

Abstracts of
**THE STUDIES CONDUCTED ON
PERIYAR TIGER RESERVE**

Compiled by

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Ecologist**

**Periyar Tiger Reserve
Thekkady**

June 2004

General

VETERINARY ACTIVITIES OF PERIYAR TIGER RESERVE

Easwaran, E.K., Forest Veterinary Officer

Periyar Tiger Reserve under Project Tiger has a resident Veterinarian. The sanctuary under takes several Veterinary activities both for the wild animals and forest grazing domestic animals. It had been observed that animals far inside the sanctuary with out human and domestic animals interference are much more healthier than those living in the periphery. The reason for this phenomena could not be found out however it has a complex base involving environmental and disease conditions.

STUDIES ON THE ACTIVITIES RELATED TO THE COLLECTION OF THELLI (BLACK DAMMAR) FROM PERIYAR TIGER RESERVE

Dr. Jomy Augustine

Dept. of Botany, St. Thomas College, Pala

An interdisciplinary study, namely “studies on the activities related to the collection of black dammar from Periyar Tiger Reserve” was done. Periyar Tiger Reserve is the largest protected area in Kerala State, with more than 60% tropical evergreen forests, which is the ideal habitat of the black dammar tree, *Canarium strictum* Roxb. Of family Burseraceae. There are more than 400 people belong to the places of Sivagiri, Davadanam, Daivapatanam, Chokkampetti and Kumily, engaged in black dammar collection. Mainly 4 paths they prefer to enter the Tiger Reserve and they engage in the collection of cardamom in addition to the black dammar collection. Both black dammar collectors and cardamom collectors are found making many negative impacts on the vegetation to the evergreen forests. The former is done with a crude and unnatural method namely, burning the bottom of the tree and chipping the bark, and the latter is injuries to the vegetation by cutting many saplings of trees to build the crude smoke houses. The population with a declining number i.e. with fever juvenile ones.

**LONG-TERM ENVIRONMENTAL AND ECOLOGICAL IMPACT OF
MULTIPURPOSE RIVER VALLEY PROJECTS
WILDLIFE STUDIES IN IDUKKI, PERIYAR AND SILENT VALLEY- 1985**

P. Vijayakumaran Nair and K. Balasubramanian

Kerala Forest Research Institute, Peechi

Studies on the impact of the Idukki hydro-electric project on the larger mammals were carried out for a period of about four years from 1981 to 1984. The study area is located in the Idukki district of Kerala. Forest types consist of grasslands, deciduous and evergreen forests. Study methods included collection of details of animals from systematically laid out sample plots. Examination of population parameters from sighting data and recording of habitat quality on gridded map. About 75 elephants are estimated to be present in the area. The herds were of a smaller size indicating disturbance. The proportion of various classes of individuals and their sex ratio was not similar to that in other populations. There were only very few young ones. Number of male elephants in the population was also very low. Animals like sambar, barking deer, jackal and wild dog were present in the study area. But their number was very low. The study area contained wild boar and hare in moderately good numbers. Gaur, bear, tiger and leopard are no more found in the area. The bonnet macaques in the periphery of the reserve indulged in a great deal of crop raiding. Wild dogs attacked domestic cattle in a few cases. The study shows that construction of the Idukki hydro-electric project had an adverse effect on many animals. In addition to the construction of dams, large scale encroachment and forest colonization also played an important role in the destruction of animals. As far as animals are considered there were both negative and positive impacts. The study recommends habitat improvement measures for the Idukki Wildlife Sanctuary need for keeping the forest continuity of crucial Meenmutty region and a few other measures to prevent further deterioration of the habitat.

**CONSERVATION OF BIO-DIVERSITY WITH SPECIAL REFERENCE TO
PERIYAR TIGER RESERVE**

Shaju Thomas

This is a time of unprecedented change in the relation between man and nature. We are overexploiting the bio-resources on earth, which is manifested mainly through the loss of biological diversity. The diversity of life on earth that initiated and sustained human origin and survival lies beyond our comprehension. Biological diversity encompasses all species of plants, animals and micro-organisms and the eco system complexes of which they are part. Maintenance of bio-diversity has become a primary objective of conservation in recent times. Kerala is blessed with immense biotic wealth. We are fortunate in having wildlife reserves established as early as 1899 as in the case of “ PERIYAR LAKE RESERVE FORESTS’. Now the priority should be to incorporate the new findings for the better understand and management of the reserve in future.

A HANDBOOK FOR ECO-CLUBS – 2001

S. Guruvayurappan

The book prepared for reference to the nature/ eco club led school teaches suggests 51 activities, which can easily done by the students. They include: Celebrate environmentally important days, Set up a library for environmental education, Prepare a ‘Green Corner’ – notice board in the institution, Conduct competitions like Quiz, Painting, Essay Writing, Elocution, Tableau, Mime, etc, Set up a medicinal garden in the school / available land – managed by the students, Prepare a plant nursery of locally available species, Conduct environmental seminars, workshops, debates, discussions, slide shows, film shows on environmental topics frequently, Promote “Eco-culture” - Invite and share the experience and knowledge of older people of the neighboring area, Adopt environment friendly habits and living, etc.

Ecological studies

**A PRELIMINARY STUDY ON THE
GRASSLANDS OF PERIYAR TIGER RESERVE, KERLA**

K.K. Srivastava, V.J. Zacharias, A.K. Bharadwaj, Jomy Augustine & Sherly Joseph

Indian Forester. 1994

Periyar Tiger Reserve has a grassland area of about 54 Km². It supports rich herbivorous animal populations. The grasslands of this Reserve are divided into Tropical Montane grasslands and South Indian Subtropical Hill Savannahs.

Besides their forage value, the grasslands are potential for maintaining micro-climates for many endangered plants and animals. Forest fire is one of the major ecological factors in grasslands. Planting of *Eucalyptus* and other exotic plants destabilize the ecology of grasslands which are ideal habitats for endangered species of fauna like Nilgiri Tahr, Nilgiri Pipit etc.

**ECONOMIC AND ECOLOGICAL VALUE OF PLANT BIODIVERSITY OF
PERIYAR TIGER RESERVE.**

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A survey of the flora of Periyar Tiger Reserves was conducted during the period 1984-1987. Even though not exhaustive we covered pockets like Mangaladevi, Kakki, Kumali, Vandiperiyar and Sabarimala. A total of 549 Angiosperms and 49 Pteridophytes were collected and processed as herbarium sheets. An analysis of economic and conservation value of this plant wealth shows 17 species of importance as wild relatives of crop plants, 51 spp as medicinal plants and 37 spp. as rare endangered or endemic plants. Some of these wild species have significance as prospective crops or ornamentals. Mere enumeration of the Flora is not going to serve any purpose unless a critical study of the basic ecology of the species, genetic erosion status and causes of rarity are taken care off. A species distribution map of the sanctuary plotting Rare, Endangered and Threatened (RET) spp against locality is a must for according *in situ* conservation and monitoring it. Demarcating a small area

as genetic reserve in the case of very important Rare, Endangered & Threatened (RET) species may be considered.

PHYTOSOCIOLOGICAL STUDY OF POONKAVANAM AREA OF PERIYAR TIGER RESERVE

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An investigation was carried out with the objectives of characterizing the floristic composition, diversity and structure in the disturbed and undisturbed zones in Poonkavanam area of Periyar Tiger Reserve. Since the area is prone to heavy biotic interference, comparison of disturbed and undisturbed zones was done with respect to vegetation parameters. Identification of different zones was based on visual assessment based on the level of anthropogenic disturbances.

In the disturbed zone, 347 individuals belonging to 94 species were recorded that constituted a density of 868 individuals per hectare. The undisturbed zone exhibited high species richness with 94 species represented by 482 individuals contributing to a density of 1205 individuals per ha. 27 species were found exclusively in the undisturbed zone whereas 21 species were found confined only to the disturbed zone. Association of *Schleichera oleosa*, *Xylia xylocarpa* and *Cullenia exarillata* was observed in the disturbed zone whereas in the undisturbed zone, association of *Cullenia exarillata*, *Vateria indica* and *Mesua ferrea* was found. Profile diagramme clearly indicated that the disturbed zone had three strata whereas four strata were identified in the undisturbed zone. The species composition of different strata also varied. In the disturbed zone, concentration of moist deciduous species was found, probably due to the retrogression. Ground vegetation was almost absent in the disturbed zone.

Woody regeneration was found to be more in the undisturbed zone. Regeneration of pioneer species was found only in the disturbed zone and domestic animals are found to trample the regeneration in this zone. In the undisturbed zone, the number of individuals decreased with GBH class. In the disturbed zone, there was a reduction in the number of individuals in the lowest girth and height class. This may be attributed to the removal of small wood for fuel and other purposes from the disturbed zone.

Animal abundance was high in the undisturbed zone indicating a better habitat use. Results indicate that disturbance has an impact on the distribution of animals, which has to be viewed seriously.

The present study was carried out in a very short time span of three months. Long-term studies are suggested for understanding the changes in habitat preference and seasonal movements of wildlife in response to disturbances.

POPULATION AND DISTRIBUTION OF TIGER IN PERIYAR TIGER RESERVE

P.S. Easa

Kerala Forest Research Institute, Peechi – 2002

A study was conducted in Periyar Tiger Reserve to estimate the population of tiger. The research programme also attempted to assess the threat to survival of the species in Periyar and adjacent areas and suggested monitoring protocols. Periyar Tiger Reserve is part of a compact forest block with an area of about 1400 km². The diverse vegetation supports a number of plant and animal species. The reserve is of undulating terrain with an annual average rainfall of 2000 mm and the share of the rainfall is from the southwest monsoon. The reservoir within the reserve feeds water to a part of Tamil Nadu.

Different parts of Tiger Reserve were visited, the pugmarks were recorded by searching all possible locations. The field measurements of the tiger pugmarks for selected parameters were made. The information on the substratum were also recorded. Plaster casts of the pugmarks were made. These casts were later measured for the same parameters using a vernier caliper. The measurements of various parameters of pugmarks of known tiger in Sri. Chamarajendra Zoological Garden, Mysore were made both in the field and using plaster casts. These data were used to test the accuracy of a computer program developed for analysis.

Fifty seven pugmarks were measured from the field during the present survey and 66 plaster casts made. Ninety two plaster casts taken during census 2000 were also made available for analysis. The estimated number of tiger in the reserve, when analysed using the plaster casts of census 2000 is 32 at 5 per cent significance level. The estimated number from the present survey is only 21 at 5 per cent level. The locations of pugmarks during the present survey are plotted in area and vegetation

maps. The threats to the tiger population from different sources are discussed. The tiger monitoring protocol using Pugmark Impression Pad are suggested with the details of location.

**ELEPHANT POPULATION IN PERIYAR AND ADJACENT AREAS –
A DEMOGRAPHIC STUDY- 2001**

P.S. Easa

Kerala Forest Research Institute, Peechi

A study was carried out in Periyar Tiger Reserve and adjacent areas including Ranni, Konni and Achenkovil Forest Divisions during 1997 to collect information on the group composition, sex ratio, density and population of elephants, especially tuskers. This area forms the portion of Elephant Reserve No. 10. the area mainly comprises tropical wet evergreen forests and grasslands, followed by deciduous forests.

Information on group size, composition and structure of elephants was collected through direct observations. The individuals were classified into different age-sex categories. Transects were laid to collect information on dung density.

A total of 379 elephants were sighted in 63 herds. Herd size of elephant was found to range from 1 to 19. About 14 percent were loners. Total number of adult males was found to be 28, of which 14 were makhnas and remaining tuskers in a proportion of 1:1. Adult females formed a major portion of the population (58.6%) followed by subadult females. Adult males constituted 7.4% of the population. The overall male to female sex ratio was 1: 8.7 and adult male to female 1:7.9. the overall sex ratio of Periyar Tiger Reserve alone was found to be 1:11.5. the overall elephant density is 0.5/km² in the study area and the density was higher in grasslands (0.9/km²) compared to other habitats.

**FOOD HABITS OF MAMMALIAN PREDATORS IN PERIYAR TIGER
RESERVE, SOUTH INDIA**

K.K. Srivastava, A.K. Bhardwaj, C.J. Abraham and V.J. Zacharias

Published in Indian Forester 1996

This study has identified new prey species of the major mammalian predators in Periyar Tiger Reserve; Nilgiri langur, Elephant and Varanus for Tiger and Flying squirrel for Leopard. The proportion of different prey species taken by these predators is also interesting.

**POPULATION DYNAMICS OF SAMBAR *CERVUS UNICOLOR* IN PERIYAR
TIGER RESERVE**

G. Harikumar, Bennichan Thomas, K.J. Joseph and V.J. Zacharias

Published in Indian Forester– 1999

Sambar in Periyar enjoys a wide distribution in the Reserve. It is major prey species of Tiger and wild dog. Sambar was seen singly and in groups of up to about 60 individuals. They eat a variety of grasses, herbs, shrubs and leaves and fruits of various trees. The sambar in Periyar prefers grasslands, but usually avoids evergreen forests. They spend considerable time foraging in moist deciduous forests and 'savannah' type vegetation. Density of population of the species in the reserve (excluding evergreen tract) is estimated to be 2.1/km². They spend a lot of time for feeding, mostly in the mornings and evenings. Active feeding as well as 'fluid grouping' are mostly seen in open areas. This may be an anti-predator device. Male-female ratio among adult individuals was 1 : 3.86. Males are seen with females/herds mostly during the reproductive season Dec- Jan. Mating was observed only once occasion. In cases, which are clearly known, young ones are born in June/July months. Males with velvet are mostly found in Dec. – Feb. months, though it is also found throughout the year. Sambar in Periyar is threatened by several factors' disease, poaching, tourism and grazing by domestic livestock.

**MICRO-HISTOLOGICAL STUDIES ON THE FOOD HABITS OF SAMBAR,
GAUR AND CATTLES IN PERIYAR TIGER RESERVE IN WINTER**

K.K. Srivastava, A.K. Bhardwaj, Sony George and V.J. Zacharias

Published in Indian Forester– 1996.

The studies on the food plants of sambar, Gaur, and Cattles conducted in the Periyar Tiger Reserve, Thekkady, Kerala have been described in this paper. The diet of the animals are dominated with grasses. There is a considerable overlap of food plants among the three animals and too much grazing by domestic cattle may lead to food scarcity in the study area.

**SOME OBSERVATIONS ON TROOP STRUCTURE, ACTIVITY BUDGET
AND FOOD HABITS OF THE NILGIRI LANGUR *PRESPYTIS JOHNI* IN
PERIYAR DURING MONSOON (JUNE – AUGUST)**

**K.K. Srivastava, V.J. Zacharias, A.K. Bhardwaj, Petrisia Joseph and Sherly
Joseph**

Published in Indian Forester– 1996.

To compare the troop and territory sizes, food habits and activity budgets of Nilgiri Langur in Periyar Tiger Reserve in monsoon seasons, a study was conducted and results are summarized.

**OBSERVATIONS ON THE FLYING SQUIRRELS *PETAURISTA
PETAURISTA PHILIPENSIS* (ELLIOT) AND *PETINOMYS FUSCOCAPILLUS*
(JERDON) IN PERIYAR TIGER RESERVE AND ITS NEIGHBOURHOOD**

V.J. Zacharias and A.K. Bhardwaj

Published in Indian Forester – 1997

The food items of the two flying squirrels are little known. Stomach contents of the food items of the above said specimens are given in detailed.

STATUS AND HABITATS OF RAPTORS IN PERIYAR

K.K. Srivastava, A.K. Bhardwaj, C.J. Abraham and V.J. Zacharias

Published in Indian Forester Vol. 121 (10) – 1995.

The detailed list of Raptors with their habitats, abundance, migratory status and management strategies in Periyar Tiger Reserve are discussed in this paper.

STUDIES ON THE AQUATIC BIRDS IN PERIYAR LAKE, KERALA

P. Muhammed Jafer, A.K. Bhardwaj, K.J. Peeyuskutty and V.j. Zacharias

Published in Indian Forester Vol. 123 (10) – 1997.

This paper is aimed at determining the population of aquatic birds in Periyar Lake for making comparable studies in future. A total of 23 species of birds were recorded. Of these 17 were residents and 6 winter visitors.

THE GREAT INDIAN HORNBILL (*BUCEROS BICORNIS*) AND MANAGEMENT OF OLD GROWTH FOREST PATCHES IN PERIYAR TIGER RESERVE

G. Harikumar, O.P. Kaler, Sherly Joseph, K.J. Peeyuskutty and V.J. Zacharias

The study though for a short period could lead to the following findings (1) old growth evergreen forest patches are very important for the survival of the Great Indian Hornbills in Periyar, (2) The fruits of *Ficus mysorensis* constitute the major food of nestling hornbills and the nesting of hornbills coincides with the fruiting season of *F. mysorensis* (3) Hornbill fly long distances, more than a km. For collecting food for the young and figs could be act as ‘ Corridors’ in the distribution of the hornbills (4) Under safe condition hornbills may nest as low as 8 m. though Salim Ali (1968) has recorded them nesting at heights of about 20 to 25 m (5) Size of the nest cavity is important in determining the nest site selection. Hornbill nests have an important role in the regeneration of plants (6) Hornbills are observed carrying snakes and lizards besides fruits for feeding the young ones.

STATUS OF THE GREY JUNGLE FOWL *GALLUS SONNERATHI* IN PERIYAR TIGER RESERVE, KERALA, S. INDIA

V.J. Zacharias

Published in Trogon Number 7

The species has a wide distribution in Periyar in different forest types. Plantations and around human habitation being commoner in mid altitude moist deciduous forests, where there is a fairly good understory. However it is absent or rare in Periyar's high hills such as Mangaladevi and Kumarikulam. It feeds mostly on insects, beetles, and also seeds and grains. Poaching of adults and egg collection seem to be the grey junglefowl's major management problems in Periyar.

**OCCURRENCE OF THE YELLOW WARBLER *PHYLLOSCOPUS*
TROCHILUS (LINN.) IN THEKKADY, KERALA, S. INDIA**

V.J. Zacharias, Hans Oelke and A.K. Bhardwaj

Published in Indian Forester Vol. 123 (10) – 1997

On 2nd January 1996 we heard a Willow Warbler singing near the forest check post at Thekkady in a bush on the forest edge. There was only one bird and it was heard again later. This is the first record of this species from South India.

**PERIYAR TIGER RESERVE
BASELINE DATA AND MAPPING**

P.Vijayakumaran Nair

The Kerala Forest Research Institute carried out a baseline mapping of Periyar Tiger Reserve as part of consultancy. A detailed atlas with division, range and section level maps of topography, boundaries and vegetation have been prepared in atlas format. Additional details are provided in separate documents. The present document brings together available data on water level, rainfall, flora and fauna.

**AN IMPACT ASSESSMENT AND BASELINE SURVEY DURING CHITRA
POURNAMI FESTIVAL AT MANGALADEVI IN PERIYAR TIGER
RESERVE**

M. Balasubramanian and A. Veeramani

Mangaladevi shrine is situated on the northern part of Periyar Tiger Reserve and the border area of Tamil Nadu and Kerala. Though the festival is being celebrated for only one day, the activities related to the pilgrimage witness considerable impact on the ecosystem. About 4600 pilgrims visited the shrine on the festive day. A total of 340 vehicles were entered into park. A considerable amount of plastic and other wastes were deposited by the pilgrims were disposed by the Forest personnels later. Possible suggestions were given.

**BASELINE SURVEY FOR THE PROTECTION ORIENTED
ADVENTUROUS TREKKING AND CAMPING SCHEME BASED ON
ECOLOGICAL INDICATORS**

M. Balasubramanian and A. Veeramani

The main activity suggested in the microplan written for the ex-vayana bark collectors EDC is ‘ The Scheme of Protection Oriented Adventurous Trekking and Camping’ with tourists in the selected interior forests of the tourism zone of Periyar Tiger Reserve. The primary objective of the scheme is protection of forests at the same time, providing alternative livelihood to the EVBC-EDC members. For an ongoing evaluation of this scheme a baseline survey was carried out and a monitoring mechanism was evolved.

**BASELINE STUDIES IN THE TREKKING ROUTES FOR TRIBAL
TRACKERS-CUM GUIDES EDC, PERIYAR TIGER RESERVE**

A. Veeramani and Joju P. Alappatt

On the emerging trends in Ecotourism, participation of local community in tourism activities is very important. Thus the tribal tracker-cum guides EDC were formed in Thekkady as part of sustainable and participatory Ecotourism and biodiversity conservation. Trekking routes were identified according to less damage to ecosystem and the same time giving protection to the sandal forest during day time. Possible impacts and suggestions were given.

**A STUDY ON THE EXTENT AND IMPACT OF FIREWOOD COLLECTION
AND BASELINE SURVEY FOR FIREWOOD AND THATCHING GRASS
COLLECTOR'S EDC**

M. Balasubramanian

The main livelihood dependencies of the people who live at Rosappookandam on Periyar Tiger Reserve are collection of firewood and thatching grass. The people utilize approximately 12 km² of forests for these activities. It was estimated from the PRA that a total of 30,000 bundles (50 kg/bundle) of firewood and 15,000 (40 kg/bundle) bundles of thatching grass are being collected annually by these 98 family members. Details of mode of collection and vegetation analysis in the area was given.

**IMPACT OF LANTANA AND OTHER EXOTIC WEEDS ON THE
ECOSYSTEM
A BASELINE SURVEY AND THE STATUS OF BIODIVERSITY IN THE
LANTANA DOMINATED AREAS IN PTR**

M. Balasubramanian

Any management intervention should be based on an appropriate baseline information. Removal of exotic weeds is an activity practiced in the Protected Areas for improving the habitat quality. Lantana inhibits the growth of native species and alters the floral diversity that is the sole basis for the entire biodiversity. However, whether lantana is a friend or foe has been the subject of considerable controversy,

and much-heated debate. Here, the major ecological issues surrounding the debate are summarized. Possible recommendations were given.

ECOLOGICAL STUDY ON HABITAT IMPROVEMENT PRACTICES IN PERIYAR TIGER RESERVE

A. Veeramani and Joju P. Alappatt

Removal of exotic weeds such as Lantana, Euphorium and Mikania is activity practiced in the PAs for improving the habitat quality. Since the habitat improvement practices such as maintenance of marshy vayals, controlled burning in hill savannahs, clearance of trek paths and vialines are applied by the Forest Department. These are the prime habitats extremely utilized by most of the wild animals especially the larger herbivores and carnivores. The more number of indirect evidences of wild animals in the maintained vayals is a clear indication of the utilization of the area. More number of plant species is recorded from the maintained vayals than the un maintained vayals. However, secondary colonizers are common in maintained vayals. In any way, habitat improvement practices are interference in nature's own programme of ecological succession. Possible recommendations were given.

IMPACT OF RAISING OF WATER LEVEL AT MULLAPERIYAR RESERVOIR IN PERIYAR TIGER RESERVE

Amit Mallick

EXECUTIVE SUMMARY

This report presents the possible impacts of the proposed increase in the water level in the reservoir in the Periyar Tiger Reserve, from the present level of 136 feet to 152 feet. Due to the constraints of time that was available to the Committee, the report is based primarily on existing literature, although limited field studies were also carried out. The impacts on flora, fauna, tourism, and people were examined.

Flora

1. Although only 777 km² in area, the Reserve has the highest species richness of flowering plants among Protected Areas in the Western Ghats, with 1965

species (including 515 endemics) recorded to date. A majority of 168 species of grasses and 91 species of sedges occur in the grasslands in the lakeshore, and the marshlands (*vayals*) near the shore. Many of 145 species orchids in the reserve are rare, and some are confined to the vegetation around the lake. For example, *Habenaria periyarensis* a new species recently described from the Reserve, is confined to the grasslands on lakeshore. Similarly, an orchid *Taeniophyllum scaberulum* rediscovered after 140 years, is currently known to exist only on trees near the lakeshore.

2. The grasslands on the lakeshore and the *vayals* are very important feeding grounds for the large herbivores. Several food species have been identified. Similarly, the highly complex vegetation and species richness in the evergreen forests, especially along streams, make them an ideal habitat for several smaller mammals, birds, lower vertebrates, and invertebrates.
3. A drastic consequence of an increase the water level would be the prolonged submergence of the grasslands and *vayals*, vegetation that has stabilized over several decades. A reestablishment of this vegetation would take several decades, if at all, and would depend of many factors such as stabilization of slopes, erosion, and sedimentation. Submergence of the evergreen forest is likely to lead to the loss of the only known populations of some species of plants, especially orchids.

Fauna

4. The use of the areas adjoining the lake by the large mammalian community is very high, compared to other parts of Reserve, due to abundance of fodder in grasslands on the lakeshore, and *vayals*. The high densities of prey also attract their predators. A drastic reduction in fodder availability around the lake would force the large herbivores to disperse to other areas, where fodder availability is low. This would lead to a decline in the density of these animals in the near future. An increase in the water level would disrupt the movement of elephants across the lake by swimming through areas that are used traditionally.
5. The dispersal of herbivores away from the lake would force their predators also to disperse. Carnivores are highly territorial; therefore, their dispersal to

other areas might cause considerable intra-specific conflict and, probably, mortality. Among the species most likely to be affected are the tiger and wild dog.

6. A decline the population of otters in the Reserve, the largest population in south India at present, is also likely. This is because of the submergence of most of their dens, loss of shallow water that form their foraging ground, and an increase in the tree stumps in the water.
7. The tree stumps in the reservoir form the nesting sites for water birds such as darters and cormorants. Thus, a drastic decline in the population of water birds is foreseen. Ceylon frog-mouth, a rare bird, is another species that would be seriously affected due to loss of its breeding habitat in the reed brakes along streams.
8. Out of 31 species of fishes recorded from the Reserve, only 6 occur in the lake, while the others are confined to the fast flowing streams and stream mouths. Many of the endemic stream fishes have very specific micro-habitat requirements for feeding as well as breeding. The loss of these micro-habitats would lead to a drastic decline in the population or even extinction of many stream fishes, like the Deccan mahseer *Tor khudree* and *Lepidopygopsis typus*, the latter a cold-water fish of Himalayan origin not reported from anywhere else.
9. About 25 species of amphibians were recorded during a brief survey of the areas around the reservoir, most of them confined to specific micro-habitats in and around streams. Very few species are found in the reservoir. The submergence of streams would lead to the loss of micro-habitats of several species of amphibians.
10. In total, 44 species of reptiles have been recorded from the Reserve. The species mostly likely to be affected are the bamboo pit-viper (*Trimeresurus malabaricus*) and the large-scaled pit-viper (*T. macrolepis*), due to the loss of reed-brakes along streams.

Tourism and people

11. About 3.6 lakhs tourists visit the Reserve annually. It is estimated that the tourists spend about Rs.34 crores annually during their visit to the Reserve.

Viewing wildlife around the reservoir during the boat ride is the major reason for tourism in the Reserve. Therefore, a drastic reduction in the wildlife around the reservoir would lead to the decline in the number of tourists. This would be a major threat to the Kumily Township and the spice industry, which are largely dependent on tourism. The tribal youths currently being trained as wildlife guides and trekking assistants under the India Ecodevelopment Project would lose their employment opportunities.

12. About 4,000 people, from about 850 households are likely to be directly impacted by increased water logging in their agricultural fields, and submergence of houses and tourist resorts.

ASSESSMENT OF BOUNDS TO WILDLIFE POPULATION WITH SPECIAL REFERENCE TO CARNIVORE POPULATION OF PERIYAR TIGER RESERVE

Rajan Varughese, James Zacharias and P.K. Surendranathan Achari

Population dynamics being an indicator of the health of a sanctuary, the sanctuary managers conduct periodic Wildlife Surveys to obtain population estimates.

A method of estimating population size is based on sample surveys. Estimates prepared, with safeguards to control bias, provide a lower bound to population size.

Usually considerable criticism is generated on account of the figures projected by surveys. A scientific study to fix the upper bound for population estimates of various species especially tiger would be of help in this respect. The upper bound is an alternate measure of the carrying capacity for different prey species. It could serve as a red signal mark for policy makers and sanctuary managers, serving as a check against the occurrence of flaws in the data collected.

A bold step in the making of and in the implementation of policies, this will become an essential for the monitoring of the health of Wildlife Sanctuaries.

ANALYSIS OF TIGER PUG MARKS BASED ON COMPUTERIZED DATA BASE MANAGEMENT TECHNIQUES

Rajan Varughese

Comparison of pugmark tracings and analysis of pugmark data are used in the analysis of data related to census of tigers. The absence of quantitative information on measurable parameters, con – uniformity in pugmark tracings in large-scale surveys and subjective decisions at the analysis stage can lead to erroneous conclusions. The figures thus obtained are not supported by any precision measurements. Measurements of a set of parameters taken on pugmark plaster casts with reference to a systematic coverage of a given geographic area are used in making a database in a computer. Programme s are developed for the analysis of the data base to identify and group pug marks of the same tiger. Statistical tools are used to provide degree of accuracy in the figures arrived at. Data obtained from the plaster-casts taken during the statistical survey of Wildlife at Periyar Tiger Reserve in January, 1993 was analysed using the technique and results are obtained. User friendly software package is being developed for handling census data related to the measurement of pug mark plaster casts and is titled “ PUGMARK”.

FOOD HABITS OF LARGE MAMMALIAN PREDATORS IN PERIYAR TIGER RESERVE 91-92

C.J. Abraham and K.K. Srivastava

A Study on pre-predator relations was started in Periyar on 1st September 1991. An important objective of the study was to identify the prey species of the major predators of the reserve, where herbivores like Chital, Hog Deer and Swamp Deer are absent. This study revealed that the major prey species of tiger in Periyar consisted at Sambar and porupine. Tiger here also preyed on Gaur, Wild boar, Elephant, Nilgiri langur, Black napped hare, Small Indian Civet, Varanus and small rodents to a latter extend. Leopard's main prey is Nilgiri langur and to a latter extend, took Sambar, flying squirrel and Rodents. Wild dog mainly fed on Sambar and they also pressed on Barking deer, Mouse Deer, Nilgiri langur and Rodents. The data collected is only for 16 months and it required at least two more years to draw a clear cut conclusion.

MICROHISTOLOGICAL STUDIES ON THE FOOD HABITS OF SAMBAR, GAUR AND CATTLE IN PERIYAR TIGER RESERVE IN WINTER 1992-93.

A.K. Bharadwaj and V.J. Zacharias

The important objectives of the study were

- (a) identify the plant species eaten by Sambar, Gaur and Cattle
- (b) to know the proportion of various classes of food materials in the diet
- (c) to find out the dietary overlap, if among these ungulates.

This study revealed that the food plants of Sambar consists totally 31 species of which 22 were grasses (70.9%) , 5 herbs (16.2%) 3 shrubs (9.6%) and one tree(3.3%). Food plants of Gaur consists of total 23 species of which 21 grasses (91.4%), one herb (4.3%) and one shrub (4.3%). In the case of cattle totally there are 12 species of plants, all are grasses. The 33.3% between Sambar and Gaur, 25.6% between Sambar and cattle, 31.5% in the case of Gaur and cattle.

**SHORT TERM STUDY ON GRASSLAND SYSTEMS OF
PERIYAR TIGER RESERVE, KERALA**

Jomy Augustine and A.K. Bharadwaj

The grasslands of Periyar Tiger Reserve has an area of 54 km². These grasslands could be divided into three major groups.

- (1) Tropical Montane grasslands
- (2) Subtropical Hill Savannah and
- (3) Grassy patches along lake shores and marshy places.

Each groups can be distinguishes from the species composition.

Herbivores like Sambar, the Gaur, the Elephant and Nilgiri Tahr depend upon the grassland for their food source. Grasslands maintain a microclimate for many endangered species of plants and animals. Forest fire could be considered as one of the major ecological factors affecting the grasslands. Eucalyptus plantations disrupts the ecology of grasslands.

**POPULATION STUDIES IN ASIATIC ELEPHANT, *Elephas maximas*
IN PERIYAR TIGER RESERVE**

S.V.Abdul Hameed and V.J. Zacharias

Asiatic Elephants is an endangered species in India. Hence a study on elephants is of vital importance. Periyar Tiger Reserve has good population of elephants. Detailed information on the population of elephants. Detailed information on the population dynamics of the species is lacking. From 1991 October we started a study on the habitat preference of Asiatic elephants in Periyar. The main objectives of this paper is to present data on the sex ratio of elephants in Periyar Tiger Reserve.

From the study a decline in the male population of elephants is noticed, which in future will be detrimental to species survival. The trend from lower level of the pyramid shows growing one. Hence measures should be taken to maintain the growing level of elephant population in the reserve.

ASPECTS OF FEEDING IN THE WILD BOAR (*Sus scrofa*)

P. Anitha Moorthy and Dr. M. Balakrishnan

A Study on feeding behaviours of the wild boar (*Sus scrofa*) was carried out in the Periyar Tiger Reserve, Kerala. Despite their nocturnal habits, two major peaks of feeding behaviour, one in the early mornings and the other late in the evenings were noticed. Olfaction was the major sense during foraging. During the active phase, 50 percent of the time was spent on digging up the earth, 15 percent on sniffing the earth, 25 percent on eating, 5 percent was accounted for other activities such as fighting and in other social activities.

The following area the preferred food of wild boar in the order of their preference in natural habitats in Periyar. *Panicum repens*, *Globba bulbifera*, *Paspalum commersonii*, *Emilia sonchifolia*, *Dinebra retroflexa*. The earth digging contained pieces of earthworms, ants and their eggs. In summer months, when the marshes dry up, they feed on the lakeside. They also feed on large number of tadpoles and small fish seen at the shore edges. The wild boars also feed on large number of tadpoles and small fish seen at the shore edges. The wild boars also feed on the remains of wild dog and tiger kills in Periyar Tiger Reserve.

A PRELIMINARY ECOLOGICAL SURVEY OF THE PERIYAR WILDLIFE SANCTUARY, KERALA STATE

G.U. Kurup

Zoological Survey of India, Madras

Published in Cheetal

The paper discussed about the basic details of Periyar wildlife Sanctuary such as Forest types, geology, climate, survey of wild animals, etc. Detailed distribution pattern and its abundance of wild animals such as elephant, gaur, wild dog, larger carnivores and others were also given. Possible solutions for the management of habitat restoration and ecological balance activities and the land use pattern also discussed.

STATISTICAL SURVEY OF WILDLIFE AT PERIYAR TIGER RESERVE TIGERS AND THEIR NATURAL PREY

1980 -1981

Rajan Varghese

U.C. College, Alwaye

The project report includes the survey of Tigers in the Periyar Tiger Reserve. The area was randomly selected for this purpose. Presence of tiger was identified by searching pugmarks, claw marks, faecal matter, kills, sound, dens, etc. Pugmark tracing and casting with plaster of paris was used for estimating tigers in the reserve. Each section was thoroughly searched for its habitat system, species structure and the population dynamics of mammal species in the block. Possible recommendations and methods for estimating tiger by the way of pugmark casting was given in detail.

HOME RANGE AND FOOD HABITS OF THE NILGIRI LANGUR,

Presbytis johnii

Robert H. Horwich

Published in J. BNHS in 1972 Vol. 69 (2)

Since Tanaka (1965) visited Periyar Sanctuary in Kerala, the three territory areas occupied by Nilgiri langurs on the southern part of the peninsula at Thekkady have remained the same, yet the troop sizes have changed considerably in two of the areas. This shows the lack of correlation of troop size to territory size. However, the core areas do change with the seasons, with a tendency for troops to forage in deciduous areas during March-May and a tendency to remain in evergreen areas in

January-February. During this deciduous feeding period, the developing parts of the plants (buds and tender leaves) were predominantly eaten. Other foods were also eaten and different methods of handling were employed for different food types. Certain resting and sleeping areas, coincident with the feeding areas, were used but the troops were not constant to them. Rather, a certain probability of their usage existed. A lone male was observed which seemed to have been displaced from one troop and forced into the evergreen areas during feeding of the main troop in adjacent deciduous areas.

**HABITAT PREFERENCE OF BIRDS IN THE
PERIYAR TIGER RESERVE, KERALA**

H.S.A. Yahya

Published in Indian Journal of Forestry Vol. 12 (4), 1981

Organisms living in natural conditions tend to remain in their own ecological niches. Likewise birds also prefer certain suitable habitat for their feeding and nesting sites. During carrying our observations on feeding and biology of barbets (*Megalaima spp*) at Periyar Tiger Reserve between February 1978 and March 1980 and during subsequent visit in 1984 & 1987, it was found that the large number of species of birds in a suitable habitat appears to be beneficial for many of the species turn to insectivore specially when the destruction of defoliator, *Hyblaea puera* swarm during April-May, thereby helping the forest management.

**ECOLOGY OF LARGER MAMMALS OF
PERIYAR WILDLIFE SANCTUARY**

K.K. Ramachandran, P. Vijayakumaran Nair and P.S. Easa

Published in JBNHS, vol. 83

Studies on the distribution, ecological requirements and resource availability to selected mammals of Periyar wildlife Sanctuary was carried out for a period of five years from 1977 to 1982. This sanctuary is located on the crest line of the Western Ghats in Penninsular India. Forest types consist of grasslands, deciduous and evergreen forests. The study methods included recording population parameters and activities of animals sighted and collection of indirect evidences of animals from

systematically laid out sample plots. The grass production from different parts of the habitat was estimated by the harvest method. A total number of 800 elephants was 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 kilometer with an ecological density as high 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, wild boar and barking deer showed extreme variation. Frequency distribution 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 were classified into two groups, the first one consisting of animals like barking deer, sambar, gaur, cattle and elephant 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 Nilgiri langur, Lion-tailed macaque, Bonnet macaque and Giant squirrel were examined. The availability of prey to carnivores and the competition among them were also studied.

STATUS OF ELEPHANTS IN PERIYAR TIGER RESERVE

V.S. Vijayan

The first census figures was brought out by the wildlife Division of Kerala Forest research Institute, after the wildlife survey conducted by them between November 1977 and December 1978. Altogether 65 herds and 8 solitary individuals to make a total of 588 were seen inside the reserve. Composition of herds, especially age groups could not be assessed in all cases due to inability to observe them from close range. However, they were classified mainly into adult bulls, subadult bulls, calves and others (cows and makhnas). Makhnas, said to be common in the area, could not often be recognized from distance, especially when they were among thick tall grass.

Their most preferred habitat inside the reserve is grassland and then, the moist deciduous forest. Though we could not see them in the evergreen forest, the presence of dung in these forests suggest that such forests also form part of their habitat. The

nature of terrain does not appear a barrier to the movement of the elephant except perhaps the very steep cliffs. The lake too is often negotiated with ease. They were seen in all kinds of terrain, from the lake margin through the numerous valleys and hills and, even grass-land hill tops like Sivagiri mettu, Madhalamthukki and Chamikayam. Possible movement pattern, threats to the elephants and recommendations are also mentioned in detailed.

THE POPULATION AND CONSERVATION STATUS OF ASIAN ELEPHANTS IN THE PERIYAR TIGER RESERVE, SOUTHERN INDIA

Uma Ramakrishnan, J.A. Santosh, Uma Ramakrishnan and R. Sukumar

Published in Current Science Vol.74(2)- 1998.

A rapid survey was carried out at Periyar during March-May 1994, when the density estimates were made and data on population structure obtained. The density of the elephants was estimated using the line transect, indirect count method. A total of 64 transects was cut in different habitat types. The total of elephants in the sanctuary was found to be 1166 (95% confidence limits of 641-2115) during 1994. Using direct elephant sightings, the adult male to female ratio was found to be 1:101. Of the 5 adult males recorded, only two were tuskers and the rest were makhnas.

POPULATION DYNAMICS OF ELEPHANTS IN PERIYAR TIGER RESERVE

P. Mohana Chandran

Research Range Officer, Periyar Tiger Reserve

Periyar Tiger Reserve has been traditionally considered as a model habitat for elephants. But the trend, which the population has started showing, calls for a review of that and a fresh quantitative habitat assessment. The data collected is as part of the animal monitoring activities done from September 1987 to January 1990. The method was to traverse different parts of the sanctuary daily and record direct sighting of animals, indirect evidences like kills and also collect scats and pugmarks tracings with respect to carnivores. A total of 193 herds were sighted with a total of 1610 elephants in these herds during the study period. Herd size of range 3 – 10 constituted 725 of the sightings. The largest herd sighted numbered 26 but was sighted just once. The total

number of elephants in the sanctuary as assessed from density figures is between 935 – 1100 elephants. The population of elephants in Periyar shows signs of degradation and the most obvious reason being the very low percentage of males in the population. Along with stringent protection measures a review of habitat quality is also suggested in view of the downward trend in herd size.

HABITAT UTILIZATION BY ELEPHANTS IN PERIYAR TIGER RESERVE

J.K. Tewari

Wildlife Preservation Officer, Thekkady

Variety of habitats, coupled with favourable climatic conditions make Periyar an ideal habitat for elephants. No wonder that it supports a population of around 1000 elephants which is the largest single population of Asiatic elephants in India, that too without creating a serious crop damage problems for adjoining areas. As per the reconnaissance report, elephants most preferred habitat is grassland and than the moist deciduous forest. They have recorded 40% sighting in moist deciduous forests, 51 % in grassland and 9% in Savannah areas with no sighting in evergreen and semi-evergreen areas. But they have recorded presence of dung in evergreen areas and inferred to be part of less preferred habitat.

SOME ASPECTS OF THE ECOLOGY AND BEHAVIOUR OF ASIATIC ELEPHANTS IN THE PERIYAR WILDLIFE RESERVE, KERALA

Joseph J. Karoor

Periyar Wildlife Reserve, Thekkady.

The geographical features, climate, vegetation and forest types of Periyar Wildlife Reserve are favourable factors to sustain a large elephant population. There are about 750-850 elephants in Periyar as evidenced by the studies conducted between 1977 and 1983. the percentage of adult tuskers is very low. It may be perhaps, less than 5%. There are only few makhnas in the population, if at all present. The number of youngones is satisfactory. Sub-adult bulls may be helping in the propagation of the species to a great extent. Herds are usually 10 to 60 in numbers, but may go up to

about 100 or more. Grassland is the main habitat of the elephants of Periyar. They feed mainly on grass. Leaves and bark of some plants are also eaten. Bamboos and reed forms a major part of their diet. Elephants are seen in all habitats, from lakeshore to the hilltops. Availability of water is not a limiting factor in Periyar, as in other parks. Elephants swim across the vast lake with ease through certain specific routes.

RESEARCH PROJECTS CARRIED OUT IN PERIYAR TIGER RESERVE BY DR. V. J. ZACHARIAS

1. Status and food habits of Tiger, *Panthera tigris* with reference to prey-predator relations in Periyar Tiger Reserve .

The major mammalian predators in Periyar comprise the Tiger, the Leopard and Wild dogs. They have a wide distribution in the reserve in smaller numbers. The prey species of tiger consist of Sambar, porcupine, gaur, wild boar, elephant, barking deer, mouse deer, rodents, varanus, domestic cattles and buffalos. Leopards prey on Nilgiri langur, sambar and flying squirrel while wild dogs prey on sambar, barking deer, mouse deer and wild boar. The proportion of different prey species taken by various predators is also interesting. Age and sex of Tiger kills were also recorded. The biomass is yet to be worked out.

2. Habitat preference of Elephants *Elephas maximus* in Periyar Tiger Reserve, South India.

Elephants in Periyar used grasslands and moist deciduous forests during monsoon and grasslands and savannahs during post monsoon period. Evergreen and semi-evergreen habitats were used more in winter and dry seasons. They took grasses like *Cymbapogon flexuosus*, *Cyrtococcum oxyphyllum* and *Panicum repens* almost throughout the year. In addition to grasses they consumed leaves, barks and fruits of a number of trees. Eighty eight food plants of Elephants in Periyar during different months of the year were identified.

3. Population dynamics of Sambar *Cervus unicolor* in Periyar.

Sambar the major prey species of Tiger, Leopard and wild dogs has a wide distribution in Periyar. The absence of chital here seems to put a high predation pressure on sambar. Sambar use mostly grasslands and moist deciduous forests. One hundred and three different food plants taken by sambar during different months of the year were recorded. Grasses constitute the major portion of the food of the species. Sambar was seen singly and in herds of upto 60 individuals. Mating takes place mostly during winter months. Males with shed antlers and in 'velvet' were observed throughout the year but mostly from December to February. Fawns were observed almost throughout the year but most of the birth were noted in May-July. Besides predation a number of sambar death due to unknown reason were recorded in 1994-96.

4. Troop structure and food habits of Nilgiri Langur *Presbytis johnii* Periyar Tiger Reserve.

Size of Nilgiri Langur troops in Periyar varied from 8-27. Adults/subadults female constitute the dominant category in langur troops. They took fruits, buds and leaves of a category of plants. One hundred and one food plants of Nilgiri langur in different months of the year were recorded. Mating was observed only once during day time. Young ones were seen almost throughout the year, mostly during June/July. Four langur were electrocuted during this period. They are the major prey species of Leopard in Periyar.

5. Status of Raptors in Periyar.

Thirty five species of raptors were recorded in Periyar. This included 10 winter visitors and 4 local migrants. The white-tailed sea eagle was the first record for South India. The raptors are recorded in fewer numbers in Periyar and the increasing crow population poses threat to them.

Flora

ORCHIDS OF HIGH WAVY RECOLLECTED

N. Sasidharan, K.P.Rajesh and Jomy Augustine

Journal: Bombay Natural Hist. Society. Vol. 94: 473-477 (1997)

The High Wavy Mountains are remarkable for their endemic flora, particularly orchids. Among the 34 orchids reported by Blatter in 1928, some of them could not be located and are considered as possibly extinct, mainly due to habitat degradation. This paper deals with 64 species of orchids including all the species reported by Blatter, except *Chrysoglossum halberii* Blatt., *Odontochilus rotundifolius* Blatt. relocated. *Bulbophyllum agastyamalayanum* Gopalan & Henry is reduced to *B. xylophyllum* Par. & Reichb.f. Distribution analysis and relevant notes are provided.

***Ficus caulocarpa* Miq. And *F. costata* Ait.**

(Moraceae) – Additions to the Flora of India

N. Sasidharan & Jomy Augustine

Rheedea Vol. 9 (1): 77-80. 1999

Occurrence of *Ficus canlocarpa* Miq. And *F. costata* Ait. In India is reported

REDISCOVERY OF *Taeniophyllum scaberulum* Hook. F., AN ENDEMIC ORCHID FROM PERIYAR TIGER RESERVE, KERALA INDIA

K.P. Rajesh, Jomy Augustine and N. Sasidharan

Rheedea Vol. 7 (1): 43-46. 1997

Taeniophyllum scaberulum Hook. F. (Orchidaceae) first collected in 1854 from 'Travancore', had so far not been located and was considered extinct. Now the species is collected after a gap of 140 years from the Periyar Tiger Reserve, Kerala.

***Habenaria periyarensis*, A NEW ORCHID FROM INDIA**

N. Sasidharan, K.P. Rajesh and Jomy Augustine

Rheedea Vol. 8 (2): 167-171. 1998

Habenaria periyarensis Sasidharan, Rajesh et Jomy (Orchidaceae) is described from the Western Ghats of India.

**OCCURRENCE OF *ROTALA RITCHIEI* (CLARKE) KOEHNE
(LYTHRACEAE) IN PERIYAR TIGER RESERVE, KERALA**

K.P. Rajesh, Jomy Augustine and N. Sasidharan

J. Econ. Tax. Bot. Vol. 20 (3): 725-727. 1996

During the study on the flora of Periyar Tiger Reserve, an interesting specimen of *Rotalla* was collected. The relocation of viable populations of this vulnerable species from Periyar Tiger Reserve, an already protected area is significant.

**SOME THREATENED PLANTS COLLECTED FROM SABARIMALA AND
SURROUNDING EVERGREEN FORESTS, KERALA**

Jomy Augustine

Indian Journal of Forestry. Vol. 25(3): 338-340, 2002

During a short term biodiversity assessment study conducted in Sabarimala area more than 410 species of flowering plants were collected and identified. They were critically studied and of which 37 species were found to be notable regarding their conservation aspects. Fifteen species of the above list are endemic to Kerala.

REAPPEARANCE OF *SYZYGIUM MYTHENDRAE* (BEDDOME EX BRANDIS) GAMBLE AND *ELLIPANTHUS TOMENTOSUS* KURZ IN THE SOUTHERN WESTERN GHATS

N. Sasidharan, P. Sujanapal & Jomy Augustine

J.Econ. Taxon. Bot. Vol. 26 No. 3 (2002)

Syzygium myhendrae (Beddome ex Brandis) Gamble and *Ellipanthus tomentosus* Kurz, known only by their earlier collections are recollected after a century. The fruit of the former is described and illustrated for the first time based on the recent collections.

NEW RECORDS OF GRASSES FROM KERALA

K.K. Sajeev, N, Sasidharan & Jomy Augustine

J. Econ. Tax. Bot. Vol. 22 No. 2 (491-494) 1998

Floristic studies in Chinnar Wildlife Sanctuary and Periyar Tiger Reserve, two protected areas in Idukki district of Kerala State resulted in the findings of 12 species of grasses as new records to Kerala.

ORCHIDS OF PERIYAR TIGER RESERVE, SOUTH INDIA

N, Sasidharan , K.P. Rajesh & Jomy Augustine

J. Econ. Taxon. Bot. Vol. 24 No. 3 (611-621) 2000

This paper is on 148 orchids collected from the Periyar Tiger Reserve, the largest protected area of Kerala State. This include one new species *Habenaria periyarensis* and some interesting records. *Bulbophyllum mysorensis* (Rolfe) J.J. Smi. *B. macraei* Lindl.) Reichb. F., *Eulophin pratensis* Lindl. and *Cheirostylis parmfolia* Lindl. are new records for Kerala State. *Taeniophyllum scaberulum* Hook f is rediscovered after more than 140 years. Distribution data and relevant notes are provided.

**REDISCOVERY OF *SYMPLOCOS MONANTHA* WIGHT
(SYMPLOCACEAE) FROM PERIYAR TIGER RESERVE**

Jomy Augustine & N. Sasidharan
Indian Journal of forestry Vo. 22(3) 271-272, 1999

Symplocos monantha Wight (Symplocaceae), described in 1848 has not been recollected and hence considered extinct. It is now collected after a gap of 150 years from Periyar Tiger Reserve, Kerala.

**A NEW SPECIES OF *Syzygium Gaertn.* (Myrtaceae) FROM SOUTHERN
WESTERN GHATS, INDIA**

N. Sasidharan & Jomy Augustine
Rheedea Vol. 9 (2): 155-158. 1999

A new species of *Syzygium Gaertn* is described from Southern Western Ghats

***Zeuxine affinis* (Lindl.) Benth. Ex. Hook.f. (Orchidaceae) – A NEW RECORD
FOR PENINSULAR INDIA**

N. Sasidharan K.P Rajesh & Jomy Augustine
Rheedea Vol. 9 (2): 159-161. 1999

Zeuxine affinis (Lindl.) Benth. Ex. Hook.f. (Orchidaceae) is reported for the first time from Peninsular India and described with illustrations.

***Lobelia Zeylanica* Linn. (Lobeliaceae): A NEW RECORD FOR SOUTH INDIA
Jomy Augustine & N. Sasidharan**

STARS, Vol. 1, No. 1, 1999, p. 19-21

The occurrence of *Lobelia zeylanica* Linn. (Lobeliaceae) in South India is reported. A description, illustration and relevant notes are provided.

FLORISTIC DIVERSITY OF PERIYAR TIGER RESERVE

N Sasidharan
Kerala Forest Research Institute, Peechi- 680 653

The Periyar Tiger Reserve lies between 9^o16' and 9^o36' North latitude and 76^o57' and 77^o25' East longitude along the Western Ghats in the Idukki Reserve District of Kerala. The Reserve which has an area of 777 km² includes the Periyar lake spread over 26 km² is the largest Protected Area in the State and forms 16 per cent of the area of Idukki district.

The varied topographic features, soil types and high rainfall favoured the formation of tropical rain forests, the principal vegetation types of the Tiger Reserve. These forests, due to the dense luxuriant growth of plants of all size and dimension have the richest diversity.

The floristic study carried out resulted in the document of 1980 taxa of flowering plants. They belong to 147 families. The Dicotyledons are represented by 1450 species under 621 genera belonging to 124 families and Monocotyledons by 530 species under 210 genera and 23 families. Poaceae with 164 species under 76 genera is the dominant family followed by Fabaceae with 155 species in 52 genera. Orchidaceae represented by 148 species in 60 genera is the third. Twenty eight dicots and 6 monocots are represented by single species each. Among the 1980 species of flowering plants collected from the Tiger Reserve, 519 are southern Western Ghats endemics which form about 26 percent. Orchidaceae stands first with 55 endemic species; Rubiaceae have 35, Acanthaceae have 32, Poaceae and Fabaceae, Lauraceae, Balsaminaceae and Euphorbiaceae have 25 each. The Periyar Tiger Reserve comes under the Anamalai-High Range Centre of endemism. Nayar (1996) reported that there are 94 species exclusively endemic to this region. The Periyar Tiger Reserve abodes 25 species endemic to the Anamalai-High Ranges.

In the Tiger Reserve, there are 151 species that have been placed under various red listed categories including 15 species belongs to the possibly extinct category. Species such as *Anacolosa densiflora*, *Casearia rubescens*, *Crotalaria peduncularis*, *Humboldtia bourdillonii*, *Ilex gardneriana*, *Symplocos monantha*, *Syzygium myhendrae*, *Taeniophyllum scaberulum* and *Vernonia multibracteata* are collected from the first time after their type collection.

The exotic species including weeds constitute only 3 per cent, indicating that the flora is relatively undisturbed. The occurrence of 1980 species in an area of 777 km² indicates the richness and diversity of the flora of the Reserve, which form about 50 per cent of the estimated flora of Kerala.

Fauna

BUTTERFLIES OF PERIYAR TIGER RESERVE – 1995

Suresh Elamon

Bird Wing, C.I.T Road, Trivandrum

This study is a maiden attempt to inventory the butterfly fauna of the sanctuary. During the project which started and lasted for twelve months, the investigator camped in various places in the Tiger Reserve. From the base camps he made daily treks to adjoining areas where he collected and photographed different butterfly species. One of the major objectives of the project was to photo document as many butterfly species as possible in their natural habitat. All the species that were collected have been properly spread, mounted, named and preserved in insect storage boxes. A total of 160 species of butterflies were collected from Periyar Tiger Reserve are described in this. Possible recommendation was given for the better management of the butterflies in the reserve.

BUTTERFLIES OF PERIYAR TIGER RESERVE, KERALA (INDIA)

M. Jafer Palot, George Mathew and V.J. Zacharias

Published in Advances in Forestry Research in India Vol. XVII, 1997

In a study on the butterflies of Periyar Tiger Reserve, Kerala, 119 species of butterflies were recorded from different habitats. Maximum number of species recorded belonged to Nymphalidae (29 spp.) followed by Pieridae (18 spp.), Satyridae (18 spp.), Hesperiiidae (14 spp.) and Lycaenidae (13 spp.).

The distribution of butterflies in the different habitats was also studied. The evergreen forests contained several endemic and rare butterflies like *Pachliopta pandiyana* Moore (Papilionidae), *Parthenos Sylvia virens* Moore (Nymphalidae) and *Idea malabarica* Moore (Danidae). The moist deciduous forests including teak and eucalyptus plantations supported a variety of butterflies belonging to Nymphalidae, Pieridae and Danidae. Local aggregations of certain endemics like *Parantica nilagiriensis* Moore and *Tirumala septentrionis dravidarum* Fruhstorfer (Danidae) were recorded from this habitat. The grasslands, because of their characteristic vegetation, supported relatively fewer species like *Vanessa cardui* Lin., *Junonia hierta* Fb. (Nymphalidae) and *Eurema* spp. (Pieridae), but these were present in abundance because of the colonization of their respective host plants in this habitat.

The reverine forests were rich in Lycaenidae and Papilionidae and aggregation of these butterflies was recorded. Nineteen species recorded in this study are endemic to South India.

**NOTE ON A COLLECTION OF SPIDERS FROM PERIYAR TIGER
RESERVE, KERALA, S. INDAI**

Jaimon Joseph, A.K. Bhardwaj and V.J. Zacharias

Published in Indian Forester, Vol. 124 (10), 1998

In a preliminary survey, 20 species of spiders were identified in Periyar Tiger Reserve. It seems that the reserve has much potential for a detailed Arachnid survey.

**OCCURRENCE OF FRESH WATER MEDUSA – *LIMNOCNIDA INDICA*
ANNANDALE IN PERIYAR LAKE, KERALA, SOUTH INDIA**

V.J. Zacharias and A.K. Bhardwaj

Published in Indian Forester Vol. 121 (10), 1995

The purpose of this note is to report the abundance of fresh water Medusa *Limnocyclus indica* Annandale in the Periyar Lake. The interesting discovery of the fresh water Medusa in Periyar lake indicate the potentials of the lake for further limnological studies.

FISH FAUNA OF PERIYAR TIGER RESERVE

V.J. Zacharias, A.K. Bhardwaj and P.C. Jacob

Published in JBNHS Vol. 93 (1), 1996

The status and distribution of fishes in the rivers and the lake of Periyar Tiger Reserve. Kerala was studied and 35 species belonging to 7 orders and 11 families were recorded. The family Cyprinidae contained maximum number of species (13). Thirteen species of fishes collected during the study are endemic to Siuthern Western Ghats. Two new species, namely *Lypidopygopsis typhus* (Schizothoracinae) and *Crossocheilus periyarensis* (Cyprinidae) were recorded from Periyar while another, *Echathalakanda (Barbus) ophiocephalus* (Cyprinidae) was rediscovered from Periyar River.

***NOEMACHEILUS MENONI*, A NEW SPECIES OF FISH FROM
MALAPPARA, PERIYAR TIGER RESERVE, KERALA**

V.J. Zacharias and K.C. Minimol

Published in JBNHS Vol. 96(2), 1999

Noemacheilus menoni is described as a new species of fish from the Periyar river of the High Ranges of the Western Ghats of Kerala State, South India. From five specimens it is characterised by a complete lateral line, an irregular reticulation of dark blotches and bands with light or creamy inter-spaces on the body and three narrow bands on the caudal fin.

**BIODIVERSITY STATUS OF FISHES OF PERIYAR TIGER RESERVE
WITH SPECIAL REFERNECE TO ENDEMIC AND ENDANGERED FISHES**

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Thirty five fish species belonging to 3 orders and 10 families were collected from various locations surveyed in Periyar Tiger Reserve for a period of two years. Family *Cyprinidae* stands out first with a numerical strength of 18 species, followed by the family *Balitoridae* with 7 species. While assessing the biodiversity status of the fishes of the Tiger Reserve, it was seen that 13 species of fishes are already under threatened category. 3 species viz. *Lepidopygopsis typus*, *G.micropogon periyarensis* and *Puntius ophicephalus* are critically endangered and their distribution is extremely confined to some of the geographical regions only. The relative abundance of the species as expressed in terms of catch/hr. within the reserve area from the respective locations show that species such as *Crossocheilus periyarensis*, *Nemacheilus menonii*, *H.micropogon periyarensis* and *Lepidopygopsis typus* were having comparatively low values.

10 species are found to be having a geographical distribution in Kerala only while 6 species are characterised by their strong endemism to Periyar Tiger Reserve. Over exploitation combined with various types of human interventions in the form of

pollution, habitat destruction and invasion of exotics are the main reasons attributed to the endangerment of the species in Periyar Lake. Differential sex ratio, asynchronisation of breeding season and low fecundity rate could be pointed out as some of the reasons for the endangerment of the species such as *Lepidopygopsis typus* and *Crossocheilus periyarensis*. Management measures to be adopted for the conservation of the species facing threats of endangerment are highlighted.

**ON THE NECESSITY OF PRESERVING THE FISH MICROHABITATS OF
PERIYAR TIGER RESERVE FOR THE CONSERVATION OF THE
ENDEMIC AND ENDANGERED FISHES**

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The relationship between habitat variables and biomass of three critically endangered and endemic species viz. *Lepidopygopsis typus*, *Hypselobarbus micropogon periyarensis* and *Crossocheilus periyarensis* of Periyar Tiger Reserve have been examined. Abundance of these species were found related to some habitat parameters and the variables showing the highest correlation with the standing stock was used for working out the habitat suitability index (HSI) models. Of the 51 physico-chemical parameters studied from different parts of Periyar river system revealed that 8 parameters such as bed rock, chute type microhabitat, lux, overhanging stream boulders, overhanging vegetation, total shaded area of the stream, total tree cover and slope showed high correlation with the biomass of *Lepidopygopsis typus*. While biomass of *Hypselobarbus micropogon periyarensis* showed a direct correlation with midchannel pools, total shaded area and overhanging vegetation and an indirect correlation with depth, total tree cover on the riparian zone and slope. Biomass of *Crossocheilus periyarensis* showed direct correlation with overhanging vegetation, scour out pools, total tree cover and large woody debris and indirect correlation with lateral pools. The results revealed that the nature of microhabitats and the habitat variables have profound influence on the distribution and abundance of these three endemic fish species in Periyar river. In order to protect these three

species, preservation of their natural habitats are very essential as these species show high degree of habitat specificity. As these species are greatly endemic to Periyar Tiger Reserve any change in their microhabitat may leads to their total extinction from the world.

THREATS TO BIODIVERSITY OF PERIYAR LAKE WITH SPECIAL REFERENCE TO MANAGEMENT OPTIONS FOR SUSTAINABLE UTILISATION OF AQUATIC LIVING RESOURCES

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Periyar Tiger Reserve is one among the 18-biodiversity hotspots of India. The distinct feature of this National park is the man-made reservoir, Periyar lake at the centre with a water spread area of 2600 ha, having a depth range from 32 to 46 m. Periyar harbours 6 endangered fish species endemic to this region alone. Being a tourist centre Thekkady attracts over 4.5 lakhs tourists annually. Around 6-7 diesel and 2-speed boats are plying for sight seeing in the lake on a daily basis. Also the sewage waste from the in and around Kumily town is being decanted directly into the lake. The present study was undertaken for a period of eight months from September 2001 to April 2002 to assess the effect of human intervention and consequent pollution in Periyar lake and also to delineate its impact on aquatic bioresources. Among the various water quality parameters monitored nutrients such as nitrite and phosphate concentrations were comparatively high and above the permissible level in Station 1 (6.55 and 1.56 moles/L respectively), levels of faecal coliforms were beyond the permissible level (52 colonies/ ml) in this station, where the sewage waste from Kumily town was directly discharged. The level of hydrocarbon was above the mandatory levels in Station 2 and 3 (1.61 and 0.93 ppm). Similarly, the concentration of lead (Pb) showed comparatively higher values in Station 1 (0.0015 ppm). Large deposits of non-degradable substances such as plastic noticed at the boat landing center and its surroundings. Eutrophication and faecal contamination rendered an alarming increase in the population of copepods (3.6 Nos./ ml) in Stations 1 and 2 which would manifest a higher degree of sewage pollution in these stations. The various threat imposed on this aquatic ecosystem have eventually resulted in the loss

of biodiversity as manifested by the disappearance of various aquatic species which were recorded earlier from the lake such as *Hypselobarbus micropogon periyarensis* and *Crossocheilus periyarensis*. The paper also discusses various mitigation measures that need to be implemented for conservation of aquatic biodiversity of this important hotspot of Kerala.

FISH DIVERSITY IN PERIYAR TIGER RESERVE

Minimol K.C.

C/o Santhoshlal U, Employees' Provident Fund Organization, Sub Regional Office,
Chalakkuzhy Bldg. Kottayam 1

Periyar Tiger Reserve include Mullaperiyar river and its tributaries. Mullaperiyar is formed of two rivers, Mullayar and Periyar. Forty one species belonging to five different orders 11 families and 24 genera were found in the reserve *Lepidopygopsis typus* Raj, *Crossocheilus periyarensis* (Menon & Jacob), and *Noemacheilus menoni* (Zacharias & Minimol) were new records.

PATTERN AND PROCESSES OF FISH ASSEMBLAGES IN PERIYAR LAKE VALLEY SYSTEM OF SOUTHERN WESTERN GHATS- 1999

L.K. Arun

Kerala Forest Research Institute, Peechi

The ecological structure and functional process of fish assemblages in the 26 km² man-made Periyar Lakh in Periyar Tiger Reserve (PTR) and 75 km long streams (Periyar and Mullayar) were studied during 1994-96. A total of 27 fish species were encountered in the system. Of these, 14 (52%) are endemic to Western Ghats, 52% are threatened and 33% are endemic and/or threatened. A comparison in the list of fishes recorded in 1948 with that of the present study indicates loss of many species (16) and addition of a few species (8). Most of the threatened fishes are found in the streams than in the lake. The exclusive (stenotopic) endemics of Periyar lake-stream system like *Lepidopygopsis typus*, *Puntius micropogon periyarensis* and *Crossocheilus periyarensis* are relatively abundant in the streams. The population densities of the threatened and endemic fishes are generally low in the system.

The diet and morphological analysis reveal that the fishes largely depend on food bases like aquatic and terrestrial insects and other benthic macroinvertebrates

with distinct trophic segregation patterns. Based on diet, the fishes are classified into groups by hierarchical clustering technique namely, terrestrial insectivore, benthic insectivore, insectivore-omnivore, insectivore-detritivore, omnivore and algivore. Similarly, on morphological characteristics, the fishes are grouped into water column rovers, bottom cligers, deep-bodied rovers, bottom eel-likes and surface-orienters. These are again readily separated into various niche types based on dietary and morphological features such as surface, pelagic, benthic, substrate and individualistic. Resource requirements based on habitat associations like depth, flow, substrates and food are assessed for endemic and threatened fishes.

Biological invasion by exotic fishes like *Oreochromis mossambicus* and *Cyprinus carpio communis*, analysed with ecological tools like diet, morphologic as well as habitat overlaps indicate the existence of a high degree of interspecific interaction between these exotic fishes and a few native, endemic and/or threatened fishes. A comparison with the fish communities in the adjacent zones or biotopes (downstream systems and the streams in nearby leeward slope) indicate a high degree of ichthyofaunal diversity in Periyar lake and streams in relation to downstream reaches and streams in the leeward slope.

The local inhabitants living around the PTR selectively fish on the exotic as well as the endemic/threatened fishes of the lake. The average daily fish catch per fisherman is estimated to be 4.2 kg. which realized an amount of Rs.168.00 per fisherman per day. The annual catch for the four selected fish species (2 exotic and 2 native) is estimated as 12 tonnes against a possible projected annual fish production of around 22 tonnes.

**STATUS AND DISTRIBUTION OF FISHES IN PERIYAR LAKE-STREAM
SYSTEM OF SOUTHERN WESTERN GHATS**

L.K. Arun

Published in Fish Gen. Biodiversity Conserv. Natcon Pub. –05: 77-87. 1998

The 26 sq.km. man made lake and 74 km long streams that drain into the lake constitute the Periyar lake-stream in the Periyar Tiger Reserve of Southern Western Ghats. Of the 27 fish species encountered in this aquatic ecosystem, 14 (52%) are endemic to Western Ghats. 14 (52%) are threatened and 9 (33%) are threatened and endemic. A comparison of the list of fishes surveyed in 1948 with that of the present study indicates the loss of many species (16) and addition of a few species (8). The fish densities in the stream habitats are more than the lake. Most of the threatened fishes are more abundantly found in the streams than in the lake. The exclusive endemics of the Periyar lake-stream system like *Lepidopygopsis typus*, *Puntius micropogon periyarensis* and *Crossocheilus periyarensis* are relatively abundantly distributed in the streams. The population densities of the threatened and endemic fishes are generally low in the system. The regulation of the streams by damming, invasion of exotic fish species and traditional tribal fishery seem to be the major threats to these unique and diverse fish communities.

RECORD OF NEW FISHES FROM PERIYAR TIGER RESERVE

L.K. Arun, C.P. Shaji and P.S. Easa

Published in JBNHS

As a part of the study on the structure of fish communities in the lake and associated streams, fishes were collected seasonally from the lake and streams during May 1994 and April 1995. The analyses of fish collections revealed the presence of six new species of fishes in the Periyar lake which were not listed in the earlier investigations. They are 1. *Cyprinus carpio communis* Linnaeus, 2. *Oreochromis mossambicus* (Peters), 3. *Garra maclellandi* (Jerdon), 4. *Bhavana australis* (Jerdon), 5. *Noemacheilus guentheri* Day and 6. *Travancoria jonesi* Hora.

**A PRELIMINARY LIST OF AMPHIBIAN FAUNA OF PERIYAR TIGER
RESERVE, THEKKADY, KERALA, SOUTH INDIA**

V.J. Zacharias and A.K. Bhardwaj

Published in Indian Forester Vol. 122 (3) – 1996

During the preliminary survey, 16 species of amphibians were identified. Of these 10 species are endemic to Western Ghats. It is an additional information on amphibians.

AMPHIBIAN FAUNA OF PERIYAR TIGER RESERVE, KERALA

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The survey was conducted in the Periyar Tiger Reserve to enlist the amphibian fauna and their microhabitats and status. A total of 25 species belonging to 5 families were recorded. Of these, 2 species were abundant, 11 species common and the rest rare in the region. The habitats, microhabitats and status of each species were discussed. The diversity, evenness, richness, ecological distribution, niche breadth and niche overlap of the amphibian assemblage were determined. The diversity was rich and the distribution of amphibian even. Niche breadth and niche overlap values were high which indicate that the amphibian community is showing great ecological similarity among co-existing species.

REPTILES OF PERIYAR TIGER RESERVE, KERALA

V.J. Zacharias

Published in JBNHS Vol. 94 – 1997.

Forty five species of reptiles including two species of testudines, 13 species of lizards and 30 species of snakes have been recorded in Periyar Tiger Reserve.

**NOTES ON THE SNAKES AND MAMMALS OF THE HIGH WAVY
MOUNTAINS, MADURA DISTRICT**

Angus F. Hutton

Highway Mountain is the North Eastern border of the Periyar Tiger Reserve and southwest corner of Madura District. The snakes collected from this area are given in details.

**A REPORT ON A HERPETOLOGICAL SURVEY OF THE
SRIVILLIPUTTUR RESERVE FOREST, TAMIL NADU**

Anita Malhotra and Kathryn Davis

Published in JBNHS Vol. 88

The Srivilliputtur Reserve Forest is situated in the south-western boundary of Periyar Wildlife Sanctuary in Kerala. The reptiles and amphibians found during a six-week survey of the Srivilliputtur Reserve Forest in July and August 1987 are described. The failure of the monsoon rains created unfavourable conditions and specimen numbers were low. The report is therefore largely anecdotal. Some observations on the breeding behaviour of the frogs *Ramanella triangularis* and *Micrixalus fuscus* are described.

BIRD SURVEY IN PERIYAR TIGER RESERVE – A REPORT 2002

A. Veeramani and Pramod G. Krishnan

An ornithological survey in Periyar Tiger Reserve was carried out for assessing the current status, distribution and habitat preferences of bird species in the Tiger Reserve. The objective of the survey was to assess status and distribution of birds, to find out their habitat preference and to identify the threats to the bird species, etc. eleven blocks were selected for the survey and 187 bird species were recorded during the survey of which 4 are entirely new additions to Periyar. Some of the new additions to Periyar by the tribal trackers and the existing records show totally 320 birds reported in Periyar. Habitat degradation, sporadic fire and cattle grazing are the major threat to the decline of bird population. The possible recommendations were given.

**BIRDS OF PERIYAR TIGER RESERVE, KERALA, SOUTH INDIA
Srivastava, V.J. Zacharias, A.K. Bhardwaj and P. Mohammed Jafer**

Published in Indian Forester Vol. 119 (10) – 1993

A check list of birds of Periyar Tiger Reserve was prepared. Two hundred and forty-nine species of birds are recorded in the reserve. Sixty species are new records for Periyar while 3 are new records for Kerala. The lesser number of wetland birds may be due to the absence of marshes and shallow water areas in the lake. Rarity of larger birds of prey may be due to their low population in nature or the agricultural practices in the surrounding areas. This study shows that Periyar has great potential for detailed ornithological research.

**A SURVEY OF CEYLON FROGMOUTH (*Batrachostomus moniliger*) BLYTH,
IN PERIYAR TIGER RESERVE
ELDHOSE, K.V**

The Ceylon Frogmouth (*Batrachostomus moniliger*) Blyth, Family Podargidae is one of the least known bird species of the evergreen forest biotope of the Western Ghats. A survey was carried out in Periyar Tiger Reserve and fifteen locations were selected for this study. The call of the Frogmouth (which differ in male and female) recorded on tapes was used for locating the bird in the selected areas. Frogmouth being a parochial bird, has limited home range and this character of the bird has been exploited to locate the birds in the selected area. When the audio-system plays, the birds if present in the locality respond to the call by producing vocal response and this helped to easily detect the occurrence of the bird in the area. The study over a period of six months for estimating the frogmouth population in Periyar Tiger Reserve resulted in recording a total 354 individuals from the 52 sites. There are several threats to the frogmouth population in PTR. Frogmouth conservation requires effective habitat management and measures must be evolved for the same with utmost urgency.

**STATUS, DISTRIBUTION AND ASPECTS OF THE ECOLOGY OF THE
NILGIRI WOOD PIGEON *Columba elphinstonii* (SYKES)
IN PERIYAR TIGER RESERVE**

V.J. Zacharias

The Nilgiri woodpigeon *Columba elphinstonii*, is a grey and green bird with a conspicuous black and white 'Chess board' on hind neck. It is an endemic species to the Western Ghats. The Nilgiri wood pigeon was sighted at Thekkady, Mullakkudy, Thannikkudy and Pachakanam. The birds were in evergreen, semi evergreen and moist deciduous habitats. The birds were met with fluing, on trees or on the ground. They took off on wings very fast and flew to distant places, often to the forest areas. Roost was once located on a dense Lantana scrub. Food of the birds were identified on few occasions. Once the wood pigeon was found to feed on fruits of *Actinodaphne hirsute*, *Persea macrantha* and figs.

**STATUS AND HABITAT USE OF THE GREY JUNGLE FOWL *GALLUS
SONNERATII*, TEMMINCK IN PERIYAR TIGER RESERVE**

V.J. Zacharias

The Grey jungle fowl *Gallus sonneratii* is a galliform bird of the size of a domestic hen. The species has a restricted distribution in the Penninsular India, in evergreen and moist deciduous biotope. Observations on the Grey Jungle fowl were carried out from morning till evening by time budget method. In Periyar Grey jungle fowl was found in different types of vegetations except the high grassy hills. The species also frequented human habitations in border areas. Food habit study shown the grey jungle fowl consumed insects including ants, termites, grasshoppers, crickets, beetles, earthworms and snails. They also took seeds of grasses and lantana and kitchen scraps. It start breeding in November. The species is threatened with poaching, egg collection and habitat destruction particularly in the periphery of the reserve.

A REPORT ON THE FOOD PLANTS OF SALIM ALI'S FRUIT BAT

LATIDENS SALIMALII

Pramod Padmanabhan, E. Kunhikrishnan & Jomy Augustine

J. Bom. nat. Hist. Soc. 98 (2) : 268-269

The analysis of fecal samples of Salim Ali's Fruit Bat collected from highwavy hills shows two species of figs. and three other tree species. The species identified were *Ficus beddomi*, *F. macrocarpa*, *Diospyros ovalifolia*, *Prunus ceylanicus* and *Eleocarpus oblongus*.

**DIVERSITY OF BATS OF PERIYAR TIGER RESERVE,
WESTERN GHATS, KERALA**

P.O. Nameer

A brief study was done to find out the bat diversity of Periyar Tiger Reserve. One hundred mist-net hours were spent, however, the capture rate was very low. Only 30 specimens could be collected. Of the specimens collected only two could be identified to the species level. The identified bat species are *Pteropus giganteus* (Flying Fox), *Cynopterus sphinx* (Short-nosed Fruit Bat) and *Rousettus sphinx* (Fulvous Fruit Bat).

**THE INDIAN FRUIT BAT *LATIDENS SALIMALII* THONGLONGYA, 1972
(CHIROPTERA: PTEROPODIDAE) REDISCOVERED IN SOUTHERN
INDIA**

Paul J.J. Bates, David L. Harrison, Nikky M. Thomas and Manoj Muni

Pub. In Bonn. Zool. Beitr. Bd. 45 (2): 89-98 --1994.

Six specimens of *Latidens salimalii* was collected in April 193 in the High wavy mountains, Tamil Nadu, India. Previously, this species was known only from the holotype which was collected in 1948. A description of the external, cranial, dental and bacular characters is included.

DISTRIBUTION AND ABUNDANCE OF NILGIRI TAHR IN PERIYAR TIGER RESERVE

Mohan Alembath

Nilgiri tahr (*Hemitragus hylocrius*, Ogilby 1838) is an endangered mountain goat listed in schedule I of the Indian Wildlife (Protection) Act 1972 and considered as vulnerable by the IUCN. In Periyar Tiger Reserve the tahr utilize Kerala part of Mangaladevi only for a short period. Activity is mainly on the Tamil Nadu side. Sixteen animals were observed in this area. The numbers were confirmed by 9 separate observations. Only two births were noticed. After a month only one was seen as survived. It would be interesting to observe whether the tahr that lost the young one has conceived again. It is reported that the tahr conceives again if the first one dies at an age of less than two weeks (Rice 1988). Signs of disturbances were very evident on the Tamil Nadu side. Workers engaged in routine forestry works like trek path maintenance, fire tracing, etc. do seem to impact the area.

STUDIES ON THE ECOLOGY AND BEHAVIOUR OF SLOTH BEAR

(*Melursus ursinus Shaw*) IN PERIYAR TIGER RESERVE

P.J. Thomas Nelson and Anil Kumar Bhardwaj

Periyar Tiger Reserve, Thekkady

A small scale survey to document the food habits of sloth bear with the chief objective of strengthening and enriching the database on this least studied important mammal of Indian forest so as to formulate effective management policies on a long-term view. Scat analysis and other indirect evidences were used for gathering data on the food habits of sloth bear. Maximum effort was taken to get direct sightings. As it was difficult to identify the sex by looking at the genitals larger animals were taken as adult males and the smaller ones females. Whenever cubs were visible the accompanying adult was taken as females.

About 65 sightings of the sloth bears were sighted from different part of the study area in different time period of the day. During the study period most of the sightings were solitary animals (N=33). Usually only one cub sighted with the mother (72.73%). More sightings of the animal were obtained from Thannikudi and Kumarikulam areas. No sightings were recorded from evergreen forest during the study period.

A total of 1594 scats were collected for analysis from different fixed transects during the study period. A total of 2186 undigested food remains were examined from 1594 scats of which, ants and termites constituted 90.89% of the overall diet. A total of 13 different food items were identified from the scats. Of these 5 were animal matter and rest belonged to seasonal fruit of different trees.

The ecological circumstances that induced structural and behavioral adaptations in the evolutionary history of sloth bears is prevalent in its greater intensity in Periyar Tiger Reserve. Active presence of different predators, carrion feeders, omnivores, an array of frugivores and above all presence of large stretches of tropical savanna with its untapped sub-terrestrial fauna have influenced the ecology of sloth bear. In Periyar Tiger Reserve, sloth bear is more an “ant eater” par excellence.

Sabarimala

- 1. Balasubramanian, M. 1999. Baseline survey and Ecological Impact Assessment in Poongavanam at Sabarimala. Periyar Tiger Reserve, Thekkady.**
- 2. Balasubramanian, M and A. Veeramani. 2000. Ecological Impact Monitoring of Swami Ayyappan Poongavanam Punarudharana Ecodevelopment Committee at Sabarimala. Periyar Tiger Reserve, Thekkady.**
- 3. Veeramani, A and Joju P. Alappatt. 2001. Ecological Impact Assessment of Sabarimala Pilgrim Routes. Periyar Tiger Reserve.**
- 4. Veeramani, A and Joju P. Alappatt. 2002. Ecological Impact Assessment of Sabarimala Pilgrim Routes. Periyar Tiger Reserve.**
- 5. Veeramani, A. 2003. Ecological Impact Assessment of Sabarimala Pilgrimage season 2002-03. Periyar Tiger Reserve.**
6. Balasubramanian, M and P.V. Karunakaran. 2003. Study on ecological impacts of SAPP EDCs intervention in managing the Sabarimala Pilgrimage along forests routes of Periyar Tiger Reserve.

All the above studies showing that over the years the pilgrimage has caused heavy destruction to the natural vegetation in Sabarimala and its surroundings. The high pilgrimage flow, removal of forest undergrowth, degradation of evergreen forests all finally made irreparable loss to the flora and fauna of the area. Establishment of exotic weeds, conversion of high altitude grassland into the disturbed habitat, noise pollution, etc. are the obvious immediate effect of pilgrimage. The natural evergreen forests changing to degraded moist deciduous patches, extensive areas of weed affected under growth are also some of the consequences. Any disturbance to this highly complex natural ecosystem comprising mainly of tropical wet evergreen forests may lead to disappearance of some of the vulnerable species from this area. The effects by Kerala Forest Department together with Ecodevelopment Committees have minimized negative impacts of the pilgrimage to a certain extent. The complete stopping in pole cutting, considerable reduction in the number of shops, sizable decrease in the accumulation of plastic wastes, etc. are some of the positive signs of this effort. The reduction in the vehicular inflow also gives hope for the rejuvenating habitats of the area. If few more strict measures are taken and regular monitoring are

implemented, it is sure that this chunk of evergreen forests can be saved for the future generations.

Some of the Recommendations given by the above studies

1. The yearly plying of heavy vehicles through the 4th mile – Uppupara route widens the forest tracts leading to landslides and soil erosion. As the continuous vehicular movement disturbs the wildlife and damage the forest tracts, vehicular movement in this route should be stopped.
2. As the plastics cause serious harm to the wildlife and soil texture, plastics carry bags and plastic packing materials should either be totally banned inside the forest or be removed immediately after end of the pilgrim season.
3. The deployment of staff mainly near thavalams for managing EDC activities has caused for ineffective perambulation in the pilgrim routes. So enough staff should be deployed in all the traditional routes for patrolling and perambulation.
4. As the cleared forest areas become the grounds for weed spread and subsequent loss of undergrowth, clearing of undergrowth for making thavalams by pilgrims should be strictly stopped.
5. Plying of tractors through Swamy Ayyappan Route has resulted in widening and deepening of the road, which often end in landslides and soil erosion. So plying of tractors through this route should be stopped.
6. Since donkeys are the most likely carriers of many contagious diseases, which affect the wildlife, donkeys should not be allowed to enter in to the forest.
7. Lack of awareness on conservation and biodiversity was mainly observed among the pilgrims. So awareness programmes should be boosted during the pilgrim season.
8. As part of the EDCs mutual commitment with the Forest Department, planting of indigenous tree species in the abandoned thavalams should be taken up by EDC members.

7. Animon, M.M and Dhaniklal, G. 2003. Phytosociological Study of Poonkavanam Area of Periyar Tiger Reserve. College of Forestry, Kerala Agricultural University.

An investigation was carried out with the objectives of characterizing the floristic composition, diversity and structure in the disturbed and undisturbed zones in Poonkavanam area of Periyar Tiger Reserve. In the disturbed zone, 347 individuals of plant belonging to 94 species were recorded that constituted a density of 868 individuals per hectare. The undisturbed zone exhibited high species richness with 94 species represented by 482 individuals contributing to a density of 1205 individuals per ha. 27 species were found exclusively in the undisturbed zone where as 21 species were found confined only to the disturbed zone. Animal abundance was high in the undisturbed zone indicating a better habitat use. Results indicate that disturbance has an impact on the distribution of animals, which has to be viewed seriously.

8. Sankar, S., N. Sasidharan, P.S. Easa and A.R.R. Menon. 2000. Environmental Impact Assessment of Diversion of Forest Land at Sabarimala. Kerala Forest Research Institute, Peechi.

The result of the study has revealed that the TDB has not fully utilized the land already diverted to them by the KFD. Further, a strong belief exists among the pilgrimage that the integrity of the Sacred landscape has to be maintained and, hence, a negative attitude towards diversion of additional land, new buildings and pucca lodging facilities.

The comprehensive Environment and Social Impact Assessment revealed that diversion of forest land will lead to serious and irreparable damage at Appachimedu, Valiyanavattam, Chalakayam-Pampa Road and Marakootam and, hence, is not advisable.

The study has recommended that the TDB may look into improving the facilities within the context of the land presently available through modernization and rationalization. TDB may imbibe a pilgrim centered approach rather than revenue centered.

9. Rajan Gurukul, P.M. 1999. Report on Periyar Tiger Reserve, Fringe Area Study. School of Social Sciences, M.G. University, Kottayam.

The TDB is an ever augmenting hostile stake-holder of the PTR. The Devaswom Board has 60 Acres of area under lease at Sabarimala and Pampa.

However, the actual land under use by it is far more than this. As the custodian of the phenomenal march of people, their goods, services and pollutant discharges with all devastating effects, the TDB is a hostile stake-holder. Under economic interests/motivations the board ignores the sanctity of the *Punkavanam* and causes more and more deforestation. What the board often projects as the basic needs of the pilgrims are not their needs at all but the board's own vested interests. It is recommended that it is extremely important that a substantial share of the temple revenue is set apart for ecological maintenance and restoration of degraded areas.

10. Rajan Gurukul, P.M. and S. Raju. 2001. Enclave Management Study. School of Social Sciences, M.G. University, Kottayam.

The study clearly showed the adverse impact of pilgrimage on the forest ecosystem. The transition of the vegetation along the Pampa-Sannidhanam route and other pilgrim routes is evident. Unscrupulous constructions and alterations of landscape all cumulatively can lead to inevitable ecological and geological disasters.

The report very wisely calls for an all out effort of both ecological persuasion and legal imposition to check the reckless flow of pilgrims through the old and new paths criss-crossing the PTR.

Based on the findings of the present study the following recommendations were given.

1. Recognise Sabarimala as the integral part of the PTR where all the rules and regulations formulated for the protection of the natural population of the Royal Bengal Tiger.
2. The worship of the deity be permitted maintaining the sanctity and calmness of the forest shrine.
3. Stop all the activities at Pampa, Sannidhanam and pilgrim routes in the Tiger Reserve which will lead to urbanization and permanent settlements.
4. Do not extend the number of days on which the shrine is kept open. Permanent settlements and continuous human activities will surely impart irreversible damages to the fragile evergreen forest ecosystem.
5. Identify and eradicate non-traditional and non-ritualistic practices at the premises of the shrine.

6. An efficient post season clearing operation with the participation of voluntary organizations and EDCs of PTR should be planned in the coming years.

11. Raju, S. 2003. Activities, Behavioural patterns and effectiveness of the Ecodevelopment Committees. Dept. of Futures Studies, University of Kerala, Thiruvananthapuram.

This report shows the behavioural patterns of the SAAP EDCs and Village EDCs engaged in various types of vending operations on the forest routes of PTR during the peak season of pilgrim tourism was the central theme. People who have a long history of being subject to some structures and at the same time showed capability to alter and modify some other structures can be repositioned to become agents of the Ecodevelopment idea and practices which are new to them. Failures of plans and projects are the outcomes of the limitations and lacks of the implementing or conceiving agency and prohibitive structures. The officials of the KFD can identify themselves with their objects of facilitation and surveillance. The facilitators are homogenous or majority actors of the Ecodevelopment share a common ambit of ideas and norms of practice.

12. Satheesh, R and P.M. Rajan Gurukul. 2000. Studies of Environmental Parameters in Sabarimala and its surrounds. M.G. University, Kottayam.

The water quality study has been carried for two seasons one during the pilgrimage season and another after the season but air and sound has been analysed only during the pilgrimage season. The water quality analysis clearly shows that the quality of water in the Pampa River is very poor and almost all the parameters are far above the permissible limits. The major pollution is due to fecal contamination and organic wastes from open defecation, septic tanks, etc. The possibility of constructing a check dam for storing water during the off season and for releasing during the pilgrimage season may be explored.

On the basis of the study the quality of water and ambient noise level is not satisfactory. The level of gaseous and particulate matter in the atmosphere is not very high but a detailed study is required to find out the variation.

13. Rajasekharan Pillai, K and A. Veeramani. 2003. Biodiversity benefit of LPGs during Sabarimala Season 2002-03. Periyar Tiger Reserve.

The commencement of “Pampa Jyothy” by Periyar West Confederation, has proved a boon to the biodiversity opulence of the traditional route to Sabarimala. During 2002-03 Sabarimala season, a total number of 1289 commercial cylinders were utilized.

It is said that 1 kg of burning LPG will discharge energy equivalent to 7.7 kg of burning fuel wood (Madhu. S, Project Engineer, ANERT, Thiruvananthapuram). Based on this a simple estimation is made here to understand how much is the benefit of using LPG by shops during the season.

Based on the calculations, it is understood that a total quantity of **202248 kg (188581 + 13667), that is 202.248 mt fuel wood** would have been used otherwise. However, as per the potential of shops and establishments engaged in season business, the quantity of fuel wood that can be saved can be augmented, by using LPG wherever possible.

14. Rajasekharan Pillai. K and S. Guruvayurappan. 2001. Sabarimala season business 2000-01 – a performance analysis.

The EDCs have been playing a crucial role in the season business from 1998-99 onwards, with the legal back of the Hon'ble High Court of Kerala. Therefore, it was necessary to conduct a performance evaluation of the business, as it was the first of its kind. The observations and possible suggestions were given.

15. S. Sivadas 2001. Conservation, development and incompatibilities: Transitions of a sacred geography. M.Phil Dissertation, School of Social Sciences, M.G. University, Kottayam.

The main objectives of the study is to delineate the nature and pattern of mass movement (caused by pilgrimage and pilgrimage related practices) in a sensitive ecosystem, which have direct bearing on its conservation. The topic of research falls broadly within the domain of human ecology. Chapter I introduces environment and sacred geography, climate, forest types, Sabarimala pilgrimage – Historical background. The Ayyappa cult, continuity and change, features of Poomkavanam. The phenomenal rise of pilgrims, major hurdles against conservation. The market forces, unsustainability, incompatibilities, etc.

Sabarimala pilgrimage made the reserve a site of political economic consensus besides conservation. The existing constructions are useful solely to the managers of Sabarimala, but also, it is against the interests of the traditional pilgrimage. Although the Forest Dept. is the actual custodian of the forest, it could play only very little role in the short and long run planning of Sannidhanam. Commercialization of the shrine has brought in many players into the scene and eco-development Committee (EDC) is the last entrant. When pilgrimage took place according to the traditional customs, what pilgrims do within Poomkavanam was predictable. Religious and cultural interests of various groups who are not inclined to environmental conservation of Poomkavanam often clash with the agencies that have inclination for it.

The impact of a mass human movement within Poomkavanam and particularly at Sannidhanam and its surroundings is segregated into three with respect to the source of environmental impacts. Three such sources are pilgrims, governmental and semi-governmental authorities and market.

The main objective of the study has been to delineate the nature and pattern of mass movement of pilgrims in Poomkavanam with a view to evaluate its ecological consequences. This preliminary study of Sabarimala finds that the environmental impacts of pilgrimage is fast becoming disastrous involving far reaching consequences. A pilgrimage due to its sheer density and duration has a destabilizing effect upon the forest. De-escalation of the pressure of the pilgrims upon the environment is the first step to ensure a sustainable pilgrimage at Sabarimala. It is being a very sensitive and vital ecosystem, it demands special conservation measures oriented towards enhancing supportive powers as the present absorptive and assimilative capacity of the reserve is low. The pilgrim population density has to be reduced by redistributing the pilgrims at satellite stations along the fringe area of the reserve, at least that there should be 10 such satellite stations.

16. S. Guruvayurappan. 2000. Status of Sabarimala pilgrimage route: Pamba to Sannidhanam: some social observations.

The report on the observations made in the road leading to Sabarimala Sannidhanam has three parts viz. ecology, pilgrimage and others. In the ecology major observations are, an average of 20 meters length of forest undergrowth fully cleared across the trek path. In some locations only bare soil is seen on the cleared area, The terrain is much steep and lack of under vegetation, Small living creatures seem to be killed all along the route by the vehicles, Weeds are seems to be concentrated near Pamba area and Chandragathan road etc. With regard to pilgrimage, The dolly carrying labourers and goods transporting labourers are the main users of the Swamy Ayyappan route, As the trek route is uneasy to walk, pilgrims tend to take diversions and make short cut routes, The pilgrims use water source areas for toileting purpose, etc. Other observations include Advertisement and welcome posters & banners were displayed along Neelimala route, Scattered Plastic wastes were noticed on the routes etc.

17. S. Guruvaurappan. Sabarimala pilgrimage 1998-99: pilgrim count.

18. S. Guruvaurappan. Sabarimala pilgrimage 2000-01: pilgrim count.

19. S. Guruvaurappan. Sabarimala pilgrimage 2001-02: pilgrim count.

The temple of Lord Ayyappa is situated in Sabarimala, which is part of Periyar Tiger Reserve. Devotees used visit Sabarimala during the pilgrimage season. It starts at mid November and ends at January 20th of every year. In this period, there are two seasons namely, Mandala pooja season and Makaravilakku season. An population of around 4 million pilgrims visit the temple over a span of 65-70 days. The method was total count for the whole pilgrimage season using hand tally count machine with the help of about 16 data collectors The consolidated data of pilgrim number counted during consecutive years is appended.

Year	Gents (in %)	Ladies(in %)	Children(in %)	Total Pilgrims (in lakhs)
1998-99	88	2	10	45.6
1999-00	87	2	11	42.0
2000-01	86	3	11	39.4
2001-02	87	3	10	37.7

(The data for the year 1999-00 is taken from the study of School of social sciences, M.G.University)

Socio-economic studies

LINKING EDCs WITH LINE DEPARTMENTS: EXPLORING VARIOUS SCHEMES FOR RURAL DEVELOPMENT

Rajasekharan Pillai, K

Periyar Tiger Reserve, Thekkady

After six years of the implementation of Ecodevelopment project in Periyar Tiger Reserve the sustainability of EDCs is a matter of concern. The financial sustainability of almost all EDCs in PTR is agriculture based. As a result of low productivity and price crash the farmers are in dilemmas. There are as many govt. department and other agencies responsible designing and implementing development programmes. This report is the result of an enquiry into the various institutions and their schemes envisaged for all round development of society.

The report has been organised into 4 parts. First part deals with various Govt. departments and their responsibilities. The various schemes under the agricultural dept. are (1) Grass root level support system for agricultural development at the Panchayat level. (2) Sustainability development of rice based farming system. (3) Coconut based farming system (4) Agricultural farms (5) Integrated nutrient management system (6) Integrated pest management system (7) Farm information and communication (8) Crop insurance (9) Small farm mechanisation and agricultural engineering service (10) Vegetable promotion programme.

The various programmes under the Animal Husbandry department are cattle breeding programme, Pig breeding programme, goat breeding programme, poultry development programme, etc. under the social welfare dept. there are various activities such as (1) scheme for welfare of women and children (2) schemes for the welfare of handicapped (3) schemes for the protection and care of orphans and destitute (4) schemes for the welfare of the aged (5) social defence schemes, probation and after care services. Health dept. conducts various schemes/activities. Such as National Programme for control of blindness, family welfare programme, maternal and child health programme, oral Rehydration therapy, child survival and safe motherhood programme. The project offices of District Rural Development Agencies (DRDA) under the rural development dept. can getting help contact. The other depts. are PWD department, Revenue department and soil conservation departments.

Second part describes specific agencies formed by central and state govts. For socio economic progress. The agencies includes ANERT (Agency for Non-

conventional Energy and Rural Technology), Agricultural research centre, Livestock development Centres, banks, Kerala state women development corporation, SIDBI (Small industries Development Bank of India), KITCO, SIDCO (State Govt. organisation for the development of small scale industries), Energy management centre – Kerala, NABARD, Spices board.

Third part elucidates the various developmental programmes. The special programmes includes developmental schemes for scheduled tribes, Developmental schemes for Scheduled castes, biotechnology based programmes for SC/ST population, Biotechnology based programmes for women and rural development, Harijan development schemes, Prime Minister's Rozgar Yojana, various programmes for Rural Development, Kudumbashree, Entrepreneurship Development Clubs, KESRU, Lead Bank scheme, single window clearance etc. Forth part introduces a prestigious NGO at Idukki district that is devoted in the well being of the people of high range.

MICRO ENTERPRISES EMERGED UNDER IEDP IN PTR AND THEIR CONSERVATION LINKAGE

Rajasekharan Pillai, K

Periyar Tiger Reserve, Thekkady

The report describes various micro enterprises, which have been started under Ecodevelopment Project in the Ecodevelopment zone of Periyar Tiger Reserve. Eco Milk: Milk procurement and sales outlet, its background, the unit and its functioning, profitability potential and SWOT (Strength, weakness, opportunities, threats) analysis. The chapter III deals with the vermin-compost unit: Production and marketing, its cost benefit analysis, present status, marketing strategy, SWOT Analysis and its conservation linkages. Chapter 4 gives details about the diesel power unit, its background, technical specifications, functioning of the unit, revenue and expenditure position, monthly receipts and expenses of the unit, findings, SWOT analysis and conservation linkage. Chapter V describes the Eco spices its capital investment, the unit and its functioning, Financial transaction of the unit from November 2001 to March 2002, profile of expenditure and sales receipts of the ecospices (Nov. 02 to Mar. 03), findings, SWOT analysis etc.

**A STUDY ON SOCIO-ECONOMIC STATUS OF MANNAKKUDY TRIBAL
SETTLEMENT, THEKKADY**

Rajasekharan Pillai. K

Periyar Tiger Reserve, Thekkady

The study has been conducted to understand the socio-economic status of Mannakkudy, a tribal community who depend upon the buffer zone of the PTR for their livelihood. The culmination part of this study is organized into four parts. The first part reviews an interesting set up in the Mannan community. The second part deals with the elders' anxiety about their tradition. Third and fourth parts list out certain observations and suggestions respectively.

**THE SOCIO-ECONOMIC STATUS OF PALIYAKKUDY TRIBAL
SETTLEMENT, THEKKADY – A REPORT**

Rajasekharan Pillai. K

Periyar Tiger Reserve, Thekkady

The study is expected to review the socio-eco status of the Paliyakkudy Tribal Settlement. The community had extensively been depending on forest resources for their livelihood. The study has been organised into three parts. The first part is for making a review of the Ecodevelopment activities and right from the very target group. The second part is resorted to make out certain observations and the last part is for putting forward certain suggestions.

**VANCHIVAYAL TRIBAL SETTLEMENT: A SOCIO-ECONOMIC
ANALYSIS**

Rajasekharan Pillai. K

Periyar Tiger Reserve, Thekkady

Vanchivayal tribal settlement, locally known as Ooralikudy, is situated on the northern boundary of Periyar Tiger Reserve. It is quite natural that the forest dependency of the people might, most often, lead to unmanageable and therefore to negative aspects. This study is expected to disclose the nature and type of forest dependency of the community and their socio-economic backgrounds.

A STATUS PAPER ON CEYLON COLONY

Rajasekharan Pillai. K

Periyar Tiger Reserve, Thekkady

This study consists of four parts. The first part deals with general information of the study area. The second chapter describes the present status of the Ceylon Colony. The third part is set aside for examining the life study of the people after implementing the Ecodevelopment Project. The culminating portions brings out observations evolved from the study.

A STUDY ON THE LITTLE KNOWN NOMADIC PRIMITIVE TRIBE:

‘MALAMPANTAARAMS’

S. Raju

There is only one group that has always deferred their participation in the India Ecodevelopment Project activities and it is a group about whom we have minimum information and knowledge. This group known as Malampantaarams (Hill Pandaram), and classified as ‘tribe’ for administrative purpose. The main objective of the proposed study is to delineate the material practices of the Malampantaarams. The focus is on those aspects of their everyday-life which have bearing on or relation with conservation of forest and people. The report has brought out the life style of Malampantaarams and their number within the Tiger Reserve.

ECO DEVELOPMENT SCHEME FOR PERIYAR TIGER RESERVE –

STRATEGIES AND ANALYSIS

A.K. Bharadwaj

Periyar Tiger Reserve has long history of conservation. Till recent past the emphasis has been on protection. Mainly after realising that for long term conservation and management of this bio-diversity area the mitigated and the local participation and good will for the reserve has to be created, Eco Development scheme for Periyar Tiger Reserve was prepared.

The Scheme deals with the type of pressures on the Reserve and strategies to counteract these pressures, simultaneously establishing a good communications with the locals, particularly tribals. The main emphasis in the scheme has been on Silvi pastural developments alternate employment, agriculture and Horticulture

improvement, welfare activities, infrastructure development, interpretation and community interactions.

The works so far done are not sufficient to arrive at the impact of the scheme. But the communications with the locals and tribals have improved and there is more success in protection during this year.

**SHORT TERM RESEARCH PROJECT ON ATTITUDINAL
COMPATIBILITY OF THE STAFF OF PTR WITH ECO-DEVELOPMENT
STRATEGIES**

P. Madhu, School of Social Sciences, M.G. University, Kottayam

The study was conducted with the focus on the attitude of staff towards the Ecodevelopment initiatives. The purpose of the study is to come out with strategies towards orienting staff towards successful implementation of the project. Detailed personal interview with the randomly selected officials from the top management of the project to the forest guard involved in the Ecodevelopment unit of the Periyar Tiger Reserve. Possible recommendation is given for the better run of the Ecodevelopment project.

**A Status Paper on the linkages between
THE CONSERVATION OF PERIYAR TIGER RESERVE AND BENEFITS
OF MULLAPERIYAR DAM - 2000**

T.R. Manoharan

The paper has addressed the linkages between the conservation measures of PTR and the benefits of Mullaperiyar Dam in the context of recent debate on the utilization of water from the dam. It is very much evident that the success story of more than hundred years of dam is not just because of the merit of the engineers of the dam but the result of the suitable conservation measures taken by the Government of Kerala from time to time. In this regard, the contribution made by the then Maharaja of Travancore should be acknowledged. If the Maharaja had not been conserved a large tracts of its surrounding forest areas, the story of the dam could have been something else.

The benefits from PTR are important for both the states of Kerala and Tamil Nadu. The utilization of water is one of the main direct consumptive use of PTR.

Irrigation and power generation are the two significant uses of water from PTR. It is also noted that there is no mechanism to ensure contribution for conservation measures from those who enjoy enormous economic benefits. In this regard, Tamil Nadu Government should come forward to support the conservation of PTR by contributing a certain percentage of the revenue earned from the tangible benefits of PTR. Similarly, the agencies within Kerala particularly Kerala State Dewaswam Board and Kerala Tourism Development Corporation should also support conservation measures through contribution.

The increase in water level in dam beyond 136 ft. FRL is a matter of concern. The recommended limit is crossed in many occasions to store more water in the reservoir. This is very much evident since 1989. It is also noted that Kerala also received some amount of surplus water during various occasions. The impact of water level on the wildlife habitat needs special concern and studies should be undertaken by involving suitable R & D Institutions.

The merit of the dam should be acknowledged. Nature education and awareness programmes are to be strengthened in this regard. The continued support and harmony of the people of two states is a vital factor for the success of conservation as well as utilization of benefits.

FINANCIAL SUSTAINABILITY: A STUDY OF THE VILLAGE ECODEVELOPMENT AT PERIYAR TIGER RESERVE

School of Social Sciences – 2003

The study attempts to examine the flow channels of assistances extended under IEDP to village committees the magnitude of amount, the expenditure component, savings component and the productive investment there from. Assessment of reinvestment potential of the beneficiaries and thereby measuring the financial sustainability of the EDCs are the ultimate objectives of the study. Methodologically, the study has resorted to the reflexive social science technology with critical social theory for evolving a conceptual frame work suitable to the context of community forestry, grassroots democracy and participatory planning and empowerment. The study observes that through financial data with its reinvestment capability is capable of generalizing some aspects of financial sustainability that alone is not sufficient. The accumulation social capital is a clear symptom of financial sustainability.

SOCIAL ASSESSMENT OF EDCs OF PERIYAR TIGER RESERVE - 2001

S. Guruvayurappan

Social assessment of all the 72 Ecodevelopment committees was made two years later after establishing all the EDCs in Periyar Tiger Reserve. The assessment was done during May 2001. All the committees were ranked in the 'seven point scale' for nine criteria. Role of chairman, Executive committee, general members, Ex-officio secretary, Range officer, implementation of microplan, CDF accrual, reciprocal commitment and overall performance of the EDC were the criteria identified. The exercise was done by the sociologist of the project in which 10 numbers of EDCs were identified as poor performing committees. The role of ex-officio secretary and project awareness are the major crucial elements in the successful implementation of Ecodevelopment project.

IMPACT OF RAISING OF WATER LEVEL AT MULLAPERIYAR RESERVOIR IN PERIYAR TIGER RESERVE - IMPACT ON HUMAN SETTLEMENTS OF KUMILY AND THEKKADY AREA 10TH APRIL 2001

S. Guruvayurappan

When the water level rises up to 152 feet from the present maximum level 132 feet, water flow in the streamlets starting from nearby Thekkady forest areas make flood in Rosapookandam area, Periyar colony and the area near Kumily township which are presently filled with resorts, business enterprises, residential areas and cash crop agricultural areas and adjoining areas. The forest department has invested an amount of average of Rs.15250/- per family for micropolanning and implementation in the area which in turn will reduce the negative impact of the people on the nearby forest, at the same time it will foster forest protection measures. Of the total area of 4113 cents of land, 2134 cents will be submerged which ultimately will affect 4330 families in the region.

ACTION PLAN FOR POOR PERFORMING EDCS

PERIYAR TIGER RESERVE – 2001

S. Guruvayurappan

The report is prepared based on the report "Social assessment of EDCs of Periyar Tiger Reserve" by the same author. A seven point scale is used for assessing all the EDCs using nine criteria. From this poor performing EDCs were identified and an action plan is prepared to rejuvenate it. Posting of Asst. Ex-officio secretaries, creating more project awareness through the concerned specialist staff,

arranging field visits and exchange programmes etc are some of the actions recommended.

IMPACT OF VILLAGE ECODEVELOPMENT IN PERIYAR TIGER RESERVE – A PARTICIPATORY ANALYSIS – 2002

S. Guruvaurappan

Socio-economic and forest dependency change is assessed annually in the EDCs since 1997. The abstract up to October 2002 is put here. The change in social rank is as follows. Wealth rank A has hike from 20% to 25%, Wealth rank B steady in 32% and Wealth rank C has decrease from 48% to 43%. The collection and use of forest resource like firewood, thatching grass, bamboo, fish etc has considerable changed. A total stoppage of collection of white and black pine, cinnamon, cutting of timber is evident.

STRATEGY FOR THE REVIVAL OF POOR AND INFIRM PEOPLE IN EDCS – 2002

S. Guruvaurappan

The approach recommended for revival of poor and infirm people in EDCs is The Ecodevelopment Committees can identify such vulnerable people among their member families. The committees can fix their own criteria for the selection of the families. The committee can select 5 families among the poorest. The respective committee shall identify the activity for such families. The EDC can recommend such identified families to Ecodevelopment Officer through proper channel along with criteria used for choosing the families. EDC shall also submit the socio-economic and resource details of the recommending family, duly certified by the executive committee. A team comprising of Asst. Field Director, Ecologist, Economist and Sociologist will scrutinize the recommended list and select the neediest families from the total application after field verification. The committee will submit the list of identified families to Ecodevelopment Officer he will make arrangements to execute the proposal.

PARTICIPATORY MONITORING OF VILLAGE ECODEVELOPMENT IN PERIYAR TIGER RESERVE - 2003

S. Guruvaurappan

An advanced system of participatory monitoring of village Ecodevelopment has evolved during the year 2003. In this mechanism a special executive committee will be convened half yearly and will assess their performance by using 15 criteria.

Each committee will present this assessment annually in the general body meeting and make annual evaluation. The fifteen criteria include, level of forest dependency, change in social ranking, implementation of microplan activities as per work schedule, reciprocal commitment, community development fund details, appraisal of sub groups, linkage with other institutions, conflict resolution, tackling newly emerging social issues, EDC functioning as per Govt. order, inter EDC co-operation and collaboration, awareness programmes, introspection of executive committees, role of forest department, and EDC dynamics.

Tourism

**CREATING A COHERENT REGULATORY FRAMEWORK FOR
MANAGING TOURISM IN PAs – THE CASE OF PERIYAR TIGER
RESERVE, KERALA**

F. Liyakhat

Equations, Bangalore

From the Study that was conducted for the preparation of Visitor Management and Participatory Ecotourism Strategy for Periyar Tiger Reserve and Surrounds, it is clear that tourism has developed in a totally unplanned and unregulated manner in the region. This is valid to the Periyar Tiger Reserve and the adjacent town of Kumily. All the various activities of tourism and related activities, development, status and impacts have been presented in the Report in full details.

This paper examines the current trends of tourism development in policy and procedures of the state government. The policy of the state government is to bank totally on tourism development as a major component of economic growth. The policy of the Department of Tourism is to open up all the 14 PAs of Kerala for ecotourism development. In this overview, the role of PTR in being a major tourism destination of Kerala is evaluated.

This paper attempts to reiterate need for regulatory mechanisms to be worked out and implemented post the submission of the Consultancy Report. Whether the PTR Management has commenced regulating tourism or is it still playing the role of a facilitator in exaggerating existing tourism infrastructure and tourism promotion is something that needs critical evaluation.

What is strongly felt is the dire need for the PTR Management to switch roles from facilitator to regulator. Being one of the best managed Reserves in India, it is strongly recommended that the PTR Management set a paradigm to other PAs in Kerala as well as in India to regulate and manage tourism. This would be a leadership role for the PTR Management in the atmosphere of colossal tourism development that has been planned for the PAs of Kerala. Finally, the PTR Management's realisation that conservation of biodiversity is to be given precedence over tourism development would be the first step in that direction.

**ECOTOURISM INITIATIVES INVOLVING LOCAL COMMUNITIES IN
PERIYAR TIGER RESERVE, KERALA**

Pramod G. Krishnan, Amit Mallick and A. Veeramani

**Paper presented in the Seminar on Recent Trends & Strategies of Eco-Tourism
in India, Hyderabad.**

Periyar Tiger Reserve, one of the famous Protected Areas in India, is situated in the Southern Western Ghats of Kerala. Ecotourism activities were carried out involving some of the Ecodevelopment Committees trained by the Park Management to manage and cater to the requirements of visitors who intend to avail trekking and camping facility inside the park. The first group is involved in a scheme called “The Protection Oriented Adventurous Trekking and Camping Scheme” (Periyar Tiger Trail) and the second group is involved in handling “Guided Day Trekking” inside the park in the Tourism zone. Another group of Ecodevelopment Committee involved in visitor management and park protection is constituted involving Protection Watchers who work as a daily wages called the “Periyar Tiger Samrakshana Ecodevelopment Committee (PETS EDC).

The above mentioned EDCs involved in park visitor management have been greatly recognized and appreciated by the public, since visitor satisfaction has largely increased. Protection has been strengthened through these participatory approaches and is factually evident in the field. Yet it is only the beginning. Working with people often brings in complex socio-economic and political issue to the fore and require constant interaction. These Ecotourism initiatives involving local communities indicate that people, park, biodiversity and visitor satisfaction can co-exist and mutually support each other. Periyar Tiger Reserve and its romance with local communities is an ample testimony to this fact.

MANAGING WILDLIFE TOURISM AT PERIYAR TIGER RESERVE WITH SPECIAL REFERENCE TO THEKKADY

Sandhya Joseph

**Dept. of Historical Studies and Tourism Management, Mother Teresa Women's
University, Kodikanal, April 2003**

Tourism industry is a limitless industry with immense growth potential. It has tremendous positive impacts on the economic and social aspects in developing countries. But it has a fragile relationship with ecology and environment. Tourism in its sustainable form calls for the management of wildlife for the betterment of people as well as the environment. Periyar Tiger Reserve is the tenth Tiger Reserve in the country that harbors an array of vegetation types and diverse life forms. This study aimed at tracing out the wildlife tourism potentials in Periyar Tiger Reserve. It also assessed the tourism facilities available and the management strategies followed. It also suggest the needed resources to promote tourism in Thekkady.

Uncontrolled and excessive tourist activities constitute a major stress for the ecosystem and a serious disturbance to the wild animals. The adverse impact of wildlife tourism is broadly due to the crowding of visitors at a given point of time and their inappropriate and unregulated activities in the protected area. Interpretation programmes are well designed to educate the visitors on the values of the biological heritage and the need for its conservation. The electric line to the accommodation units, run by KTDC inside the sanctuary passes through the reserve and has caused electrocution of wild animals including a tiger. Other impacts are littering of solid waste in the aquatic zone and roads, degradation of vegetation due to parking of vehicles and resting of tourists, disturbance of wild animals due to over speed and noise of vehicles, death of wildlife by consuming non-biodegradable wastes and violating park ethics and rules.

Several environment awareness activities are being implemented in PTR to conserve the biodiversity by addressing both the impact of local people on the PAs and the impact of the PAs on local people. Nature camps for students, club members and other professionals, special camps for EDC members and their children, folklore theatre programmes (Vanambadikal), extension education programmes to educational institutions and EDCs by Nature Education Officer, various workshops and seminars

at local and regional levels and wildlife week celebrations focusing biodiversity conservation are some among them.

The study found that wildlife and scenic beauty are the main reasons which drive the tourists to this particular destination. Friends and literature are the main sources of information to the tourists. It was understood that only a couple of people got information from media. Nearly half of the people stayed at Thekkady only for a day. This can avoid degradation of the environment and overcrowding at the destination to a great extent. Cent percent of the tourists favoured the preservation of the environment in and around Thekkady. They contribute to preservation by avoiding the use of polythene bags (26%), disposing the wastes properly (26%), boycotting wildlife products (22%) and by taking utmost care not to disturb wildlife (26%).

The study recommends promotional resources to promote wildlife tourism at Thekkady. It includes special schemes for students, steps to popularize Thekkady through media, kids entertainment facilities, upgrading of the information centre at boat landing and so on.

VISITOR MANAGEMENT AND PARTICIPATORY ECO-TOURISM FOR PERIYAR TIGER RESERVE AND SURROUNDS

Equation – 2001

Tourism in ecologically sensitive regions raises serious concerns in the absence of precautionary legal guidelines and principles. The recent tendency to qualify tourism in ecologically sensitive regions like the forests and the coasts, as 'eco-tourism' or 'nature tourism' is too vague a terminology as it is applied for the convenience of tourism service providers. Under such circumstances the practice of tourism can only be termed as 'mass tourism'.

The disadvantages of haphazard and unplanned development of tourism are well illustrated by many areas in India. There are many examples of uncontrolled growth of industries, shops and slums near tourist spots creating environmental problems. Despite a measure of governmental control during the development, the great increase in a number of visitors to those areas resulted in rapid, unplanned construction of hotels and dwellings for tourists and for migratory service employees. These expansions threatened to destroy the very environment that is the tourist attraction.

Tourism in protected areas needs to be contextualised in circumstances where it is located and practiced. The discriminative notion about 'certain people' as

pressure on PAs has resulted in conflicts rather than harmony with the traditional community. Under such circumstances, conservation could be made possible only through measures that could be monitored through systems that are transparent.

In the absence of defined legal backing, available legal and social tools could be attempted through a visitor management.

The visitor management strategy for Periyar Tiger Reserve is such an attempt based on the broad evolved norms of eco-tourism and practicing democracy of the land. The methodologies applied by EQUATIONS for visitor management of PTR adopt mechanisms to bring in PTR management, private tourism service providers, the local community and also civil society systems for acting together in a democratic space.

Visitor management and participatory eco-tourism strategy for Periyar Tiger Reserve and surrounds was carried out to:

1. Review and catalogue of all available information of tourism activities in PTR and surrounds.
2. Assessing the current situation in the tourism zone.
3. Assess the tourism related activities impacts with in the impact zone.
4. Evolving short-term strategies for eco-tourism and visitor management.
5. Evolving long-term strategies for eco-tourism/visitor management and biodiversity conservation.

Case studies and literature review available on tourism in ecologically sensitive areas/PAs and eco-tourism were reviewed to impart a deeper insight on the social, ecological and economic consequences of the tourism development. An analysis of the existing environment in the concerned study area (PTR and surrounds) was carried out by compiling the primary and secondary information on land use, forests, flora, fauna, local people, existing tourist activities and its impacts, existing tourists operators and related infrastructure, visitor related eco-friendly activities and marketing mechanisms, visitor related opportunities for local people, procedure/mechanisms for biodiversity conservation, various acts governing/its violation, tour operators perception on the study area.

Based on the analysis, recommendations and strategies for Eco-tourism/visitor management and biodiversity conservation were developed. The baseline sustainability concerns of each activity derived by using scientific principle and modern management techniques. Also an attempt is made by developing a

conservation oriented management strategies to formalize the linkage between administration, traditional community and local people.

The emphasis of the plan is on finding ways to develop and manage tourism in a sustainable way. Discussion on proposal(s) for managing conservation-oriented tourism are therefore included. Evolving visitor management strategy and formalizing linkages between administrations, traditional community and local people are considered.

IMPACT OF RAISING OF WATER LEVEL AT MULLAPERIYAR RESERVOIR IN PERIYAR TIGER RESERVE - IMPACT ON TOURISM -2001

S. Guruvayurappan

Tourist preference to Thekkady is mainly for viewing natural beauty, wildlife, for boating and trekking. From the tourism activity, tourists prefer to purchase spice and handicrafts from here. The tourists spent a total of about 340 million rupees in Kumily an Thekkady for purchase of things, accommodation, food, local travel etc.. in 1999-00. in which 240 million was from part of Indians and 70 million from foreigners. The possible impact of water level in the reservoir and the tourism industry are, Kumily will suffer a loss of minimum $\frac{1}{4}$ of tourists and about decrease of 80 million rupees, the eco-tourism activities for tribes an forest dependent communities of Periyar Tiger Reserve will suffer because it is fully dependent of tourism, and lead to loss of feeding ground of large herbivorous will be submerged resulting in non visibility of them in the lake side.