 15 | Vazhukkappara | Ele. grass Copice of Grewia, Terminalia paniculata, Emblica officinalis | Gentle slope | 2m elephant grass | Elephants, Sambar & Porcupine | Annual fire | |
| 16 | Kathiramudi | Semi-evergreen | Slope | Strobilanthus | Sambar, Barking deer Elephant Wild boar Porcupine | Nil | |
| 17 | Chorakkotta | Semi-evergreen forest & Elephant grass | Slope | Lantana, canes, reeds | Elephant & Sambar | Annual fire on grassland | |

Appendix I contd. ..

| 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 |
|---|---|---|---|---|---|---|---|
| 18 | Palluvachan oda | Elephant grass | Steep slope | Strobilanthus thickets, Phoenix & Pterocarpus trees | Sambar, hare, Elephant | Annual fire | |
| 19 | Mullathode | Semi-evergreen | | | | | Could not be marked. Area too disturbed |
| 20 | Chaverkuzhi | semi-evergreen | Steep slope | Strobilanthus | Sambar, Gaur, Elephant | Nil | Involves climbing about 500 m. to reach the plot |
| 21 | Kattumadumottai | Semi-evergreen | Slope | Cane, reed | Gaur & Sambar | Nil | |
| 22 | Kovilmala | Evergreen | Slope | Strobilanthus and seedlings | Porcupine, barking deer | | |
| 23 | Pandaravara | Semi-evergreen | Slope | Reed thicket cane | Elephant Sambar Barking deer Gaur Porcupine Mouse deer | | |

Appendix I contd.. ..

| 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 |
|---|---|---|---|---|---|---|---|
| 24 | Ottamaram | Semi-evergreen | Crest of a hillock | Lantana thickets | Elephant<br>Sambar<br>Barking deer<br>Gaur<br>Mouse deer<br>Porcupine | | |
| 25 | Chakkumuthy | Evergreen | Slope | Seedlings | Porcupine<br>Barking deer<br>Toddy cat | Nil | Beside Periyar river |
| 26 | Aladi | Evergreen riverine | Slope | | Porcupine<br>Pangolin | Nil | |
| 27 | Arjunankota | Crassland (Failed Eucalyptus plantation | Slope | | | Pilgrims, fire etc. | Near pilgrim route |
| 28 | Emmenkaramala | Semi-evergreen | Slope | Strobilanthus | Elephant | | |

## APPENDIX II

### Avifauna of the reserve

| Sl. No. | Common name | Scientific name | Status* | Migration | No. of species from reserve | From Kerala |
|---|---|---|---|---|---|---|
| 1 | 2 | 3 | 4 | 5 | 6 | 7 |
| | | ORDER PODICIPITIFORMES | | | | |
| 1 | Dabchick | Podiceps ruficollis | R | | 1 | 1 |
| | | ORDER PELECANIFORMES | | | | |
| 2 | Little cormorant | Phalacrocorax niger | N | | | |
| 3 | Indian darter | Anhinga rufa | C | | 2 | 5 |
| | | ORDER CICONIIFORMES | | | | |
| 4 | Eastern grey heron | Ardea cinerea | R | | | |
| 5 | Indian little green bittern | Butorides striatus | R | | | |
| 6 | Indian pond heron | Ardeola grayii | V | | | |

| 1 | 2 | 3 | 4 | 5 | 6 | 7 |
|---|---|---|---|---|---|---|
| 7 | Cattle egret | Bubulcus ibis | C | | | |
| 8 | Eastern large egret | Egretta alba | N | | | |
| 9 | Chestnut bittern | Ixobrychus cinnamomeus | R | | | |
| 10 | Yellow bittern | Ixobrychus sinensis | R | | | |
| 11 | Black bittern | Ixobrychus flavicollis | R | | | |
| 12 | White-necked stork | Ciconia episcopus | R | | 9 | 18 |
| | | ORDER FALCONIFORMES | | | | |
| 13 | Black winged kite | Elanus caeruleus | N | | | |
| 14 | Indian blackcrested baza | Ariceda leuphotes | N | | | |
| 15 | Brahminy kite | Haliastur indus | N | | | |
| 16 | Ceylon shikra | Accipiter badius | N | | | |
| 17 | Black eagle | Ictinaetus malayensis | R | | | |
| 18 | White bellied sea eagle | Haliaeetus leucogaster | R | | | |
| 19 | Grey headed fishing eagle | Ictchyophaga ichthyaetus | N | | | |

Appendix II contd....

| 1 | 2 | 3 | 4 | 5 | 6 | 7 |
|---|---|---|---|---|---|---|
| 20 | King vulture | Sarcogyps calvus | R | | | |
| 21 | Short toed eagle | Circaetus gallicus | R | | | |
| 22 | Crested serpent eagle | Spilornis cheela | C | | | |
| 23 | Osprey | Pandion haliaetus | N | | | |
| 24 | Indian kestrel | Falco tinnunculus | R | M | 12 | 38 |
| | | ORDER GALLIFORMES | | | | |
| 25 | Blue Grey Quail | Coturnix chinensis | R | | | |
| 26 | Jungle bush quail | Perdicula sp. | R | | | |
| 27 | Travancore red spur fowl | Galloperdix spadicea | N | | | |
| 28 | Grey jungle fowl | Gallus sonneratii | V | | | |
| 29 | White breasted water hen | Amaurornis phoenicurus | N | | 5 | 10 |
| | | ORDER CHARADRIIFORMES | | | | |
| 30 | Redwattled lapwing | Vanellus indicus | V | | | |
| 31 | Little ring plover | Charadrius dubius | N | M | | |

| 1 | 2 | 3 | 4 | 5 | 6 | 7 |
|---|---|---|---|---|---|---|
| 32 | Marsh sand piper | Tringa stagnatilis | R | M | | |
| 33 | Common snipe | Gallinago gallinago | R | M | 4 | 49 |
| | | ORDER COLUMBIFORMES | | | | |
| 34 | Southern green pigeon | Treron phoenicoptera | V | L | | |
| 35 | Grey fronted green pigeon | Treron pompadora | V | | | |
| 36 | Jerdon's imperial pigeon | Ducula badia | V | | | |
| 37 | Nilgiri wood pigeon | Columba elphinstonii | V | | | |
| 38 | Indian spotted dove | Streptopelia chinensis | C | | | |
| 39 | Indian emerald dove | Chalcophaps indica | C | | 6 | 12 |
| | | ORDER PSITTACIFORMES | | | | |
| 40 | Rose ringed parakeet | Psittacula krameri | V | | | |
| 41 | Western blossom headed parakeet | Pstittacula cyanocephala | V | | | |

| 1 | 2 | 3 | 4 | 5 | 6 | 7 |
|---|---|---|---|---|---|---|
| 42 | Blue winged parakeet | Psittacula colomboides | V | | | |
| 43 | Malabar lorikeet | Loriculus vernalis | C | | 4 | 5 |
| | | ORDER CUCULIFORMES | | | | |
| 44 | Brain fever bird | Cuculus varius | C | | | |
| 45 | Indian drongo-cuckoo | Surniculus lugubris | N | | | |
| 46 | Indian koel | Eudynamys scolopacea | C | | | |
| 47 | Small green billed malkoha | Rhopodytes viridirostris | N | | | |
| 48 | Southern crow pheasant | Centropus sinensis | C | | | |
| 49 | Lesser coucal | Centropus toulou | R | | 6 | 14 |
| | | ORDER STRIGIFORMES | | | | |
| 50 | Collared scops owl | Otus bakkamoena | N | | | |
| 51 | Indian great horned owl | Bubo bubo | N | | | |
| 52 | Forest eagle owl | Bubo nipalensis | R | | | |

| 1 | 2 | 3 | 4 | 5 | 6 | 7 |
|---|---|---|---|---|---|---|
| 53 | Brown fish owl | Bubo zeylonensis | R | | | |
| 54 | Malabar jungle owlet | Glaucidium radiatum | C | | | |
| 55 | South Indian hawk owl | Ninox scutulata | N | | | |
| 56 | Southern spotted owlet | Athene brama | C | | | |
| 57 | Brown wood owl | Strix leptogrammica | N | | 8 | 13 |
| | | ORDER CAPRIMULGIFORMES | | | | |
| 58 | Indian jungle nightjar | Caprimulgus indicus | C | | | |
| 59 | Common Indian nightjar | Caprimulgus asiaticus | C | L | | |
| 60 | Ceylon frogmouth | Batrachostomus moniliger | R | | 3 | 6 |
| | | ORDER APODIFORMES | | | | |
| 61 | Brown throated spinetail swift | Chaetura gigantea | N | | | |
| 62 | White rumped spinetail swift | Chaetura sylvatica | N | | | |
| 63 | House swift | Apus affinis | R | | | |

| 1 | 2 | 3 | 4 | 5 | 6 | 7 |
|---|---|---|---|---|---|---|
| 64 | Palm swift | Cypsiurus parvus | N | | 4 | 7 |
| | | ORDER TROGONIFORMES | | | | |
| 65 | Malabar trogon | Harpactes fasciatus | N | | 1 | 1 |
| | | ORDER CORACIFORMES | | | | |
| 66 | Travancore pied kingfisher | Ceryle rudis | C | | | |
| 67 | Common ceylon kingfisher | Alcedo atthis | C | | | |
| 68 | Blue eared kingfisher | Alcedo meninting | R | | | |
| 69 | Brownheaded stork-billed kingfisher | Pelargopsis capensis | N | | | |
| 70 | Indian white breasted kingfisher | Halcyon smyrnensis | V | | | |
| 71 | Chestnut headed bee-eater | Merops leschenaulti | C | | | |
| 72 | Small green bee-eater | Merops orientalis | N | | | |
| 73 | Southern Indian roller | Coracias benghalensis | N | | | |
| 74 | Broad billed roller | Eurystomus orientalis | N | | | |

Appendix II contd....

| 1 | 2 | 3 | 4 | 5 | 6 | 7 |
|---|---|---|---|---|---|---|
| 75 | Ceylon hoopoe | Upupa epops | N | | | |
| 76 | Malabar grey hornbill | Tockus griseus | V | | | |
| 77 | Great Indian Hornbill | Buceros bicornis | C | | 12 | 19 |
| | | ORDER PICIFORMES | | | | |
| 78 | Small green barbet | Megalaima viridis | V | | | |
| 79 | Malabar crimson throated barbet | Megalaima rubricapilla | V | | | |
| 80 | Nilgiri speckled piculet | Picumnus innominatus | C | | | |
| 81 | Southern rufous woodpecker | Micropternus brachyurus | C | | | |
| 82 | South Indian small yellow naped woodpecker | Picus chlorolophus | C | | | |
| 83 | Malabar golden backed woodpecker | Dinopium benghalense | V | | | |
| 84 | Malabar black woodpecker | Dryocopus javensis | N | | | |
| 85 | Southern yellow fronted pied woodpecker | Picoides mahrattensis | C | | | |



Appendix II contd....

| 1 | 2 | 3 | 4 | 5 | 6 | 7 |
|---|---|---|---|---|---|---|
| 86 | Malabar pigmy woodpecker | Picoides nanus | N | | | |
| 87 | Heart spotted woodpecker | Hemicircus canente | N | | | |
| 88 | Black backed woodpecker | Chrysocolaptes festivus | R | | 11 | 16 |
| | | ORDER PASSERIFORMES | | | | |
| 89 | Indian pitta | Pitta brachyura | R | M | | |
| 90 | Small Nilgiri Skylark | Alauda gulgula | C | | | |
| 91 | Dusky crag martin | Hirundo concolor | C | | | |
| 92 | Red rumped swallow | Hirundo duarica | C | | | |
| 93 | Southern grey backed shrike | Lanius schach | N | | | |
| 94 | Brown shrike | Lanius cristatus | N | M | | |
| 95 | Indian oriole | Oriolus oriolus | C | | | |
| 96 | South Indian black headed oriole | Oriolus xanthornus | N | | | |

• Appendix II contd....

| 1 | 2 | 3 | 4 | 5 | 6 | 7 |
|---|---|---|---|---|---|---|
| 97 | Black drongo | Dicrurus adsimilis | N | | | |
| 98 | Indian grey drongo | Dicrurus leucophaeus | V | | | |
| 99 | Bronzed drongo | Dicrurus aeneus | C | | | |
| 100 | Large racket tailed drongo | Dicrurus paradiseus | C | | | |
| 101 | Ashy swallow shrike | Artamus fuscus | C | | | |
| 102 | Grey headed myna | Sturnus malabaricus malabaricus | C | L | | |
| 103 | White headed myna | Sturnus malabaricus blythii | C | | | |
| 104 | Brahminy myna | Sturnus pagodarum | N | | | |
| 105 | Rosy pastor | Sturnus roseus | R | | | |
| 106 | Common myna | Acridotheres tristis | V | | | |
| 107 | Southern jungle myna | Acridotheres fuscus | V | | | |
| 108 | Southern grackle | Gracula religiosa | V | | | |
| 109 | Tree pie | Dendrocitta vagabunda | C | | | |
| 110 | Southern tree pie | Dendrocitta leucogastra | C | | | |

Appendix II contd....

| 1 | 2 | 3 | 4 | 5 | 6 | 7 |
|---|---|---|---|---|---|---|
| 111 | Ceylon house crow | Corvus splendens | N | | | |
| 112 | Indian jungle crow | Corvus macrorhynchos | N | | | |
| 113 | Black backed pied fly catcher - shrike | Hemipus picatus | N | | | |
| 114 | Malabar wood shrike | Tephrodornis gularis | C | | | |
| 115 | Indian common wood shrike | Tephrodornis pondicerianus | C | | | |
| 116 | Large Indian cuckoo shrike | Coracina novaehollandiae | C | | | |
| 117 | Black headed cuckoo shrike | Coracina melanoptera | C | | | |
| 118 | Orange minivet | Pericrocotus flammeus | V | | | |
| 119 | Malabar small minivet | Pericrocotus cinnamomeus | V | | | |
| 120 | Ceylon iora | Aegithina tiphia | N | | | |
| 121 | Goldfronted chloropsis | Chloropsis aurifrons | V | | | |
| 122 | Jerdons chloropsis | Chloropsis cochinchinensis | C | | | |
| 123 | Fairy bluebird | Irena puella | C | | | |

Appendix II contd....

| 1 | 2 | 3 | 4 | 5 | 6 | 7 |
|---|---|---|---|---|---|---|
| 124 | Rubythroated bulbul | Pycnonotus melanicterus | C | | | |
| 125 | Southern red-whiskered bulbul | Pycnonotus jocosus | V | | | |
| 126 | Indian redvented bulbul | Pycnonotus cafer | C | | | |
| 127 | Yellow browed bulbul | Hypsipetes indicus | V | | | |
| 128 | South Indian black bulbul | Hypsipetes madagascariensis | V | | | |
| 129 | Travancore spotted babbler | Pellorneum ruficeps | N | | | |
| 130 | Travancore scimitar babbler | Pomatorhinus schisticeps | C | | | |
| 131 | Bourdillon's black headed babbler | Rhopocichla atriceps | C | | | |
| 132 | Rufous babbler | Turdoides subrufus | C | | | |
| 133 | Malabar jungle babbler | Turdoides striatus | V | | | |
| 134 | Wynad laughing thrush | Garrulax delesserti | N | | | |
| 135 | Blanforest laughing thrush | Garrulax jerodoni meridionale | N | | | |

Appendix II contd....

| 1 | 2 | 3 | 4 | 5 | 6 | 7 |
|---|---|---|---|---|---|---|
| 136 | Nilgiri quakker babbler | Alcippe poioicephala | V | | | |
| 137 | Brown fly catcher | Muscicapa latirostris | N | | | |
| 138 | Eastern redbreasted flycatcher | Muscicapa parva | R | M | | |
| 139 | White bellied blue flycatcher | Muscicapa pallipes | N | | | |
| 140 | Blue throated fly catcher | Muscicapa rubeculoides | N | M | | |
| 141 | Tickell's blue flycatcher | Muscicapa tickelliae | N | | | |
| 142 | Grey headed flycatcher | Culicicapa ceylonensis | N | | | |
| 143 | Southern whitebrowed fantail flycatcher | Rhipidura aureola | N | | | |
| 144 | Paradise flycatcher | Terpsiphone paradisi | C | | | |
| 145 | Indian blacknaped blue flycatcher | Monarcha azurea | N | | | |
| 146 | Travancore streaked fantail warbler | Cisticola juncidis | N | | | |

Appendix II contd....

| 1 | 2 | 3 | 4 | 5 | 6 | 7 |
|---|---|---|---|---|---|---|
| 147 | Coorg wren - warbler | Prinia hodgsonii | N | | | |
| 148 | Nilgiri wren-warbler | Prinia subflava | N | | | |
| 149 | Tailor bird | Orthotomus sutorius | N | | | |
| 150 | Indian great reed warbler | Acrocephalus stentoreus | R | | | |
| 151 | Blyth's reed warbler | Acrocephalus dumetorum | N | M | | |
| 152 | Large billed leaf warbler | Phylloscopus magnirostris | C | M | | |
| 153 | Greenish leaf warbler | Phylloscopus trochiloides | C | M | | |
| 154 | Southern magpie robin | Copsychus saularis | N | | | |
| 155 | Nilgiri pied Bushchat | Saxicola caprata | N | | | |
| 156 | South Indian black backed robin | Saxicoloides fulicata | R | | | |
| 157 | Malabar whistling thrush | Myiophonus horsfieldii | C | | | |
| 158 | White throated ground thrush | Zoothera citrina cyanotus | N | | | |
| 159 | Black bird | Turdus merula | N | | | |

Appendix II contd....

| 1 | 2 | 3 | 4 | 5 | 6 | 7 |
|---|---|---|---|---|---|---|
| 160 | Indian grey tit | Parus major | C | | | |
| 161 | Travancore yellow cheeked tit | Parus xanthogenys | N | | | |
| 162 | Velvet fronted nuthatch | Sitta frontalis | C | | | |
| 163 | Richard's pipit | Anthus novaeseelandiae | C | M | | |
| 164 | Forest wagtail | Motacilla indica | R | M | | |
| 165 | Yellow wagtail | Motacilla flava | N | M | | |
| 166 | Grey wagtail | Motacilla caspica | C | M | | |
| 167 | Large pied wagtail | Motacilla maderaspatensis | N | | | |
| 168 | Thick billed flower-pecker | Dicaeum agile | C | | | |
| 169 | Tickelle's flower-pecker | Dicaeum erythrorhynchos | C | | | |
| 170 | Nilgiri flowerpecker | Dicaeum concolor | N | | | |
| 171 | Indian purple rumped sunbird | Nectarinia zeylonica | N | | | |

Appendix II contd....

| 1 | 2 | 3 | 4 | 5 | 6 | 7 |
|---|---|---|---|---|---|---|
| 172 | Small sunbird | Nectarinia minima | C | | | |
| 173 | Loten's sunbird | Nectarinia lotenia | C | | | |
| 174 | Indian purple sunbird | Nectarinia asiatica | C | | | |
| 175 | Little spider hunter | Arachnothera longirostris | N | | | |
| 176 | Nilgiri white-eye | Zosterops palpebrosa | C | | | |
| 177 | Indian house sparrow | Passer domesticus | R | | | |
| 178 | White throated munia | Lonchura malabarica | N | | | |
| 179 | Rufous bellied munia | Lonchura kelaarti | N | | | |
| 180 | Black headed munia | Lonchura malacca | N | | | |
| 181 | Common Indian rosefinch | Carpodacus erythrinus | C | M | 93 | 156 |

* R = Rare; C = Common; V = Very common; N = Not common; M = Migratory; L = Local migrant

## APPENDIX III-A

### Sightings of elephants

| Sl. No. | Date | Location | Total | Details of elephant herd+ | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | | | Calves | Juveniles | Males | | Females | |
| | | | | | | S. Adult | Adult | S. Adult | Adult |
| 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 |
| 1 | 29-10-77 | Chevalod | 19 | | | | | | |
| 2 | 31-10-77 | Dam site | 10 | | | | | | |
| 3 | 1-11-77 | Deer Island | 5 | | | | | | |
| 4 | 2-11-77 | Deer Island | 24 | | | | | | |
| 5 | 3-11-77 | Thanikudy | 6 | | | | | | |
| 6 | 3-11-77 | Thanikudy | 27 | | | | | | |
| 7 | 7-11-77 | Karadiallu | 1 | | | | 1 | | |
| 8 | 10-11-77 | Anchuruli | 1 | | | | 1 | | |
| 9 | 10-11-77 | Edappalayam | 6 | | | | | | |
| 10 | 25-01-78 | Boat landing | 5 | | | | 1 | 2 | 2 |
| 11 | 28-01-78 | Padikkayam | 18 | 3 | | | 1 | 2 | 12 |
| 12 | 30-01-78 | Kadukkappara | 7 | | | | | | |
| 13 | 30-01-78 | Padikayam | 15 | 3 | | | | 2 | 4 |
| 14 | 30-01-78 | Edappalayam | 11 | | | | | | |

| 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 |
|---|---|---|---|---|---|---|---|---|---|
| 15 | 06-02-78 | Panamkal | 60 | 1 | - | 4 | 1 | - | - |
| 16 | 08-02-78 | Thampuranthuruthu | 36 | | | | 2 | | |
| 17 | 10-02-78 | Thampuranthuruthu | 17 | 4 | | 1 | | | |
| 18 | 07-03-78 | Mullakkudy | 10 | | | | 1 | | |
| 19 | 11-03-78 | Mullathode | 17 | | | | | | |
| 20 | 13-03-78 | Mullakkudy | 1 | | | | 1 | | |
| 21 | 14-03-78 | Palkachimala | 10 | 2 | | | | | |
| 22 | 17-03-78 | Deer Island | 49 | 6 | | 2 | | 7 | |
| 23 | 19-03-78 | Mullakkudy | 29 | 5 | | 1 | | 2 | |
| 24 | 20-03-78 | Navikayam | 10 | | | | | | |
| 25 | 21-03-78 | Ottamaram | 9 | 2 | | | 1 | | |
| 26 | 23-03-78 | Navikayam | 3 | | | | 2 | | |
| 27 | 24-03-78 | Swamikayam | 24 | 3 | | | | | |
| 28 | 30-03-78 | Mangaladevi | 28 | | | 1 | 1 | | |
| 29 | 01-04-78 | Ummikuppan | 17 | | | | | - | |
| 30 | 02-04-78 | Vaikapatappu | 6 | | | | | | |
| 31 | 06-04-78 | Murikadikayam | 4 | | | | | | |
| 32 | 06-04-78 | Karian oda | 8 | 2 | | | 1 | | |
| 33 | 07-04-78 | Thanikudy | 12 | 4 | | | | | |

| 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 |
|---|---|---|---|---|---|---|---|---|---|
| 34 | 07-04-78 | Chorakkotta | 8 | 2 | | | 1 | | |
| 35 | 13-05-78 | Vakilalayan | 3 | | | | | | |
| 36 | 19-05-78 | Lakshmipara | 10 | 2 | | | | | 8 |
| 37 | 05-06-78 | Arali oda | 8 | | 4 | | 1 | | 3 |
| 38 | 05-06-78 | Kozhikanam | 6 | 1 | | | | 2 | 3 |
| 39 | 15-06-78 | Valiyamedu | 10 | 1 | | | | 1 | 5 |
| 40 | 13-02-79* | Boatlanding | 6 | | | | | 3 | 3 |
| 41 | 13-02-79 | Paravalavu | 2 | | | | | | |
| 42 | 02-03-79 | Paravalavu | 4 | | | | | | |
| 43 | 15-03-79 | Edappalayam | 1 | | | 1 | | | |
| 44 | 16-03-79* | Roadkadavu | 2 | | | | | 1 | 1 |
| 45 | 29-03-79* | Mullakkudy | 26 | 6 | | | 2 | | 18 |
| 46 | 05-04-79 | Ummikuppan oda | 1 | | | | 1 | | |
| 47 | 08-04-79 | Ummikkuppan oda | 7 | | | | | | |
| 48 | 10-05-79* | Manakkavala | 19 | | 3 | 4 | | | 12 |
| 49 | 14-05-79 | Thuripara oda | 7 | | | | | | |
| 50 | 14-05-79* | Paravalavu | 9 | 1 | | 1 | | 1 | 6 |
| 51 | 14-05-79 | Mullakkudy | 1 | | | | 1 | | |
| 52 | 14-05-79 | Deer Island | 1 | | | | 1 | | |
| 53 | 24-05-79 | Thuriparamoola | | | | | | | |

Appendix III-A contd....

| 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 |
|---|---|---|---|---|---|---|---|---|---|
| 54 | 02-06-79 | Padikkayam | 1 | | | | 1 | | |
| 55 | 03-06-79 | Manakkavala | 4 | | | 1 | | | 2+1 |
| 56 | 03-06-79* | Manakkavala | 9 | 1 | | 1 | | 3 | 4 |
| 57 | 03-06-79 | Manakkavala | 12 | | | | | | |
| 58 | 08-06-79 | Valiathuruthu | 18 | | | | | | |
| 59 | 08-06-79 | Poovarasu | 2 | | | | | | |
| 60 | 09-06-79 | Manakkavala | | | | | 1 | | |
| 61 | 22-07-79 | Nellikkampatti | 12 | | | | | | |
| 62 | 23-07-79 | Nellikkampatti | 3 | | | | | | |
| 63 | 25-07-79 | Thozhumoola | 1 | | | | 1 | | |
| 64 | 25-07-79 | Manakkavala | | | | 2 | | | |
| 65 | 14-08-79 | Edappalayam | 3 | | | | | | |
| 66 | 14-08-79 | Chakkappara | 2 | | | | | 1 | 1 |
| 67 | 14-08-79 | Kavalapara | 1 | | | | 1 | | |
| 68 | 26-10-79 | Kathiramudi | 10 | | | | | | |
| 69 | 26-10-79 | Thanikudy | 10 | | | | | | |
| 70 | 27-10-79* | Thanikudy | 5 | | | 1 | | 1 | 3 |
| 71 | 27-10-79* | Thanikudy | 28 | | | 1 | 1 | 2 | |
| 72 | 28-10-79 | Kumarikulam | 33 | | | | | | |

Appendix III-A contd....

| 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 |
|---|---|---|---|---|---|---|---|---|---|
| 73 | 18-12-79* | Edappalayam | 6 | | | | | 2 | 3+1 |
| 74 | 29-12-79 | Koyaguthotti | 19 | | | 4 | | | |
| 75 | 12-01-80 | Edappalayam | 11 | | | | | | |
| 76 | 16-02-80 | Road kadavu | 2 | | | | | 1 | 1 |
| 77 | 22-02-80 | Chevlod | 3 | | | | | 1 | 2 |
| 78 | 15-10-80 | Mangaladevi | 5 | | | | | | |
| 79 | 15-10-80 | Nellikkampatti | 5 | 2 | | | | | 3 |
| 80 | 23-11-80* | Thanikudy | 7 | 1 | 3 | | | | 3 |
| 81 | 02-12-80 | Ummikkuppan | 12 | | | | | | |
| 82 | 14-11-80* | Thanikudy | 12 | 2 | 1+3 | 1 | | | 5 |
| 83 | 16-12-80* | Mullakudy | 7 | 1 | 2 | | | | 4 |
| 84 | 16-12-80* | Edappalayam | 9 | 1 | 1 | | | 1 | 6 |
| 85 | 27-12-80* | Edappalayam | 5 | | 2 | 1 | | | 2 |
| 86 | 27-12-80* | Edappalayam | 7 | 1 | 2 | | | | 4 |
| 87 | 27-12-80* | Mullakudy | 11 | 1 | 3 | 1 | | | 6 |
| 88 | 29-12-80* | Mullakudy | 3 | 1 | | | | | 2 |
| 89 | 29-12-80 | Mullakudy | 20 | | | | | | |
| 90 | 01-01-81* | Mullakudy | 3 | | 1 | | | | 2 |
| 91 | 01-01-81 | Mullakudy | 12 | | | 1 | | | |

| 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 |
|---|---|---|---|---|---|---|---|---|---|
| 92 | 28-01-81* | Edappalayam | 4 | 1 | | | | | 3 |
| 93 | 28-01-81* | Edappalayam | 7 | 1 | | | | 1 | 5 |
| 94 | 29-01-81* | Padikkayam | 4 | 1 | | | | | 3 |
| 95 | 29-01-81* | Kozhippara | 3 | | 1 | | | | 2 |
| 96 | 29-01-81* | Manakkavala | 10 | 1 | | 2 | | 1 | 6 |
| 97 | 04-02-81* | Paravalavu | 6 | | | 1 | | 1 | 4 |
| 98 | 24-03-81 | Manakkavala | 6 | 2 | | | | | 4 |
| 99 | 24-03-81* | Karadippara | 12 | 2 | 1 | 2 | | | 7 |
| 100 | 27-03-81 | Deer Island | 19 | | | 2 | | | |
| 101 | 06-04-81* | Manakkavala | 12 | 3 | | 1 | | | 8 |
| 102 | 06-04-81* | Manakkavala | 14 | 5 | | 2 | | 2 | 5 |
| 103 | 09-04-81 | Thuripara | 1 | | | | 1 | | |
| 104 | 17-04-81 | Paravalavu | 32 | | | | | | |
| 105 | 22-04-81* | Karadikkavala | 11 | 3 | 1 | | | 1 | 6 |
| 106 | 22-04-81* | Karadikkavala | 10 | | 2 | 1 | | 1 | 6 |
| 107 | 24-04-81 | Paravalavu | 3 | | | 1 | | | 2 |
| 108 | 24-04-81 | Paravalavu | 10 | 1 | 2 | 3 | | | 4 |
| 109 | 24-04-81 | Deer Island | 23 | 3 | 1 | 2 | 1 | 3 | 13 |
| 110 | 26-04-81* | Paravalavu | 11 | | 6 | | | 1 | 4 |
| 111 | 27-04-81* | Dam site | 5 | 1 | | | | 1 | 3 |
| 112 | 13-05-81 | Edappalayam | 5 | | | | | | |

| 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 |
|---|---|---|---|---|---|---|---|---|---|
| 113 | 15-05-81 | Edappalayam | 20 | | | | | | |
| 114 | 15-05-81 | Edappalayam | 1 | | | | | | |
| 115 | 15-05-81 | Ayyappankurukku | 6 | 2 | | | | | 4 |
| 116 | 18-08-81 | Poovarasu | 3 | | | | | | |
| 117 | 19-08-81 | Edappalayam | 3 | 1 | | | | | 2 |
| 118 | 02-10-81* | Kavalappara | 7 | 1 | | | | 2 | 4 |
| 119 | 02-10-81 | Padikkayam | 1 | | | | 1 | | |
| 120 | 02-10-81 | Mullakkudy | 4 | | | | | | |
| 121 | 02-10-81 | Pandaravara | 3 | 1 | | | | | 2 |
| 122 | 15-10-81* | Manakkavala | 3 | | 1 | | | | 2 |
| 123 | 15-10-81* | Deer Island | 5 | | 1 | | | 1 | 3 |
| 124 | 15-10-81* | Kavalapara | 20 | 1 | 1 | | | 5 | 13 |
| 125 | 15-10-81 | Dam site | 7 | | | | | | |
| 126 | 16-10-81 | Kavalapara | | | | | | | |
| 127 | 20-10-81* | Paravalavu | 7 | 1 | 1 | 1 | | | 4 |
| 128 | 20-10-81 | Ayyappankurukku | 1 | | | | 1 | | |
| 129 | 06-02-82 | Deer Island | 3 | | | | | | |
| 130 | 08-02-82 | Ayyappankurukku | 11 | | | | | | |
| 131 | 08-02-82 | Manakkavala | 3 | | 1 | | | | 2 |
| 132 | 08-02-82 | Kadukkappara | 5 | | | | | | |
| 133 | 08-02-82 | Chettichivayal | 7 | | | | | | |
| 134 | 08-02-82 | Chettichivayal | 1 | | | | | | |

APPENDIX III-B

Sightings of Gaur

| Sl. No. | Date | Location | No. of individuals | Details |
|---|---|---|---|---|
| 1 | 2 | 3 | 4 | 5 |
| 1 | 29-10-77 | Manakkavala padam | 16 | |
| 2 | 11-02-78 | Near Edappalayam R.H. | 8 | |
| 3 | 21-03-78 | Opposite Mullakkudi R.H. | 1 | Adult bull |
| 4 | 24-03-78 | Kakka oali | 7 | One adult bull |
| 5 | 06-04-78 | Ummikuppan kanam | 1 | Bull |
| 6 | 09-04-78 | Opposite Thanikudy R.H. | 18 | Five calves |
| 7 | 04-06-79 | Chorakotta oada | 1 | Bull |
| 8 | 12-06-79 | Ponparamalai | 22 | One small calf, two bulls |
| 9 | 24-07-79 | Koonamavu | 13 | Three calves, Two bulls |
| 10 | 04-10-79 | Samiyar oada | 5 | |
| 11 | 29-12-79 | Opposite Deer Island | 1 | Bull |
| 12 | 27-11-80 | Kattumadumottai | 10 | One calf |
| 13 | 12-03-80 | Opposite Manakkavala R.H. | 13 | One small calf |
| 14 | 16-10-81 | Kavalappara mala | 2 | |

Appendix III-B contd....

APPENDIX III-C

Sightings of Sambar

| Sl. No. | Date | Location | No. of individuals | Details |
|---|---|---|---|---|
| 1 | 2 | 3 | 4 | 5 |
| 1 | 28-10-1977 | Nellikkampatti | 3 | Two does |
| 2 | 28-10-1977 | Chevlod thodu | 1 | |
| 3 | 29-10-1977 | Chevlod thuruthu | 5 | |
| 4 | 31-10-1977 | Dam site | 2 | |
| 5 | 02-11-1977 | Paravalavu | 6 | Five stags |
| 6 | 03-11-1977 | Near Thanikudy R.H. | 1 | Doe |
| 7 | 03-11-1977 | Chennaippara | 4 | One stag |
| 8 | 08-11-1977 | Manakkavale machan | 2 | |
| 9 | 09-11-1977 | Manakkavala | 2 | One stag |
| 10 | 30-01-1978 | Chakkappara | 2 | Stags |
| 11 | 10-03-1978 | Swamikayam | 1 | Doe |
| 12 | 17-03-1978 | Near Padikkayam | 1 | Stag |
| 13 | 23-03-1978 | Kotta kurakkal area | 5 | |

| 1 | 2 | 3 | 4 | 5 |
|---|---|---|---|---|
| 14 | 26-03-1978 | Medakanam oada | 1 | |
| 15 | 29-03-1978 | Near deer island | 3 | Two stags |
| 16 | 01-04-1978 | Near Thanikudy R.H. | 1 | Doe |
| 17 | 03-04-1978 | Opposite Thanikudy machan | 1 | Doe |
| 18 | 05-04-1978 | Kumarikavu malai | 1 | |
| 19 | 06-04-1978 | Near Murukkadikayam kanam | 1 | Stag |
| 20 | 07-04-1978 | Thanikudy machan area | 1 | |
| 21 | 19-05-1978 | Pudukkad | 2 | One stag |
| 22 | 06-06-1978 | Eucalyptus plantation (1962) | 10 | Seven does and Three fawns |
| 23 | 13-06-1978 | Near Inchimalai | 1 | |
| 24 | 15-06-1978 | Uralkuzhy theertham top | 1 | Doe |
| 25 | 16-02-1979 | Deer Island | 1 | Stag |
| 26 | 02-03-1979 | Dam site (near) | 1 | Stag, velvet |
| 27 | 02-03-1979 | Opposite Cruzo Island | 10 | |
| 28 | 15-03-1979 | Edappalayam | 2 | One doe |
| 29 | 06-04-1979 | Thanikudy mala | 1 | Doe |
| 30 | 06-04-1979 | Near Thanikudy machan | 1 | |
| 31 | 06-04-1979 | Near Thanikudy machan | 1 | Stag |
| 32 | 05-05-1979 | Aruvithodu | 3 | |



Appendix III-C contd....

| 1 | 2 | 3 | 4 | 5 |
|---|---|---|---|---|
| 33 | 14-05-1979 | Deer Island | 1 | |
| 34 | 15-05-1979 | Deer Island | 2 | One hard antler, One velvet |
| 35 | 03-06-1979 | Thanikudy | 8 | |
| 36 | 04-06-1979 | Chorakotta | 2 | |
| 37 | 11-06-1979 | Thanikudy | 3 | |
| 38 | 11-06-1979 | Ponparamalai | 1 | |
| 39 | 23-10-1979 | Kadukkappara kanam | 1 | Doe |
| 40 | 29-10-1979 | Thoothipara | 1 | |
| 41 | 07-06-1979 | Manakkavala | 3 | One stag |
| 42 | 10-06-1979 | Manakkavala | 2 | |
| 43 | 26-06-1979 | Manakkavala | 5 | |
| 44 | 26-06-1979 | Manakkavala | 6 | |
| 45 | 14-08-1979 | Kavalappara mala | 1 | Stag |
| 46 | 04-10-1979 | Moonnamthuruthu | 3 | Stags |
| 47 | 04-10-1979 | Moonnamthuruthu | 2 | One doe One yearling |
| 48 | 04-10-1979 | Valia thuruthu | 3 | One doe Two fawns |
| 49 | 23-10-1979 | Moonnamthuruthu | 3 | Stags |
| 50 | 25-10-1979 | Near Machan, Thanikudy | 1 | Doe |

| 1 | 2 | 3 | 4 | 5 |
|---|---|---|---|---|
| 51 | 25-10-1979 | Near Nachan, Thanikudy | 1 | |
| 52 | 25-10-1979 | Near Nachan, Thanikudy | 2 | One stag |
| 53 | 26-10-1979 | Thanikudy | 1 | Doe |
| 54 | 26-10-1979 | Thanikudy | 2 | One stag |
| 55 | 27-10-1979 | Thanikudy | 1 | |
| 56 | 27-10-1979 | Thanikudy | 1 | |
| 57 | 28-10-1979 | Pothamperi mala | 2 | One doe |
| 58 | 28-10-1979 | Thanikudy malai | 1 | Male |
| 59 | 28-10-1979 | Thanikudy malai | 4 | Does |
| 60 | 28-10-1979 | Thanikudy malai | 1 | Doe |
| 61 | 19-06-1980 | Sankaran kovil | 1 | |
| 62 | 08-10-1980 | Chevlod | 1 | |
| 63 | 08-10-1980 | Near Boatlanding | 4 | Does |
| 64 | 14-10-1980 | Chevlod | 1 | |
| 65 | 17-11-1980 | Thanikudy malai | 1 | Doe |
| 66 | 18-11-1980 | Kathiramudi | 1 | Stag |
| 67 | 18-11-1980 | Thanikudy | 1 | Doe |
| 68 | 18-11-1980 | Ummikuppanmala | 3 | Does |

| 1 | 2 | 3 | 4 | 5 |
|---|---|---|---|---|
| 69 | 18-11-1980 | Kathiramudi | 4 | |
| 70 | 19-11-1980 | Vakilalayan mala | 1 | Doe |
| 71 | 19-11-1980 | Palluvachanoda | 1 | Doe |
| 72 | 19-11-1980 | Thanikudy | 1 | Doe |
| 73 | 20-11-1980 | Ummikuppan malai | 3 | |
| 74 | 20-11-1980 | Ummikuppan malai | 4 | |
| 75 | 21-11-1980 | Ummikuppan malai | 6 | |
| 76 | 23-11-1980 | Thanikudy | 3 | |
| 77 | 12-12-1980 | Chaverkuzhy mala | 2 | One stag |
| 78 | 14-12-1980 | Near Chaverkuzhy mala | 1 | Stag |
| 79 | 29-12-1980 | Padikkayam | 1 | Doe |
| 80 | 02-03-1981 | Mullakkudi | 1 | |
| 81 | 24-03-1981 | Opposite Thuripara | 5 | |
| 82 | 27-03-1981 | Opposite Thurippara oali | 2 | Doe |
| 83 | 11-06-1981 | Opposite Savithri munni | 1 | Stag |
| 84 | 17-08-1981 | Arjunankota | 2 | |
| 85 | 19-10-1981 | Near Savithri munni | 1 | |

APPENDIX III-D

Sightings of Wild boar

| Sl. No. | Date | Location | No. of individuals | Details |
|---|---|---|---|---|
| 1 | 2 | 3 | 4 | 5 |
| 1 | 28-10-1977 | Chevlod | 14 | |
| 2 | 29-10-1977 | Chevlod | 14 | |
| 3 | 30-10-1977 | Edappalayam | 2 | |
| 4 | 07-11-1977 | Manakkavala padam | 11 | |
| 5 | 08-11-1977 | Manakkavala machan | 23 | |
| 6 | 09-11-1977 | Manakkavala | 21 | |
| 7 | 25-01-1978 | Thekkady | 20 | |
| 8 | 28-01-1978 | Padikkayam | 45 | |
| 9 | 30-01-1978 | Padikkayam | 45 | |
| 10 | 30-01-1978 | Chakkappara area | 28 | |
| 11 | 06-02-1978 | Nellikkampatti | 40 | |
| 12 | 08-03-1978 | Medakanam road | 22 | |
| 13 | 10-03-1978 | Swamikayam | 1 | |

| 1 | 2 | 3 | 4 | 5 |
|---|---|---|---|---|
| 14 | 11-03-1978 | Mullathode | 31 | |
| 15 | 20-03-1978 | Chennaipara oali | 1 | |
| 16 | 20-03-1978 | Near Crusoe Island | 8 | |
| 17 | 29-03-1978 | Near Deer Island | 37 | |
| 18 | 29-03-1978 | Near Kadukkappara | 2 | |
| 19 | 22-05-1978 | Near Melappara | 1 | |
| 20 | 05-06-1978 | Kozhikkanam road | 1 | |
| 21 | 05-06-1978 | Uppupara | 1 | |
| 22 | 16-02-1979 | Deer Island | 1 | |
| 23 | 02-03-1979 | Kakka oada | 8 | |
| 24 | 15-03-1979 | Edappalayam | 1 | |
| 25 | 15-03-1979 | Edappalayam | 1 | |
| 26 | 02-04-1979 | Mullakkudi | 13 | |
| 27 | 10-05-1979 | Chevlod | 29 | |
| 28 | 06-06-1979 | Manakkavala | 8 | |
| 29 | 06-06-1979 | Manakkavala | 8 | |
| 30 | 07-06-1979 | Manakkavala | 7 | |
| 31 | 07-06-1979 | Manakkavala | 10 | |
| 32 | 12-06-1979 | Manakkavala | 3 | One feeding on Ophiocephalus fish |

Appendix III-D contd....

| 1 | 2 | 3 | 4 | 5 |
|---|---|---|---|---|
| 33 | 12-06-1979 | Manakkavala | 8 | |
| 34 | 13-06-1979 | Manakkavala | 1 | |
| 35 | 22-07-1979 | Manakkavala | 1 | |
| 36 | 23-07-1979 | Manakkavala | 1 | |
| 37 | 24-07-1979 | Manakkavala | 10 | |
| 38 | 25-07-1979 | Thozhumoola | 11 | |
| 39 | 25-07-1979 | Thozhumoola | 1 | |
| 40 | 26-07-1979 | Manakkavala | 10 | |
| 41 | 14-08-1979 | Thuripara oali | 20 | |
| 42 | 04-10-1979 | Manakkavala | 1 | |
| 43 | 04-10-1979 | Kadukkappara | 2 | |
| 44 | 04-10-1979 | Kadukkappara | 3 | |
| 45 | 29-10-1979 | Edappalayam | | |
| 46 | 29-10-1979 | Manakkavala | 1 | |
| 47 | 20-12-1979 | Kadukkappara | 6 | |
| 48 | 20-12-1979 | Kadukkappara | 1 | |
| 49 | 29-12-1979 | Near Thuripara | 1 | |
| 50 | 29-12-1979 | Manakkavala | 6 | |
| 51 | 29-12-1979 | Manakkavala | 6 | |



Appendix III-D contd....

| 1 | 2 | 3 | 4 | 5 |
|---|---|---|---|---|
| 52 | 29-12-1979 | Paravalavu | 50 | 16 Adults |
| 53 | 31-12-1979 | Near Aranyanivas | 8 | |
| 54 | 01-01-1980 | Thuripara | 1 | |
| 55 | 01-01-1980 | Thuripara | 16 | |
| 56 | 09-01-1980 | Opposite Edappalayam R.H. | 2 | |
| 57 | 09-01-1980 | Opposite Deer Island | 1 | |
| 58 | 09-01-1980 | Dam site area | 1 | |
| 59 | 10-01-1980 | Chevlod | 2 | |
| 60 | 10-01-1980 | Chevlod | 1 | |
| 61 | 11-01-1980 | Manakkavala | 1 | |
| 62 | 11-01-1980 | Manakkavala | 2 | |
| 63 | 11-01-1980 | Manakkavala machan area | 50 | |
| 64 | 19-01-1980 | Manakkavala | 30 | |
| 65 | 06-02-1980 | Thampuran thuruthu | 25 | |
| 66 | 16-02-1980 | Deer Island | 1 | |
| 67 | 16-02-1980 | Deer Island | 1 | |
| 68 | 19-02-1980 | Chevlod | 26 | Six adults feeding on frog tad poles |
| 69 | 20-02-1980 | Chevlod | | |
| 70 | 03-03-1980 | Chevlod | 4 | |

Appendix III-D contd....

| 1 | 2 | 3 | 4 | 5 |
|---|---|---|---|---|
| 71 | 11-03-1980 | Near Nellikkampatti | 4 | |
| 72 | -08-1980 | Chevlod area | 7 | |
| 73 | 08-10-1980 | Nellikkampatti | 30 | |
| 74 | 15-10-1980 | Chevlod | 7 | |
| 75 | 22-10-1980 | Near Boatlanding | 1 | |
| 76 | 03-12-1980 | Near Thanikudy machan | 1 | |
| 77 | 24-03-1981 | Manakkavala machan area | 30 | |
| 78 | 27-03-1981 | Manakkavala | | |
| 79 | 28-03-1981 | Manakkavala | 29 | |
| 80 | 09-04-1981 | Opposite Edappalayam | 11 | |
| 81 | 17-04-1981 | Near Edappalayam | 2 | |
| 82 | 17-04-1981 | Near Thuripara | 1 | |
| 83 | 18-04-1981 | Chevlod | 22 | |
| 84 | 27-04-1981 | Near Koonamavu | 1 | |
| 85 | 11-06-1981 | Opposite Edappalayam | 1 | |
| 86 | 11-06-1981 | Savithri munni | 6 | |
| 87 | 11-06-1981 | Near Paravalavu | 6 | |
| 88 | 20-10-1981 | Opposite Edappalayam | 2 | |
| 89 | 20-10-1981 | Ayyappan Kurukku | 2 | |

## APPENDIX III-E

Sightings of Bonnet macaques

| Sl. No. | Date | Location | No. of individuals | Details |
|---|---|---|---|---|
| 1 | 29-10-1977 | Chevlod thuruthu | 1 | Female and infant |
| 2 | 28-03-1978 | Opposite Edappalayam | 5 | |
| 3 | 29-03-1978 | Kadukkappara | 2 | |
| 4 | 21-05-1978 | Melappara estate | 10 | |
| 5 | 22-05-1978 | Near Inchipara | 1 | |
| 6 | 30-05-1978 | Near Ponvarai estate | 3 | |
| 7 | 05-06-1978 | Kozhikanam | 1 | |
| 8 | 09-06-1978 | Vallithodu thavalam | | Heard |
| 9 | 09-06-1978 | Near vellaram chetta thavalam | | Heard |
| 10 | 12-06-1978 | Near Punnar dam | | Heard |
| 11 | 09-01-1981 | Near Banglakallu | 30 | |
| 12 | 31-03-1979 | Vaikkappadappu | 5 | |
| 13 | 11-06-1981 | Lake shore | 10 | |
| 14 | 10-10-1979 | Manjaneyakan kanavu | 6 | |
| 15 | -10-1979 | Sabarimala | | One troup |

| 1 | 2 | 3 | 4 | 5 |
|---|---|---|---|---|
| 5 | 7-03-1978 | Methakanam area | 40 | |
| 6 | 8-03-1978 | Methakanam area | 40 | |
| 7 | 8-03-1978 | Near Mullakkudy | 8 | |
| 8 | 8-03-1976 | Near Mullathode | 2 | |
| 9 | 10-03-1978 | Opp. Mullakkudy | * | |
| 0 | 12-03-1978 | Kannimarmedu area | | |
| 1 | 14-03-1978 | Near Palkachi mala | | |
| 2 | 15-03-1978 | Karadivalavu | 1 | |
| 3 | 15-03-1978 | Methakanam area | 40 | |
| 4 | 18-03-1978 | Ottamaram | 5 | |
| 5 | 19-03-1978 | Opp. Mullakkudy | | |
| 6 | 20-03-1978 | Near Navikayam | | |
| 7 | 21-03-1978 | Mulakupara | 14 | Two babies |
| 8 | 01-04-1978 | Near Thanikudy Bungalow | 6 | |
| 9 | 01-04-1978 | Near Ummikuppan oda | 1 | |
| 0 | 01-04-1978 | Near Ummikuppan | 4 | |
| 1 | 02-04-1978 | Near Thanikudy Bungalow | 6 | |
| 2 | 02-04-1978 | Vaikapatappu kanam | 1 | |
| 3 | 02-04-1978 | Vazhukkipara kanam | 1 | |

| 1 | 2 | 3 | 4 | 5 |
|---|---|---|---|---|
| 34 | 03-04-1978 | Karikavukanam | 1 | |
| 35 | 03-04-1978 | Ummikuppan path | 1 | |
| 36 | 05-04-1978 | Vaikapatappu oda | 1 | |
| 37 | 05-04-1978 | Thoshampara kanam | 2 | |
| 38 | 05-04-1978 | Kumarikavu malai | 1 | |
| 39 | 06-04-1978 | Murukkadikayam kanam | 2 | |
| 40 | 07-04-1978 | Chorakotta oda | 2 | |
| 41 | 08-04-1978 | Thekkudakkum para kanam | 1 | |
| 42 | 08-04-1978 | Pulikayam kanam | 1 | |
| 43 | 09-04-1978 | Near Thanikudy Bungalow | 2 | One feeding on ground |
| 44 | 13-04-1978 | Near Pandara malai | | |
| 45 | 13-04-1978 | Pathamperi | 32 | |
| 46 | 13-4-1978 | Chinnamamala Periya mamala | | |
| 47 | 13-04-1978 | Vathilelan | 2 | |
| 48 | 14-05-1978 | Near Koyil malai | 6 | |
| 49 | 14-05-1978 | Koyil malai | 4 | |
| 50 | 15-05-1978 | Koyilmala base | 8 | |
| 51 | 15-05-1978 | Kathiramudi base | 11 | |

| 1 | 2 | 3 | 4 | 5 |
|---|---|---|---|---|
| 52 | 18-05-1978 | Kadamamalai estate | 1 | |
| 53 | 18-05-1978 | Naduthottam area | 1 | |
| 54 | 18-05-1978 | Kuthukal kanam | | |
| 55 | 18-05-1978 | Nedumpara | | |
| 56 | 18-05-1978 | Lakshmipara estate | 10 | |
| 57 | 19-05-1978 | Near Lakshmipara | | |
| 58 | 19-05-1978 | Tholukkampara kavala | 1 | |
| 59 | 19-05-1978 | Tholukkampara Thodu | 5 | |
| 60 | 19-05-1978 | Tholukkampara | 2 | |
| 61 | 20-05-1978 | Kathiranthammettu | | |
| 62 | 20-05-1978 | Verukudungi | | |
| 63 | 22-05-1978 | Near Inchiparathodu | | |
| 64 | 23-05-1978 | Near Valiyameenkayam | | |
| 65 | 24-05-1978 | Pullakayam | | |
| 66 | 24-05-1978 | Near Manadi | 1 | |
| 67 | 25-05-1978 | Chakkumuthi oda | | |
| 68 | 25-05-1978 | Near Aladi | | |
| 69 | 27-05-1978 | Choripara odathelappu | | |
| 70 | 27-05-1978 | Periyathukooti oda | | |

| 1 | 2 | 3 | 4 | 5 |
|---|---|---|---|---|
| 71 | 27-05-1978 | Madhalamthooki thodu | | |
| 72 | 05-06-1978 | Near Kozhikkanam landing | | |
| 73 | 05-06-1978 | Near Arali oda | 2 | |
| 74 | 05-06-1978 | Kozhikanam | 19 | Feeding on mangoes |
| 75 | 05-06-1978 | Chamikanam | | |
| 76 | 05-06-1978 | Pachakanam | 4 | |
| 77 | 06-06-1978 | Near Uppupara | 1 | |
| 78 | 06-06-1978 | Vamanakulam quarters | | |
| 79 | 06-06-1978 | Near Fourth mile | | |
| 80 | 07-06-1978 | Attapudungi | | |
| 81 | 07-06-1978 | Near Poomkavanam | | |
| 82 | 07-06-1978 | Near Sabarimalai | | |
| 83 | 08-06-1978 | Ponnambalamedu | | |
| 84 | 12-06-1978 | Near Ambalakkadavu | | |
| 85 | 12-06-1978 | Saramkuthi | 11 | |
| 86 | 12-06-1978 | Near Sabaripeedam | 11 | |
| 87 | 12-06-1978 | Kunnar dam | 10 | |
| 88 | 12-06-1978 | Near Nedumtheri | 10 | |

| 1 | 2 | 3 | 4 | 5 |
|---|---|---|---|---|
| 89 | 13-06-1978 | Near Inchimalai | | |
| 90 | 13-06-1978 | Appachikuzhi | 12 | |
| 91 | 14-06-1978 | Near Chalakayam | | |
| 92 | 10-11-1978 | Near Manalar | | |
| 93 | 11-11-1978 | Upper manalar | 5 | |

* Call heard only

+ Numbers include only those which could be seen outside the canopy

APPENDIX III-G

Sightings of Liontailed macaque

| Sl. No. | Date | Place | No. of individuals | Details |
|---|---|---|---|---|
| 1 | 2 | 3 | 4 | 5 |
| 1 | 26-4-1978 | Mullathodu | 18 | |
| 2 | 15-5-1978 | Koyilmala base | 5 | Two young ones |
| 3 | 16-5-1978 | Ummikuppan | 15 | |
| 4 | 20-5-1978 | Sivagiri mettu | 5 | |
| 5 | 22-5-1978 | Melappara estate | 15 | |
| 6 | 24-5-1978 | Near Manadi | 1 | |
| 7 | 27-5-1978 | Choripara oada Thalappu | * | |
| 8 | 27-5-1978 | Madalamthukki oada | | |
| 9 | 28-5-1978 | Elatheri estate | 6 | |
| 10 | 05-6-1978 | Near Ponvarai estate | 10 | |
| 11 | -6-1978 | Poonkavanam | 10 | |

* Call heard

## APPENDIX III-H

Sightings of Wild Dog

| Sl. No. | Date | Location | No. of individuals | Details |
|---|---|---|---|---|
| 1 | 05-11-1977 | Near boatlanding | 2 | |
| 2 | 11-02-1978 | Near Thampuran thuruthu | 6 | |
| 3 | 24-03-1978 | Nellikkampatti | 6 | |
| 4 | 30-03-1978 | Cheriyakanam | 4 | |
| 5 | 07-04-1978 | Near Thanikudy machan | 13 | |
| 6 | 21-05-1978 | Melappara estate | 9 | |
| 7 | 22-05-1978 | Melappara estate | 9 | |
| 8 | 06-04-1979 | Thanikudy | | |
| 9 | 10-06-1979 | Manakkavala | 10 | |
| 10 | 26-06-1979 | Edappalayam | 9 | |
| 11 | 04-12-1979 | Boatlanding | 6 | |
| 12 | 12-01-1980 | Manakkavala machan | 1 | |

## APPENDIX III-I

Sightings of other animals

| Sl. No. | Date | Location | No. | Name of animal |
|---|---|---|---|---|
| 1 | 2 | 3 | 4 | 5 |
| 1 | 03-06-1979 | Vaikkappadappu | 1 | Tiger |
| 2 | 04-05-1979 | Deer Island | 1 | Varanus |
| 3 | 14-06-1979 | Thanikudy | 1 | Rudy mongoose |
| 4 | 10-10-1979 | Gudalloor | 1 | Varanus |
| 5 | 30-10-1979 | Karadi oada | 1 | Bear |
| 6 | 30-10-1979 | Karadi oada | 1 | Mongoose |
| 7 | 08-07-1979 | Near boatlanding | 1 | Tiger |
| 8 | 12-06-1980 | Paravalavu | 1 | Tiger |
| 9 | 23-10-1979 | Near paravalavu | 1 | Stripe necked mongoose |
| 10 | 02-03-1979 | Kavalappara thuruthu | 8 | Otter |
| 11 | 23-10-1979 | Near boatlanding | 5 | Otter |
| 12 | 01-01-1980 | Edappalayam | 9 | Otter |
| 13 | 01-01-1980 | Near boatlanding | 7 | Otter |
| 14 | 09-01-1980 | Near boatlanding | 8 | Otter |

Appendix III-I Contd....

| 1 | 2 | 3 | 4 | 5 |
|---|---|---|---|---|
| 15 | 02-10-1980 | Near boatlanding | 2 | Otter |
| 16 | 19-10-1981 | Edappalayam | 5 | Otter |
| 17 | 20-10-1981 | Edappalayam | 3 | Otter |
| 18 | 08-02-1982 | Chevlode | | |
| 19 | 18-01-1979 | Near Thanikudy | 1 | Barking deer |
| 20 | 19-01-1979 | Manakkavala | 1 | Barking deer |
| 21 | 15-03-1979 | Near boatlanding | 1 | Barking deer |
| 22 | 07-06-1979 | Near boatlanding | 1 | Barking deer |
| 23 | 10-06-1979 | Manakkavala | 2 | Mother and young barking deer |
| 24 | 28-10-1979 | Near lake | 1 | Barking deer |
| 25 | 30-10-1979 | Near Manakkavala | 1 | Barking deer |
| 26 | 19-12-1979 | Near Manakkavala | 1 | Barking deer |
| 27 | 20-02-1980 | Near Manakkavala | 1 | Barking deer |
| 28 | 03-03-1980 | Near Manakkavala | 1 | Barking deer |
| 29 | 04-03-1980 | Kokkara | 1 | Barking deer |
| 30 | 04-03-1980 | Kokkara | 1 | Barking deer |
| 31 | 08-10-1980 | Panankala oada | 2 | Barking deer male and female |
| 32 | 14-10-1980 | Kokkara hill | 1 | Barking deer male and female |
| 33 | 17-10-1980 | Panankala oada | 1 | Barking deer male and female |
| 34 | 19-10-1981 | Near boatlanding | 2 | Male and female |