

## CIVET CHRONICLES



### Search for the Malabar Civet (*Viverra civettina*) in Kerala and Karnataka

Nixon AMA, Siddharth Rao, Karthik K, Ashraf NVK and Vivek Menon



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Suggested Citation: Nixon AMA, Sidharth Rao, Karthik K, Ashraf NVK and Vivek Menon (2010). Civet Chronicles - Search for the Malabar civet (*Viverra civettina*) in Kerala and Karnataka. Wildlife Trust of India, New Delhi.

Keywords: Malabar civet, camera trapping, conservation survey, Western ghats, Kerala, Karnataka, wet evergreen forest, deciduous forests, habitat fragmentation, critically endangered species.

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- Nixon AMA: Front cover: Small Indian civet (camera trap photo: from Malappuram Distt., Kerala), Pg 3, 4 (right), 8,9,10,13,42 (right top), 47 and Pg. 66 (Sl. No. 1,2,3,11,16 -21 & 24 from camera trap)
- Ashraf NVK: Pg. 4 (left) and 17 (left & middle)
- Sidharth Rao: Title Pg: Brown palm civet (camera trap photo from Someshwara WLS, Karnataka) 12, [Pg.27, 35 (top & bottom left) 36,40, 42 (left & right below), 66 (Sl.No.4,5,6,10,12,13, 14,15,22,23) and 25 -28 from camera trap]
- Karthik K: Pg 35 bottom right and 66 (Sl. No. 7,8,9 [from camera trap])
- Prasaneet Navgire: Pg. 15,17 (extreme right) 21 and back cover.

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October 2008

An Occasional Report of a Wild Species project



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वहाँ है खुशहाली ।

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## **PREFACE**

The tiger is not the most endangered animal of India despite hoardings across the country proclaiming that it is. It is not even close to being the most endangered animal of India. Forget animal, even among mammals, there are many other species that are more endangered than the tiger. This is easily seen from the IUCN Red Lists. Critically endangered is the highest category of threat in these threatened listings that are worldwide the benchmark of endangerment. There are six species on the critically endangered list that are mammals found in India. The tiger is not critically endangered but comes in the next category of plain 'endangered'. Not that this in way diminishes the importance of saving the tiger, not least for itself but also for the magnificent forests that it acts as a flagbearer for. There should, however, be at least as much concern over the other species that are most certainly more endangered than the tiger and that are found in India. Of these, the most endangered mammal may well be the Malabar civet. Last documented from a dead skin in 1990, this large dog-sized lowland forest carnivore has all but vanished from Malabar. There have been in the intervening years few claims of naturalists having spotted one, but none have photographic or other irrefutable evidence to show its presence. All that remains, it seems are the faded memories of tribal hunters and the lingering scent of the civet in the nostrils of their hunting dogs.

This search, elusive thus far, but promising in certain areas has been Schaller Conservation Surveys at its best. To seek, against all odds and find the current status of threatened mammals has been the unwritten motto of these surveys and as with the markhor, the chiru or the takin, this survey has been all about science and intrepidity trying to pit itself against an elusive quarry. In this case, alas, thus far still very much the most endangered mammal in India

Vivek Menon  
Executive Director, WTI



## **ACKNOWLEDGEMENTS**

At the outset, we are grateful to the Ministry of Environment and Forests, Government of India, for funding this first ever long-term conservation survey of the critically endangered Malabar civet. Thanks are due to Shri V. Gopinathan, IFS, the Chief Conservator of Forests (Wildlife) & Chief Wildlife Warden of Kerala, and Shri A.K. Varma, IFS, the Principal Chief Conservator of Forests (Wildlife) and Chief Wildlife Warden of Karnataka, for all their timely permission to carryout the camera-trapping survey in the respective states.

Several biologists and naturalists have provided valuable inputs to the survey team during the course of the two year survey. Dr. John A Burton, Chief Executive officer, World Land Trust, U.K and Dr. Ajith Kumar, Course Director, Wildlife Conservation Society, Bangalore, need special mention for their contribution during the brainstorming session we had in Nagerhole NP.

We express our sincere thanks to the Divisional Forest Officers and Range Officers of Kannavam Reserve forest, Wayanad south, Mananthavady, Kalikavu, Trivandrum, Peppara and Neyyar Wildlife sanctuaries in Kerala for their continuous support and logistics. We also thank Divisional Forest Officers and Range Officers of Mysore, Biligiri Rangan Temple Wildlife Sanctuary, Coorg, Uduppi, Someshwara Wildlife Sanctuary, Mangalore, Shimoga, Sharavathi Wildlife Sanctuary and Uttar Kannada for their support and logistics during the survey.

We are indebted to Shri Vivek Menon, Executive Director, Wildlife Trust of India, for showing considerable interest on the conservation of the Malabar civet and his constant encouragement while carrying out the field surveys. We also acknowledge WTI's Field Officer in Wayanad Mr. Ram Kumar for his skills in preparing the maps for this report.

## EXECUTIVE SUMMARY

A 30 month (2006-2008) survey to establish the continued presence of Malabar civet (*Viverra civettina*) was conducted in selected areas in Kerala and Karnataka during 2006-2008. Methods employed were interviews with local people, followed by camera-trapping in specific locations. The study began with a rapid reconnaissance survey interviewing a selective group of people comprising mainly of hunters, forest tribes and Ayurvedic physicians in eleven districts in Kerala and six in Karnataka. The interviews revealed a significant difference on the knowledge of the species between people of Kerala and Karnataka. While 62% of the 125 respondents living in the lowland districts of Kerala readily recognized the species and claimed to have it, only 7.1% of the 222 people interviewed in Karnataka reported about the presence of a large civet the description of which roughly matched that of the Malabar civet.

Camera traps were laid for 2790 trap-nights in Kerala and 1157 trap-nights in Karnataka. Camera traps recorded 282 individual animals of 29 species of mammals in 234 successful trap-nights, over a period of 8 months in Karnataka and 18 months in Kerala. The camera trapping study failed to establish the presence of Malabar civet in Someshwara Wildlife Sanctuary (WLS), Sharavati WLS and Biligiri Rangan Temple WLS in Karnataka and in Peppara WLS and the Reserve Forests of Kannavam, Nilambur and Periya in Kerala. The species also could not be trapped in plantations of Malappuram district in Kerala from where specimens have been obtained in the past.

The overall camera-trapping success was 7.1%, but it varied from one area to another, the highest being from Someshwara WLS (34%). Trapping success was the highest in evergreen/semi-evergreen forests (15.8%) followed by plantations (5.8%) and lowest in deciduous forest

(1.7%). The number of species recorded was also the highest in evergreen/semi evergreen forest (22), followed by deciduous forest (13) and plantations (8). Family Viverridae dominated in all the vegetation types forming 36.6 to 56.3% of the photo-captures. While 20% of the photographs taken during camera trapping survey were that of the brown palm civet (Fig 25), 16% were that of the small Indian civet. Of the remaining 64%, two small carnivores namely the common palm civet (8.6%) and ruddy mongoose (6.4%) were the most commonly photographed. While all the trappings of brown palm civet was restricted to evergreen forests, that of the common palm civet was almost entirely from deciduous forests and plantations. Among felids, all images of jungle cat were obtained from deciduous forests and plantations (0.3%), but those of leopard cat (0.1%) from evergreen forests. The only picture of the tiger came from Biligiri Rangan Temple WLS.

The fact that the present survey failed to obtain even a single photograph of the Malabar civet from areas where it is sympatric with the commoner Small Indian and common palm civets only goes on to show that the animals that were caught from these areas in the past were individuals of remnant populations struggling to survive in the modified environment. The existing Malabar civet populations, if any, along its distribution range are therefore relict populations inhabiting sub-optimal habitats along the foothills and lower slopes of Western Ghats.

Failure to establish the occurrence of the species in the surveyed areas does not rule out the possibility of establishing the presence of the species in other areas in Karnataka and Kerala. Even extensive camera trapping surveys focused on a particular area have failed to trap all the species known to occur in the area. Since camera trappings have failed in realizing the objective of this survey, other methods that could be tried are the DNA extraction from scats and tracking the civets using trained scent-detection dogs. The technique of using scent dogs to search rare

animals has been proved to be effective in studying mammals and birds. Trained sniffer dogs could be used to locate the elusive Malabar civets that take refuge in thickets during the day.

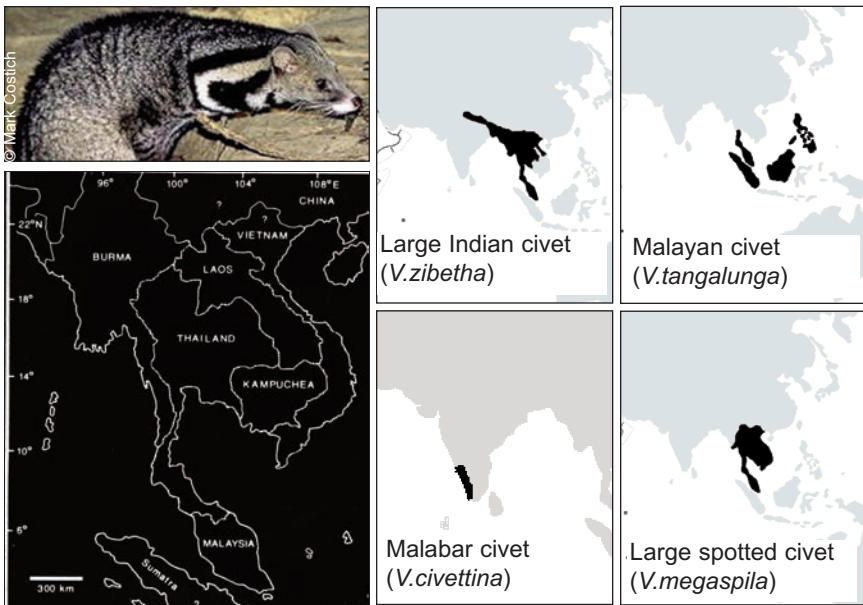
## 1. INTRODUCTION

Very little is known on the ecology, distribution and population status of small carnivores in India (Mudappa, 1999; Kumar and Yoganand, 1999) as they are not mega-carnivores like the tiger, leopard or bear to attract the attention of biologists to study their ecology and the state Forest Departments during their annual census operations. Though few short-term studies have been carried out on viverrids in the Western Ghats (Ashraf *et al*, 1993; Rai and Kumar, 1993b; Kumar and Yoganand, 1999; Umapathy and Kumar, 1999), the only long-term ecological study carried out on viverrids in India comes from Kalakkad-Mundanthurai and Anaimalai regions in the Western Ghats where Mudappa *et al*, (2007) studied the impact of forest fragmentation on small carnivore abundance.

Civets belong to the family Viverridae, comprising the largely arboreal palm civets of the family Paradoxurinae and the terrestrial true civets of the subfamily Viverrinae. True civets are distinguished from palm civets and genets and linsangs by their perineal 'civet' glands which secrete a waxy substance "civet musk" or simply the "civet" which the animals use to scent-mark in the wild (Tsegaye *et al*, 2008), by pressing the everted gland against an object which is often a tree trunk (Estes, 1991). True civets, being terrestrial, are also known to defecate in particular spots called "civetries". Scent marking studies in African civet (*Civettictis civetta*) has shown that most of the scent markings happen around these 'civetries' (Tsegaye *et al*, 2008) which must be the case with other civet species as well.

In the Western Ghats alone there are four species of civets, two under the subfamily Paradoxurinae, namely the common palm civet (*Paradoxurus hermaphroditus*) and brown palm civet (*P. jerdoni*), and two under Viverrinae, namely the small Indian civet (*Viverricula indica*) and Malabar civet (*Viverra civettina*). The brown palm civet and the Malabar civet are endemic to the Western Ghats.

Of all the four large civets of the genus *Viverra* found in Southeast Asia, the Malabar civet has the most restricted distribution range (Fig. 1). Of these four, two occur in India, the large Indian civet (*Viverra zibetha*) being quite common in the *terai* belt along Himalayan foothills, and in the Eastern and Northeastern parts of India (Prater, 1948; Peter 2003; Choudhury, 1997a, 1997b, 1999; Acharjyo and Patnaik, 1987, Menon, 2003) and the Malabar civet which is a critically endangered species restricted to the lowland (coastal) Western Ghats (Jerdon, 1874; Prater, 1948; Ashraf *et al*, 1993; Rai and Kumar, 1993b). The Malabar civet was earlier regarded as a subspecies of *Viverra megaspila* (Ellerman and Morrison Scott 1951; Honacki *et al*, 1982), but Lindsay (1928) and Pocock (1939) reviewed its taxonomic position and considered it as a separate species *V. civettina*. It is also the only viverrid listed in the Schedule I of the Indian Wildlife (Projection) Act, 1972.



**Fig. 1** Distribution ranges of the four species of large civets of the genus *Viverra* in Asia.

Listed 'possibly extinct' in the IUCN Mammal Red Data Book of 1978, the Malabar civet was rediscovered by the Zoological Survey of India in 1987 (Kurup, 1987). The few historical records available on the occurrence of the species are all from the coastal forests in the Western Ghats (Jerdon 1847, Pocock 1939; Prater 1948). Only two published records of the species' possible sightings exist; one in Bhagavathy valley in Karnataka (Karanth, 1986) and the other in Thiruvalla, Kerala (Kurup, 1989).

The coat pattern of Malabar civet does not have any distinct stripe or spots on the body. The fresh skins of the species obtained in 1990 were grayish dull white with indistinct spots that tend to unite to form vaguely defined vertical stripes on the body and clear horizontal stripes on the rump and hind legs. The distinguishing features are the erectile black hairs that run through the entire dorsal ridge from neck to tail tip. When compared to the body length, the species has a shorter tail with six alternate bands of black and white rings (Fig 2); these white tail-rings being incomplete dorsally due to the blade of black hairs that continue from the neck, through the back, along the tail and ending in a black tail tip. To summarize, the Malabar civet's large body size (weight:



**Fig. 2 Some of the distinguishing features of the tail of the Malabar civet**

about 8 kg), the crest of black hairs on the back, imprecise spots forming rough vertical stripes on the body, and the incomplete, unequal and fewer white tail-rings that end in a longer black tail-tip distinguish the species from the smaller small Indian civet (weight: 2-4 kg) (Fig 3).



**Fig. 3 Top Skin specimen of small Indian civet (left) and Malabar civet (right)**



Though surveys in the past have established the continued presence of the species on the coastal regions of the Western Ghats through specimens (Ashraf *et al.*, 1993) and interviews with local people (Rai and Kumar, 1993a), no photographic evidence of the species has been established so far. Moreover, these surveys were carried out more than a decade back. The recently completed survey by the Kerala Forest Research Institute (KFRI) used two live traps concentrating in Elayur (the place of its rediscovery, 60 km from Calicut), succeeded in obtaining only the small Indian and common palm civets (Jayson, 2008). The only survey using camera traps was conducted by Rai and Kumar (1993) but their effort was limited to a period of four months, one district in Kerala and using one camera trap. A long term survey that would cover potential areas all along the lowland Western Ghats employing more camera traps was realized. Wildlife Trust of India, with the support of the Ministry for Environment and Forests and the cooperation of the forest departments of Kerala and Karnataka, initiated a two-year comprehensive survey titled “Conservation of the Malabar civet (*Viverra civettina*) in Kerala and Karnataka”. This report is based on the results of the survey conducted from January 2006 to July 2008.

The aim of the project was to conduct field surveys to identify the presence of relict populations of Malabar civet along the lowland Western Ghats of Kerala and Karnataka in Reserve Forests, Protected Areas and plantations.

## **2. SURVEY AREAS**

The Western Ghats is one of the 34 biodiversity hotspots of the world (Mittermeier *et al.* 2005). Geographic position, varied topography, climate and forest types make this hill range rich in biodiversity. It is a chain of mountains that extends from the Tapti (Tapi) River (21°N) in Gujarat to Kanniyakumari (Cape Comorin; 8° N), Tamil Nadu, the southern most tip

of Indian Peninsula. Geologically these Ghats fall into two sectors; (1) The Ghats north of Krishna basin formed of fragile Basalt rocks of the Deccan Trap and (2) South of Krishna basin formed of pre-Cambrian archean, crystalline hard rocks such as granites, schist, gneiss and quartzite's (Vajravelu and Vivekananthan, 1996).

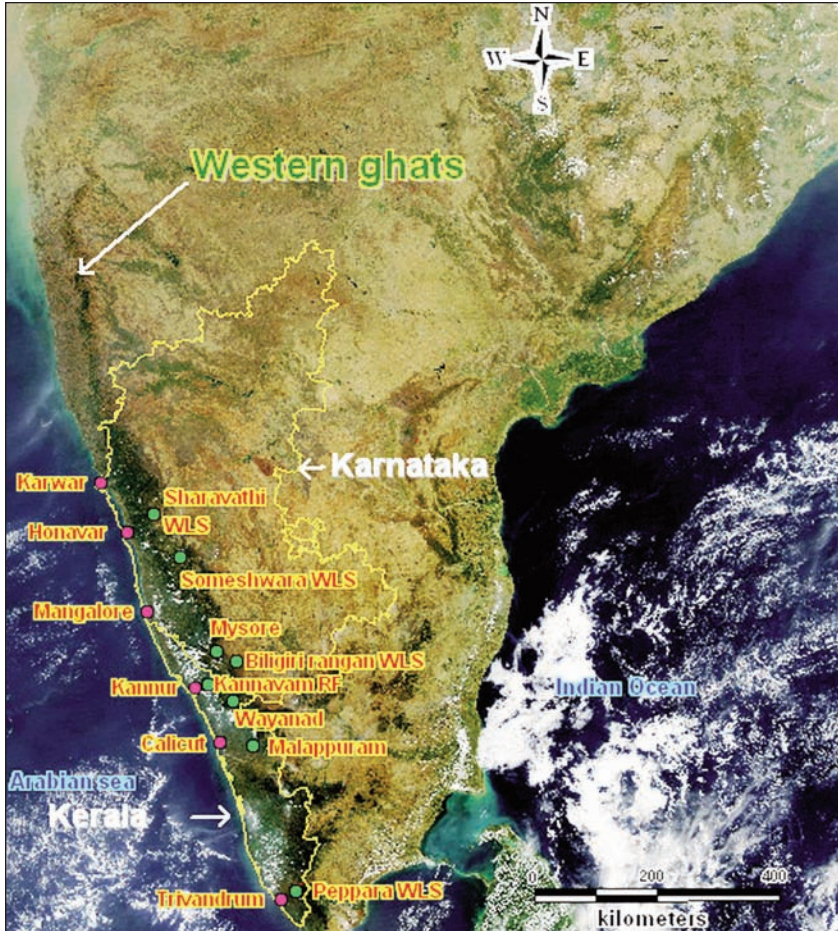


Fig. 4 Study areas in Western Ghats and major cites in Kerala and Karnataka

## 2.1 KERALA

Kerala lies within E 74° 52' and 72° 22' and N 8° 18' and 12° 48'. The forest area of the state is 1.12 million ha, which constitutes 28.87% of the land area. Situated in the humid tropical belt, the state is characterized by high rainfall and humidity. The rainfall varies between 1,520 to 4,075 mm and the temperature ranges from 19.8° C to 36.7°C. Eleven districts in Kerala surveyed namely Trivandrum, Kollam, Pathinamthitta, Ernakulam, Thrissur, Palghat, Malappuram, Kozhikode, Kannur, Waynaad and Kasargode, located in the low undulating coastal Western Ghats. The vegetation types in the western slopes of Western Ghats are lowland moist deciduous, semi evergreen and evergreen. Cashew (*Anacardium occidentale*), ailanthus (*Ailanthus malabaricum*) and areca-nut (*Areca catechu*) plantations were included for the survey. Since coastal Kerala is densely populated with very few undisturbed forests or secondary forests left, the reconnaissance surveys were conducted amongst respondents living in and around plantations that could harbor remnant population of the species. Based on the reconnaissance survey, four intensive study sites were selected for camera trapping in Kerala. Details of these areas are given below.



**Fig. 5 Plantations of abandoned *Ailanthus* and managed *Areca***

### 2.1.1 Kannavam Reserve Forest

Kannavam reserve forest comes under the Kannur forest division in Kerala. The floristic composition of Kannavam reserve forest is an admixture of both evergreen and deciduous species in the top storey. The altitude ranges from 40 to 1554 m ASL. The prominent evergreen species are *Artocarpus heterophyllus*, *Bischofia javanica*, *Calophyllum elatum*, *Euvodia lunuankenda*, *Hopea ponga*, *Mangifera indica*, *Mesua ferrea* and *Myristica dactyloides*. The deciduous floral elements include *Acrocarpus fraxinifolius*, *Bombax ceiba*, *Chukrasia tabularis*, *Dalbergia latifolia*, *Grewia tiliaefolia*, *Lagerstroemia microcarpa*, *Pterospermum sp.* *Terminalia bellerica* and *Toona ciliata*. The species occurring in the lower layer are the same as seen in the evergreen forests (Champion and Seth 1968).



**Fig. 6 A view of Kannavam Reserve Forest**

### 2.1.2 Periya Reserve Forest

This area consists of west coastal evergreen forests and *Acacia* plantations. The western slope of Waynaad south forest division is

evergreen which is contiguous with Kannur forest division. Average altitude of this area is 300 m ASL. The forest is dominated by evergreen species such as *Mesua ferrea*, *Palaquium ellipticum*, *Cullenia exarillata*, *Calophyllum elatum*, *Hopea parviflora* and *Dipterocarpus indicus*.



**Fig. 7 Evergreen forest along slopes in Periya RF, Kerala**

### **2.1.3 Malappuram district**

The Malabar Coast moist deciduous forest region (N 10° 15' and 12° 18' N and E 75° 14' and 76° 56') was once a verdant tropical evergreen forest that extended along the western coast of the Deccan Peninsula between the Western Ghats Mountains and the Indian Ocean (Champion and Seth 1968). Altitude ranges from 5 m to 477 m ASL. Currently the coastal moist deciduous forest has been cleared for human habitation, agriculture, rubber and areca plantations. Apart from Nilambur reserve forest, Malappuram district holds a few small patches of moist deciduous forest in cherukodu (Kallumala) and Chathangotupuram (Vettikatri) areas where camera trapping was carried out.



**Fig. 8 A relict deciduous forest patch in Kallumala, Malappuram district Kerala**

#### **2.1.4 Peppara Wildlife Sanctuary**

Peppara wildlife sanctuary is located in Trivandrum district (N 8 34' 30" and 8 41' 25" and E77 6' 50" and 77 14' 5"). The extent of the sanctuary is 53 km<sup>2</sup>. The altitude ranges from 150 to 1050 m ASL. Forest types include west coast tropical evergreen, Southern hilltop tropical evergreen, West coast semi -evergreen, Southern moist mixed deciduous forest, myristica swamp forest, sub-mountain hill valley swamp forest etc (Champion and Seth, 1968). These forests are characteristic in having a high proportion of *Mesua ferrea*, *Palaquium ellipticum*, *Cullenia exarillata* and *Calophyllum elatum*. These are dense evergreen forests with lofty trees of more height. Semi-evergreen forests are found in the western part and moist deciduous forest in the southern part of Peppara Wildlife sanctuary. The undergrowth consists of cane, creeping bamboo, and palms. With the increase in elevation and rainfall, the height of the forest

diminishes, though it remains dense and evergreen, changing into the stunted wet sub-tropical forest (Rodgers and Panwar 1988).

## 2.2 KARNATAKA

Karnataka is situated on a tableland where the Western and Eastern Ghat ranges converge into the Nilgiri hill complex. The State of Karnataka is confined roughly within N11° 5' and 18° 5'; E 74° and 78° 5'. The forest area of Karnataka is about 38,720 km<sup>2</sup>. The rainfall varies between 500 to 3500 mm and the temperature ranges from 16° C to 40° C. Six districts in Karnataka were selected for the survey based on the earlier report of the presence of Malabar civet. Lowland evergreen and semi evergreen forests were surveyed extensively in these six districts, namely Kodagu, Dakshin Kannada, Uttara Kannada, Udupi, Shimoga and Chickmagalur. Following this reconnaissance survey, three intensive study areas were short listed for camera trapping.

### 2.2.1 Someshwara Wildlife Sanctuary

This sanctuary is located in Udupi district (N 13° 28' and E 75° 3') and the extent of the sanctuary is around 88 km<sup>2</sup>. The altitude ranges from 75 to 870 m ASL. This sanctuary consists of lowland semi-evergreen and evergreen forests. Adjacent to the sanctuary are 26,000 acres of evergreen forest in the Someshwara reserve forest. Important plant genera found in the area are *Calophyllum*, *Artocarpus*, *Dipterocarpus*, *Hopea*, *Lophopetalum*, *Poeciloneuron*, *Bischofia*, *Terminalia*, *Lagerstroemia*, *Machilus*, *Syzygium*, *Mangifera* and *Vitex*. The vegetation types at low elevations include secondary semi-evergreen, secondary moist deciduous, teak and *eucalyptus* plantations. Trees found in the evergreen forests at low elevations include species like *Poeciloneuron indicum*, *Dipterocarpus indicus*, *Diospyros candolleana* and *Diospyros oocarpa* (Pascal *et al*, 1982).



**Fig. 9 A streambed in Someshwara WLS**

### **2.2.2 Biligiri Rangaswamy Temple Wildlife Sanctuary**

The choice of this protected area for camera trapping was not based on the reconnaissance survey. The survey team decided to cover this area also following the report of the possible sighting of Malabar civet by researchers (Aparajita Dutta *pers. com*). Biligiri Rangaswamy Temple Wildlife Sanctuary (N 11° 40...12° 9' and E 77° 05...77° 15'.) is a compact hill block of about 540<sup>2</sup> km, situated between the Eastern and Western Ghats, the mountain ranges that flank the Indian peninsula. Elevation ranges from about 600 to 1,500 m above sea level. The sanctuary supports forest types, ranging from scrub forests, dry deciduous forest, moist deciduous forest, and evergreen forest in the lower to mid-elevation, to high-elevation shola forest and grasslands. Tree species found in the dry, deciduous forests of this sanctuary consist of *Anogeissus latifolia*, *Chloroxylon swietenia*, *Albizia amara*, *Pterocarpus marsupium* and *Terminalia* sp (Pascal *et al*, 1992).





**Fig. 10 Deciduous forest in Biligiri Rangan Temple WLS**

### **2.2.3 Sharavathi valley wildlife sanctuary**

The Sharavathi Valley Wildlife Sanctuary (N13° 54'10" to 14° 16'31", E 74° 38'32" to 74° 59'45") is located in Shimoga district and the spread over an area 431km<sup>2</sup>. The altitude ranges from 63 m (Nagavalli) to 1102 m (Devakunda). Vegetation types of the sanctuary include mainly dense evergreen and semi-evergreen forests which is contiguous with Mookambika sanctuary to the south. The Lingamakki reservoir on the Sharavathi River occupies almost half the sanctuary. Lying at the junction of the northern sahyadris, it has floral and faunal elements of both regions. The vegetation types of the region consists moist deciduous forests, and grasslands. The sanctuary has mainly evergreen, semi-green and some moist deciduous forests. The prominent tree species found in Sharavathi WLS include *Dipterocarpus indicus*, *Calophyllum tomentosum*, *Machilus macrantha*, *Caryota urens* and *Aporosa lindleyana*, *Largerstroemia lanceolata*, *Hopea parviflora*, *Dalbergia latifolia*, *Careya arborea*, *Embllica officinalis*, *Terminalia Sp.* and *Vitex altissima* (Pascal et al, 1992).

### **3. METHODS**

#### **3.1 Reconnaissance survey**

Reconnaissance survey was conducted during January-March 2006 in Kerala and Karnataka and also during February-March and August-September 2008 in Karnataka. The survey areas were prioritized based on the previous published and informal reports on the habitat preference of the Malabar civet. The survey thus concentrated among tribes living in lowland forest areas and non-tribes inhabiting plantations outside protected areas. The target group was primarily hunters, tribes, civet rearers, Ayurvedic physicians and forest department personnel. In order to avoid suspicion and elicit unbiased information on the identity of the species, the initial questions posed pertained to wildlife in general. Subsequently questions were narrowed down to specifics, about civets and other mammals. During the interaction, every attempt was made to make the respondent describe on their own each and every species they have encountered. As far as possible, individuals were interviewed separately to avoid getting influenced by others during the interview. Since there is no photograph of Malabar civet available, line drawings of Malabar civet, photographs of skin and other species of large civets were used. To facilitate an informal atmosphere, no questionnaire was distributed to the respondents; instead their responses were noted in field note book and later transcribed into a data sheet (Appendix I).

#### **3.2 Camera trapping**

Camera trapping is potentially a powerful and simple method for establishing the presence of a species and monitoring wildlife diversity and abundance (Yasuda, 2004; Tobler *et al*, 2008). The camera traps used in this study were developed at the Centre for Electronics Design and Technology (CEDT), Indian Institute of Science (IISc), Bangalore. The system had a passive infrared heat detector which was linked to a 35-mm camera that recorded the images. Cameras were loaded with 36-

exposure 200 and 400 ASA color films. Totally fourteen camera traps were used for the survey, seven each in Kerala and Karnataka.

Camera traps were placed at a height of approximately 0.50 m above ground to target the small sized animals that were the focus of this survey (Fig. 11). The average home range of most large civets of the genus *Viverra* is about one square kilometers, that of *V. tangalunga* for instance is said to be 110 ha (Colon, 2002). Hence, 500 m spacing between traps was considered ideal. The distance between each camera trap varied from 100 m to almost a kilometer, though most of the camera traps were placed at an average distance of 250 meters between them.



**Fig. 11 Field Officer Nixon fixing a camera-trap in Peppara WLS**

Various kinds of “lures”, often glandular extracts of carnivores have been used to attract the animals towards the camera-traps (Gaiman *et al*, 2006). A combination of different lures and baits were used in order to attract animals to the camera traps. Lures used were “Saber Tooth” and Alley Cat”, both imported from Wildlife Control Supplies, CT, USA. The

former is a coyote gland extract and the latter one a felid gland extract used for attracting feral cats. A few drops of lure was taken on a small stick and applied on the leaf, stone and log in front of the camera (Fig. 12). Apart from lures, baits were also placed as a reward for animals. Common baits used were dry fish, fresh fish, meat or chicken gut. Information on habitat type, camera trap location, anthropogenic disturbances, distance to the nearest village and distance to water source were noted down for every camera trap location (Appendix II).

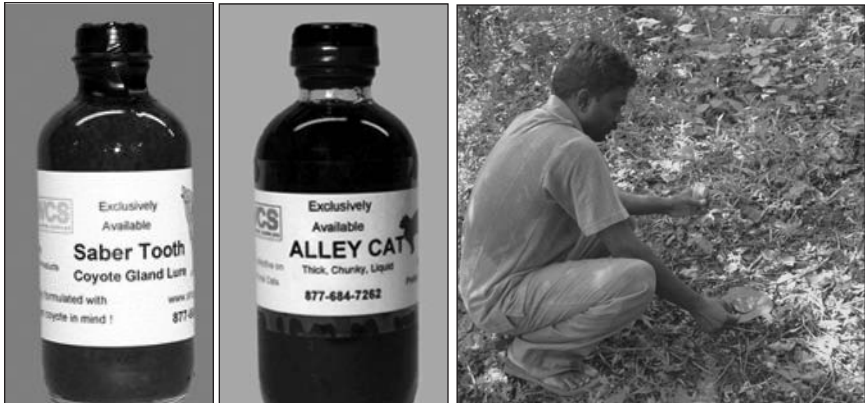
As the primary objective of this survey was to establish the evidence of the Malabar civet through camera-traps, every effort was made to place the traps in locations where viverrids area known to frequent. Most wild animals, including civets are known to use roads and trails while moving within their home ranges (Colon, 1999, 2002; Jennings *et al.* 2005). It has been also established that, roads and trails are centrally located in all home ranges of species like the Malay civet (*V. tangalunga*; Colon, 1999). Day bed sites of terrestrial viverrids are also located exclusively on the ground on well drained sites with high cover (Colon, 1999 & 2002). The choice of a camera trap location was thus decided after taking into account the following factors;

- Proximity to a water body since recent records of the species capture has been from riparian areas.
- Previous sightings by local people
- Trails used by animals
- Presence of a den or thicket
- Wild animal tracks and signs like smell of 'civetone' and foot prints
- Lavatory sites (civetries)

The camera trapping data thus obtained over the two year study was analysed to elicit the following information:

- Presence and absence of a particular species
- Relative abundance of the species photo-trapped in different locations

- Trapping success in different habitats and camera trap locations
- Efficiency of lures and baits in attracting different species



**Fig.12 Lures used for the survey (left) being applied on leaves (right)**

### 3.3 Analysis

One camera trap-night constituted a functional camera kept in the site overnight and one successful trap-night meant at least one picture of a wild animal. Thus seven cameras placed about 250-300 m apart would constitute seven trap-nights in this study. Trapping success is presented as percent success by taking into the number of successful trap-nights and the total number of trap-nights. The difference in trapping success between vegetation types and within vegetation types for disturbed and undisturbed areas was statistically analyzed. Relative frequency (%) of a species meant the percentage of individuals of that species photographed amongst all individuals of all species. Photographs of individual animals were distinguished on a combination of factors like distinguishing features, time lag between successive photographs and time of capture of the same species in the adjoining cameras.

## **4. RESULTS**

### **4.1 Reconnaissance survey**

As the survey was restricted to the lowland Western Ghats, most of the respondents of the interview-based reconnaissance survey were from the coastal districts of Kerala and Karnataka. The questionnaire survey covered 66 villages in Kerala spread across eleven districts (Trivandrum, Kollam, Pathinamthitta, Ernakulam, Thrissur, Palghat, Malappuram, Kozhikode, Kannur, Waynaad and Kasargode) (Fig. 13) and 50 villages in Karnataka across seven districts (Udupi, Mangalore, Uttar Kannada, Shimoga, Coorg, Dakshin Kannada and Mysore) (Fig. 14). At the end of the three months survey in Kerala, 125 individuals were interviewed; and the four months survey in Karnataka yielded information from 222 respondents. It should be reiterated that these respondents were not randomly selected common public but a very select group comprising hunters, civet rearers, forest department field staff, Ayurvedic physicians and tribes living in forests.

#### **4.1.1 Background of the respondents**

The respondents were classified into two main groups, namely tribes and non-tribes. Among the respondents interviewed in both the states, 53.4% were non-tribes and 46.6% were tribes. The non-tribal respondents included forest department personnel, agriculturists, Ayurvedic physicians and civet keepers (Fig. 15). About one third of the respondents in Kerala were agriculturists, while they comprised only 10.5% in Karnataka. A majority of those interviewed in Karnataka were tribes (52%), while they formed about 42% in Kerala. Tribes interviewed comprised thirteen communities in twenty three different protected areas and reserve forests (Table 1) (Fig 16). The number of forest personnel interviewed was less (8.1%).

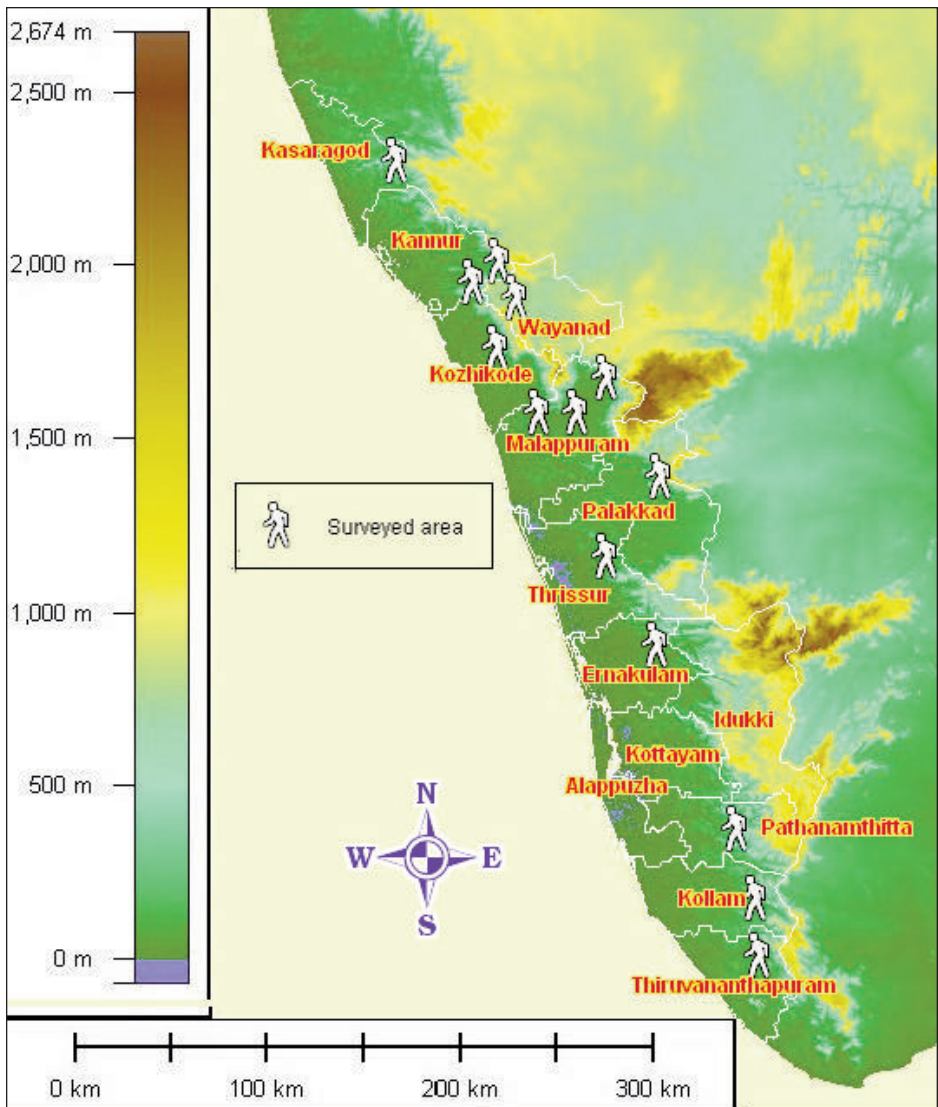
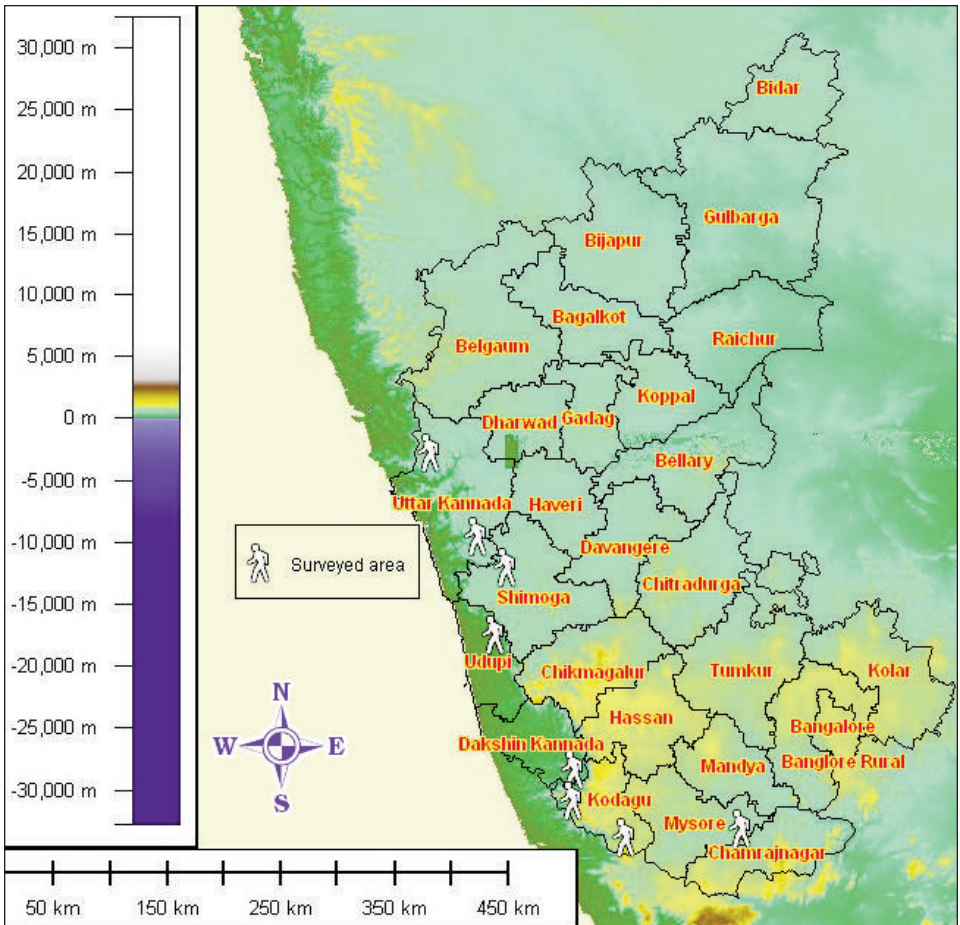


Fig. 13 Locations of reconnaissance survey in 11 districts of Kerala



**Fig. 14** Locations of reconnaissance survey in seven districts of Karnataka



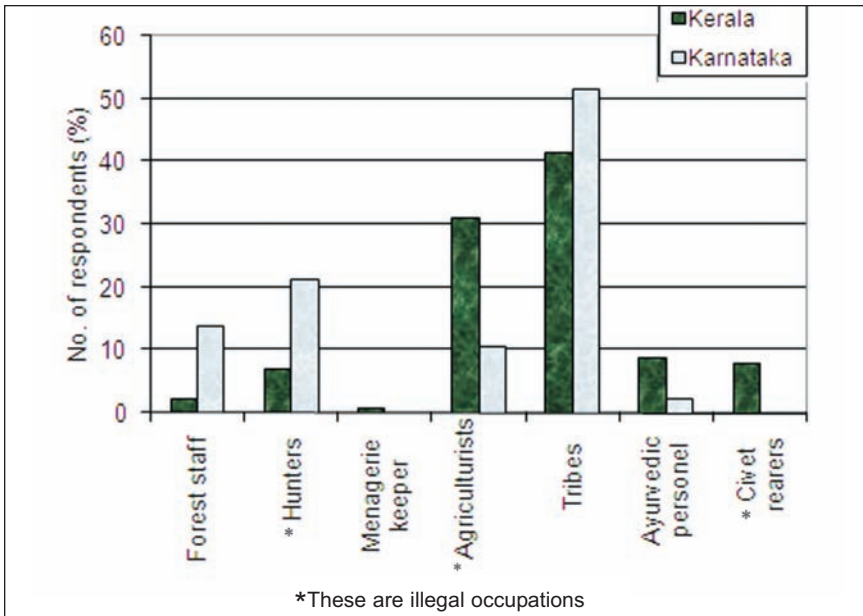


Fig. 15 Background of respondents in Kerala and Karnataka



Fig. 16 A Kani tribe settlement in Podiyakala in Peppara WLS

**Table 1 Tribes interviewed during the reconnaissance survey**

No.	Tribes	Kerala	Karnataka
1	Kumri marati	Not encountered	Mookambika & Sharavathi WLS
2	Are marati	Not encountered	Mookambika WLS, Gerosoppa RF
3	Uppar	Not encountered	Gerosoppa forest, Honnavara RF
4	Nayak	Not encountered	Mookambika & Sharavathi WLS
5	Eediga	Not encountered	Mookambika & Sharavathi WLS
6	Malekudi	Not encountered	Talkaveri WLS, Sulliya RF
7	Yeruva	Not encountered	Coorg
8	Jeenu kuruba	Wayanad WLS	South coorg, BRT WLS
9	Pale	Karsargod RF	Talkaveri WLS
10	Aadi kanadiga	Not encountered	Talkaveri WLS
11	Paniyar	Kannavam, Kasargode and Wayanad	Brahmagiri WLS
12	Kuruchiyar	Kasargod, Kannavam and Manathavady	Not encountered
13	Kani	Kulathupuzha, Peppara and Neyyar WLS	Not encountered

#### 4.1.2 Respondents' knowledge of the Malabar civet

The difference in the level of awareness on the Malabar civet between respondents in Kerala and Karnataka was evident from the results of the interviews conducted on 347 select groups of respondents. Only 7.1% of the respondents from Karnataka seemed to recognize the species as opposed to a whopping 62.4% from Kerala. Overall, tribes contributed more information about the Malabar civet than non-tribes. Among the tribal respondents in Kerala, 86.8% of them claimed to have seen the Malabar civet, but this percentage was nearly half in the case of non-tribes (44.44%). Most of these tribes were from Peppara, Neyyar and Kannavam. Surprisingly Paniyar tribes, relocated from neighboring

Reserve forests and living near Aralam Wildlife Sanctuary, had little idea of the species. Among non-tribes, respondents from Thrissur, Palghat, Ernakulam and Pathinamthitta were not aware of Malabar civet.

In Karnataka only 16.6% of the 66 tribes interviewed reported to have seen a larger civet, and this percentage was even less in the case of non-tribes (1.8%) (N=56). However, unlike in Kerala where the descriptions given by the tribes perfectly matched with that of the Malabar civet, in Karnataka only 3% of the tribes' description could be regarded befitting. Two respondents from Thirthahalli near Someshwara and Megani in Mookambika seemed to know the species as evident from their description of a large civet.

The knowledge of Malabar civet and the local names were different in different district of Kerala (Table 2). The most common name among non-tribes who recognized the species in Kerala was 'Jawad', all hailing from Malappuram and Calicut districts. The tribes in Kerala, however, had different names and these were popular only within the respective communities. No particular local name of significance could be registered for the Malabar civet in Karnataka and the only name "Hedebala bekku" recorded from Udupi district in Karnataka, was known only to the Kumri Marti's and not others. The other name "Kallu Suniga" commonly used among tribes in Someshwara WLS areas proved to be that of the stripe-necked mongoose.

**Table 2 Local names for Malabar civet and small Indian civet in both states**

SI No.	Districts	Tribes	Local Names	
			Malabar civet	Small Indian civet
1.	Kasarkodu	Kuruchiyar	<i>Kuthiri</i>	<i>Chanthu</i>
2.	Kannur	Kuruchiyar	<i>Kannan chanthu</i>	<i>Chanthu</i>

SI No.	Districts	Tribes	Local Names	
			Malabar civet	Small Indian civet
3.	Malappuram	Local respondent	<i>Jawad</i>	<i>Kodi meru</i>
4.	Kollam	Kani	<i>Vengala Verugu</i>	<i>Kodi verugu</i>
5.	Trivandrum	Kani	<i>Vengala verugu</i>	<i>Kodi verugu</i>
6.	Udupi	Kumri Marati	<i>Hedebala becku</i>	<i>Punugina becku</i>

#### 4.1.3 Respondents' knowledge about other small carnivores

The respondents' had a good knowledge of the most common species of small carnivores, namely the common palm civet, brown palm civet, small Indian civet and jungle cat. Very few had an idea about the brown palm civet, brown mongoose and at times even the leopard cat. All those who could recognize the brown palm civet in Kerala (20%) were from Peppara and Neyyar Wildlife sanctuaries and Kulambi (Kulathupuzha forest range).

The reconnaissance survey also revealed that the latest report of capture of the Malabar civet in Kerala was from Kuzhiperampa near Chembarakkattoor in Malappuram district when a live animal was trapped by Shankaran Vaidyar in 2003 (Paramal Moosa, civet rearer, *pers. com.*). The animal was apparently released soon after its capture as its aggressive nature was found unsuitable for keeping it in captivity. The latest reliable sighting comes from Kani tribes in Peppara Wildlife Sanctuary who reported to have sighted one animal in July 2008. Other reliable sightings have all comes from tribes living in Kannavam, Peppara and Neyyar.

#### 4.2. Camera trapping results

The camera trapping survey began in May 2006 with eight cameras and this was increased to fourteen cameras by July 2007. Each survey site comprised of 5 to 10 locations where trapping continued for 7-15 trap-

nights over a period of 30 days. The 18 months of the survey period could cover four intensive survey sites in Kerala and three sites in Karnataka. The four study sites in Kerala across four districts consisted of ten locations in Kannur, ten in Malappuram, three locations in Trivandrum and one location in Wayanad (Periya WLS) (Fig.17). The vegetation types

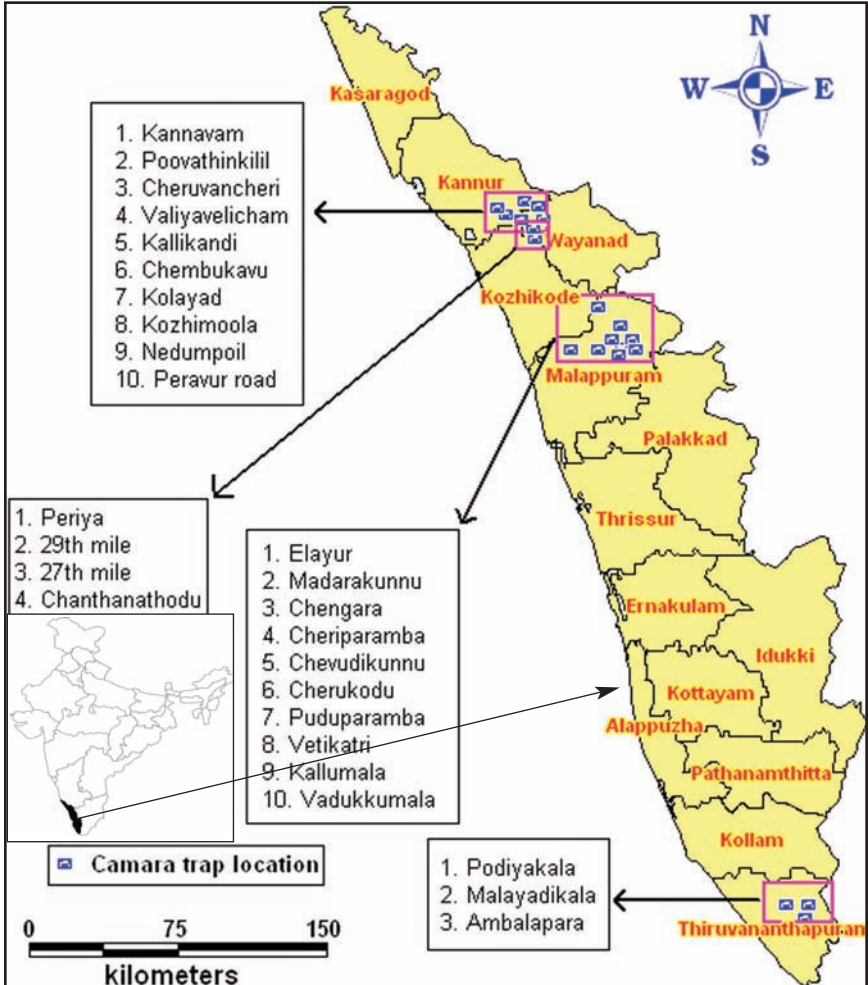


Fig. 17 The four camera trapping sites with the locations in Kerala

in these areas were moist deciduous, semi evergreen and evergreen forests. In Karnataka all the camera trappings were carried out in protected areas (Someshwara, Biligirirangan and Sharavathi wildlife sanctuaries) (Fig 18). Plantations chosen for camera trapping were that of *Ailanthus* (*Ailanthus malabaricum*), areca nut (*Areca catechu*) and cashew (*Anacardium occidentale*), all from Kerala.

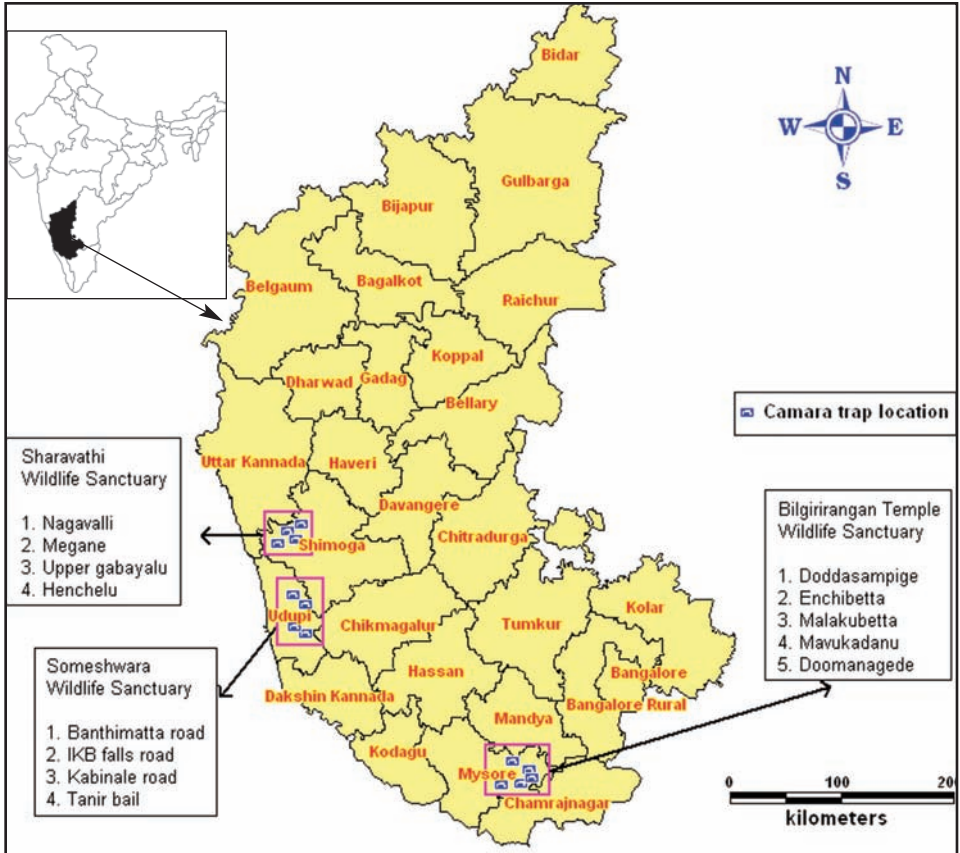


Fig. 18 The three camera-trap sites and the different locations in Karnataka

#### 4.2.1. Relative frequency of photo-captures

Camera traps were laid for 2790 trap-nights in Kerala and 1157 trap-nights in Karnataka. Camera traps recorded 736 photographs of 280 individual animals of 27 species of mammals in 232 successful trap-nights, over a period of 8 months in Karnataka and 18 months in Kerala (see Appendix III for images). When the stripe-necked mongoose and spotted deer, photo-trapped during the daytime is also included, the number of species becomes 29 in 234 successful trap-nights. Though nine species of birds were also photo-trapped, they have not been considered for further analysis in this report for two reasons: Firstly, birds were mostly photo-trapped during the day when ever the traps were set early in the evening and secondly, they were anyway not the focus of the present survey. No photograph of the Malabar civet could be obtained. The list of birds photo-trapped has been given in Table 4.3. Among birds crested serpent eagle, Indian robin, common babbler, Malabar whistling thrush, and orange ground thrush, jungle crow, fairy blue bird and pale capped pigeon were the species photographed (Fig 19).



**Fig. 19 Pale-capped pigeon (*Columba punicea*) from Someshwara Wildlife Sanctuary**

The results showed that some species were flash-shy while others were unperturbed by the repeatedly flashing of camera traps. The average number of images of small carnivores photo-captured whenever they came in front of the camera varied according to species. During successful camera trap-nights, the average number pictures taken of an individual carnivore was found to be high for common palm civet (6.1%), followed by jackal (5.3%), brown palm civet (3%) and small Indian civet (2.2%) (Table 4). Other species like the grey mongoose, ruddy mongoose, mouse deer and barking deer appeared to be very flash-shy (1 to 1.4%).

**Table 3 List of mammals and birds photo-trapped during the survey**

SI No.	Order/Family	Scientific name	Common name
	<b>Mammals</b>		
1.	Carnivora	<i>Paradoxurus hermaphroditus</i>	Common palm civet
2.	Carnivora	<i>Paradoxurus jerdoni</i>	Brown palm civet
3.	Carnivora	<i>Viverricula indica</i>	Small Indian civet
4.	Carnivora	<i>Amblonyx cinereus</i>	Small clawed otter
5.	Carnivora	<i>Herpestes edwardsii</i>	Grey mongoose
6.	Carnivora	<i>Herpestes smithii</i>	Ruddy mongoose
7.	Carnivora	<i>Herpestes vitticollis</i>	Stripe-necked mongoose *
8.	Carnivora	<i>Felis chaus</i>	Jungle cat
9.	Carnivora	<i>Canis aureus</i>	Golden Jackal
10.	Carnivora	<i>Panthera pardus</i>	Leopard
11.	Carnivora	<i>Melursus ursinus</i>	Sloth bear
12.	Carnivora	<i>Panthera tigris</i>	Tiger
13.	Carnivora	<i>Prionailurus bengalensis</i>	Leopard cat
14.	Artiodactyla	<i>Moschiola meminna</i>	Mouse deer
15.	Artiodactyla	<i>Muntiacus muntjak</i>	Barking deer



SI No.	Order/ Family	Scientific name	Common name
16.	Artiodactyla	<i>Axis axis</i>	Spotted deer
17.	Artiodactyla	<i>Cervus unicolor</i>	Sambar deer
18.	Artiodactyla	<i>Bos gaurus</i>	Indian gaur
19.	Artiodactyla	<i>Sus scrofa</i>	Wild boar
20.	Pholidota	<i>Manis crassicaudata</i>	Indian pangolin
21.	Primates	<i>Macaca radiata</i>	Bonnet macaque
22.	Primates	<i>Macaca silenus</i>	Lion-tailed macaque
23.	Primates	<i>Semnopithecus entellus</i>	Common langur
24.	Lagomorpha	<i>Lepus nigricollis</i>	Black-napped hare
25.	Rodentia	<i>Suncus montanus</i>	Hill shrew
26.	Rodentia	<i>Rattus rattus</i>	Field mouse
27.	Rodentia	<i>Bandicota bengalensis</i>	Lesser bandicoot
28.	Rodentia	<i>Hystrix indica</i>	Indian porcupine
29.	Proboscidea	<i>Elephas maximus</i>	Asian elephant

**Birds**

1.	Passeriformes	<i>Zoothera citrina ynotus</i>	Orange-headed Thrush
2.	Passeriformes	<i>Myophonus horsfieldii</i>	Malabar whistling Thrush
3.	Columbiformes	<i>Columba punicea</i>	Pale-capped pigeon
4.	Passeriformes	<i>Saxicoloides fulicata</i>	Indian robin
5.	Passeriformes	<i>Turdoides striatus</i>	Jungle babbler
6.	Accipitriformes	<i>Spilornis cheela</i>	Crested serpent eagle
7.	Galliformes	<i>Gallus sonneratii</i>	Grey jungle fowl
8.	Galliformes	<i>Galloperdix spadicea</i>	Red spur fowl
9.	Strigiformes	<i>Strix leptogrammica</i>	Brown wood owl

\* These species were photo-trapped during the day.

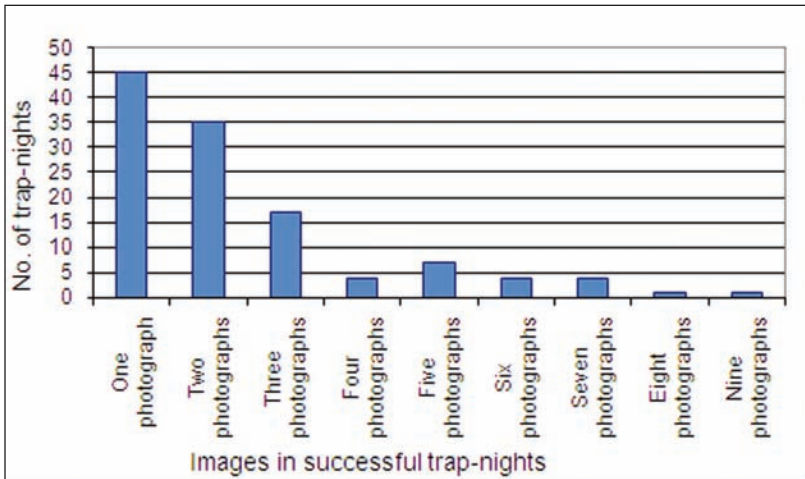
**Table 4 Specieswise list of number of individuals and number of photographs taken for all mammals in Kerala and Karnataka**

Species	No. of Animals	No of Photos	Average No. of Photos
Common palm civet ( <i>Paradoxurus hermaphroditus</i> )	24	147	6.1
Brown palm civet ( <i>Paradoxurus jerdoni</i> )	56	170	3.0
Small Indian civet ( <i>Viverricula indica</i> )	45	100	2.2
Ruddy mongoose ( <i>Herpestes smithii</i> )	18	26	1.4
Grey mongoose ( <i>Herpestes edwardsii</i> )	6	7	1.2
Small-clawed otter ( <i>Amblonyx cinereus</i> )	2	3	1.5
Jungle cat ( <i>Felis chaus</i> )	3	7	2.3
Leopard cat ( <i>Prionailurus bengalensis</i> )	1	2	2.0
Leopard ( <i>Panthera pardus</i> )	2	3	1.5
Tiger ( <i>Panthera tigris</i> )	1	1	1.0
Golden jackal ( <i>Canis aureus</i> )	6	32	5.3
Mouse deer ( <i>Moschiola meminna</i> )	13	17	1.3
Barking deer ( <i>Muntiacus muntjak</i> )	7	11	1.6
Sambar deer ( <i>Cervus unicolor</i> )	13	23	1.8
Gaur ( <i>Bos gaurus</i> )	15	37	2.5
Wild boar ( <i>Sus scrofa</i> )	11	21	1.9
Pangolin ( <i>Manis crassicaudata</i> )	1	2	2.0
Porcupine ( <i>Hystrix indica</i> )	12	23	1.9
Black-napped hare ( <i>Lepus nigricollis</i> )	5	8	1.6
Hill shrew ( <i>Suncus montanus</i> )	1	3	3.0
Field rat ( <i>Rattus rattus</i> )	19	29	1.5
Lesser bandicoot ( <i>Bandicota bengalensis</i> )	5	33	6.6
Common macaque ( <i>Macaca radiata</i> )	3	8	2.7
Lion-tailed macaque ( <i>Macaca silenus</i> )	1	3	3.0
Hanuman langur ( <i>Semnopithecus entellus</i> )	4	6	1.5
Elephant ( <i>Elephas maximus</i> )	4	10	2.5

Species	No. of Animals	No of Photos	Average No. of Photos
Sloth bear ( <i>Melursus ursinus</i> )	2	4	2.0
<b>Grand total</b>	<b>280</b>	<b>736</b>	<b>2.6</b>

**Note:** Day time captured photos of stripe-necked mongoose and spotted deer have not been shown here.

The average number of images captured during the 232 successful trap-nights was around 2.6 (max: 29, min: 1). Ninety one trap-nights produced single image and 51 trap-nights produced two images. The frequency came down for every further increase in the number of images taken per night (Fig 20). With respect to species, the maximum number of species photographed in a single trap-night was five. This happened twice, both at Peppara wildlife sanctuary containing images of elephant, sambar, gaur, wild boar and field rat on one occasion and with the images of porcupine, common palm civet, barking deer, mouse deer and small

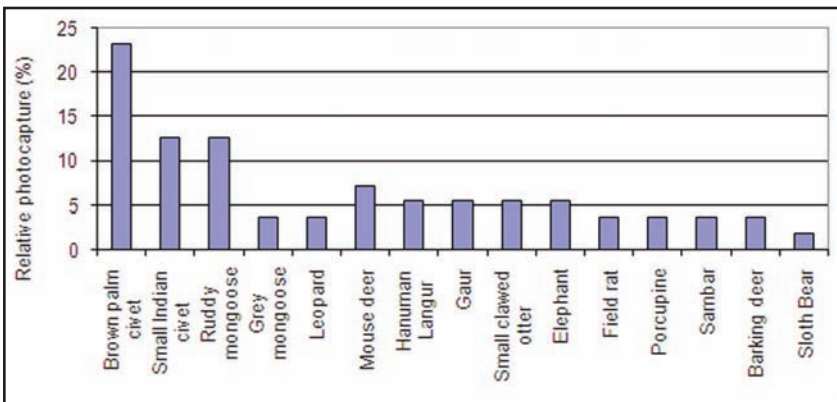


**Fig. 20** Number of images captured during successful trap-nights

Indian civet on the other. Three species were trapped in a camera for five trap-nights and two species in 25 trap-nights. Most of the double and triple species photographs were taken in Shomeshwara WLS.

Surprisingly no wild dog was photo-trapped even though many of the surveyed areas reportedly had these species. Though *Kani* tribes reported brown palm civet in Peppara and Periya, no images of this species could be obtained in spite of 626 trap-nights. Sloth bear was photographed in Biligiri Rangan and Sharavathi wildlife sanctuaries. Barking deer, mouse deer and sambar deer were recorded from evergreen forests of Waynaad and Peppara wildlife sanctuaries.

In Kerala, 28.9% of the animals photo-trapped were common palm civet closely followed by small Indian civet (21.7%) (Fig. 21). Mouse deer, porcupine, gaur and elephant were rarely photographed with a relative abundance of 1.3% each. Jungle cats were less (3.6%) when compared to golden jackal (7.1%). These two species of carnivores were photo-captured only in abandoned cashew plantations in Kannavam and Wandoor. Mouse deer and barking deer were photo-trapped only in a protected area (Peppara Wildlife sanctuary).



**Fig. 21** Relative frequency of species camera trapped in Kerala

Among the species photo-captured in Karnataka, 28.3% was brown palm civet, followed by small Indian civet (13.6%) and ruddy mongoose (9.1%). Other small mammals photo-trapped in Karnataka were mouse deer, small clawed otter and barking deer; larger mammals included elephant, gaur, sambar deer and leopard (Fig. 22).

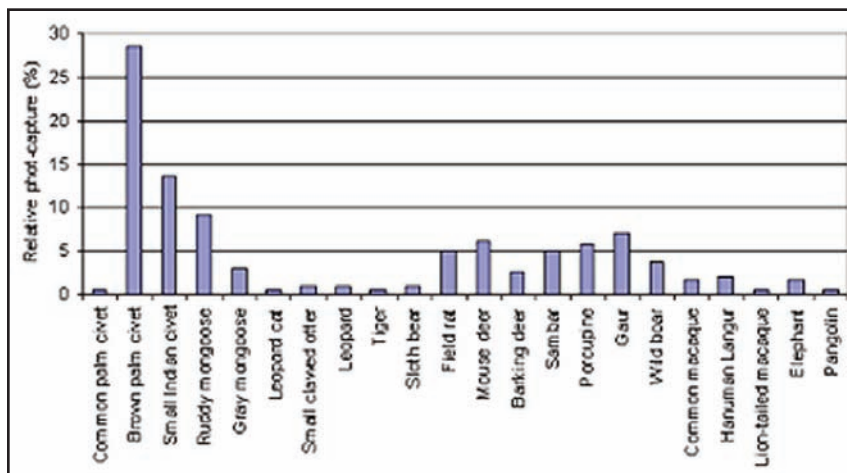


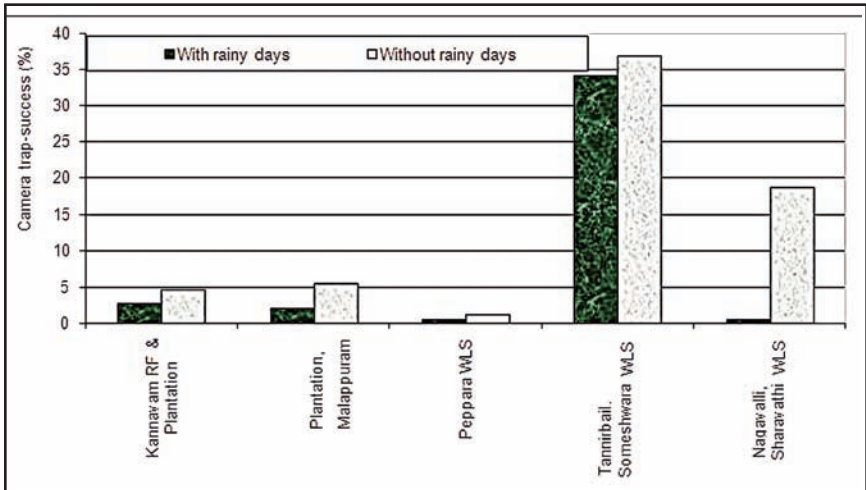
Fig. 22 Relative frequency of species camera trapped in Karnataka

#### 4.2.2. Trapping success

The overall camera-trapping success was 7.1%, but it varied from one area to another. Trap success in the seven surveyed sites in Kerala and Karnataka is shown in Table 5. Highest trapping success was in Someshwara WLS (34%) and the lowest in Peppara WLS in Kerala (0.6%) and Sharavathi WLS in Karnataka (0.5% respectively). The very low percentage in these two areas could be due to the pre-monsoon showers that affected the trapping success considerably. When rainy nights were removed from the analysis of data obtained from five rain-affected sites, the trap success increased drastically (Fig 23).

**Table 5 Trapping success in each trapping site**

State	Sl. No	Trap sites	Trap-nights	Trap success(%)
Kerala	1	Kannavam, Kannur	436	2.8
	2	Plantation, Malappuram	1728	2.1
	3	Peppara, Trivandrum	499	0.6
	4	Periya, Wayanad	127	3.9
Karnataka	1	Nagavalli, Sharavathi	579	0.5
	2	Tannirbail, Someswara	450	34
	3	Doddasampige, BRT	128	7.8
Overall trap success				7.1



**Fig. 23 Difference in camera-trap success when rainy days were removed**

Trap success in Karnataka was dominated by viverrids (7.2%) and cervids (2.3%). Interestingly otter (small clawed otter), common langur, leopard and mongooses (namely grey mongoose, ruddy mongoose and striped-necked mongoose) were photographed only from Karnataka (Fig

24). Of the three sites surveyed in Karnataka (Someshwara WLS, Sharavathi WLS, and BRT WLS), trapping success was the least in Sharavathi WLS and this could be due to early monsoons which washed away the lure.



**Fig. 24 All the three species of mongoose (ruddy, stripe-necked and grey) found in Karnataka.**

**(i) Trap success in different vegetation types**

Trapping success was different across evergreen forests (EVG), moist deciduous forests (DEC) and plantations (PLA) (areca, cashew and *Ailanthus*). It was the highest in evergreen/semi-evergreen forests (15.8%) followed by plantations (5.8%) and lowest in deciduous forest (1.7%). Trapping success in evergreen forests could have been still higher but for low trapping success achieved in Peppara and Sharavathi WLS due to the early arrival of monsoon. When rainy trap-nights were removed from the analysis, trapping success in Nagavalli area of Sharavathi WLS increased significantly from 0.5% to 18.8% (97.2% rainy nights;  $t=5.212$ ,  $p<0.001$ ), that of Kannavam RF from 3% to 5.1% (41.3% rainy nights;  $t=2.613$ ,  $p<0.05$ ), but that Someshwara WLS and Padiakkala in Peppara WLS increased only marginally (from 34.2% to 36.9% in the case of Someshwara and from 0.6% to 1.1% in the case of Peppara). The rainy nights at these two sites were 7.3% and 38.5% respectively.

While 20% of the photographs taken during the 18 month survey were that of the brown palm civet (Fig.25), 16% were that of the small Indian



**Fig. 25 The endemic brown palm civet was the most commonly photo-trapped species at night.**



civet. Of the remaining 64%, two small carnivores namely the common palm civet (8.6%) and ruddy mongoose (6.4%) were the most commonly photographed (Table 6). However, when these figures were corrected for vegetation types, their relative frequencies within a particular vegetation type provided some interesting results. When carnivores alone were taken into consideration, brown palm civet, small Indian civet and ruddy mongoose dominated the photo-captures from evergreen/ semi-evergreen forests (28.7%, 13.3% and 9.2% respectively). In both deciduous forests and plantations, common palm civet, small Indian civet, golden jackal and jungle cat were the most frequently photographed, with only their relative frequency differing marginally (see Table 6).

Trapping efforts, however, were not the same in the different vegetation types. Of the 3,947 trap-nights, 31% were in evergreen forests, 45% deciduous forests and the remaining 24% in plantations. Habitat-wise trapping success of different families, genera and species therefore showed different results. The number of species recorded was the highest in evergreen/semi evergreen forest (22), followed by deciduous forest (13) and plantations (8). Family Viverridae dominated in all the vegetation types forming 36.6 to 56.3% of the photo-captures (Fig 26). Overall, mammals belonging to sixteen families have been photographed.

**Table 6. Relative percentage of different species camera trapped in different vegetation types (rainy nights included).**

Species	Vegetation types			Overall %
	EVR	DEC	PLA	
Total no. of individuals photographed	195	30	55	280.0
<b>Carnivores</b>				
Common palm civet	0.5	23.3	29.1	8.6

Species	Vegetation types			Overall %
	EVR	DEC	PLA	
Brown palm civet	28.7	0.0	0.0	20.0
Small Indian civet	13.3	13.3	27.3	16.1
Grey Mongoose	3.1	0.0	0.0	2.1
Ruddy Mongoose	9.2	0.0	0.0	6.4
Small Clawed otter	1.0	0.0	0.0	0.7
Jungle cat	0.0	6.7	3.6	1.4
Leopard cat	0.5	0.0	0.0	0.4
Leopard	1.0	0.0	0.0	0.7
Tiger	0.0	3.3	0.0	0.4
Golden Jackal	0.0	6.7	5.5	1.8
<b>Ungulates</b>				
Mouse deer	6.2	3.3	0.0	4.6
Barking deer	2.1	10.0	0.0	2.5
Sambar	6.2	3.3	0.0	4.6
Gaur	6.7	6.7	0.0	5.4
Wild boar	3.6	3.3	7.3	4.3
<b>Others</b>				
Pangolin	0.5	0.0	0.0	0.4
Porcupine	5.6	3.3	0.0	4.3
Black Napped hare	0.0	0.0	9.1	1.8
Hill shrew	0.5	0.0	0.0	0.4
Field rat	6.2	0.0	10.9	6.4
Bandicoot	0.5	0.0	7.3	1.8
Common macaque	1.5	0.0	0.0	1.1
LTM	0.5	0.0	0.0	0.4
Langur	2.1	0.0	0.0	1.4
Elephant	0.0	13.3	0.0	1.4

Species	Vegetation types			Overall %
	EVR	DEC	PLA	
Sloth Bear	0.5	3.3	0.0	0.7
<b>TOTAL</b>	<b>100.0</b>	<b>100.0</b>	<b>100.0</b>	<b>100.0</b>

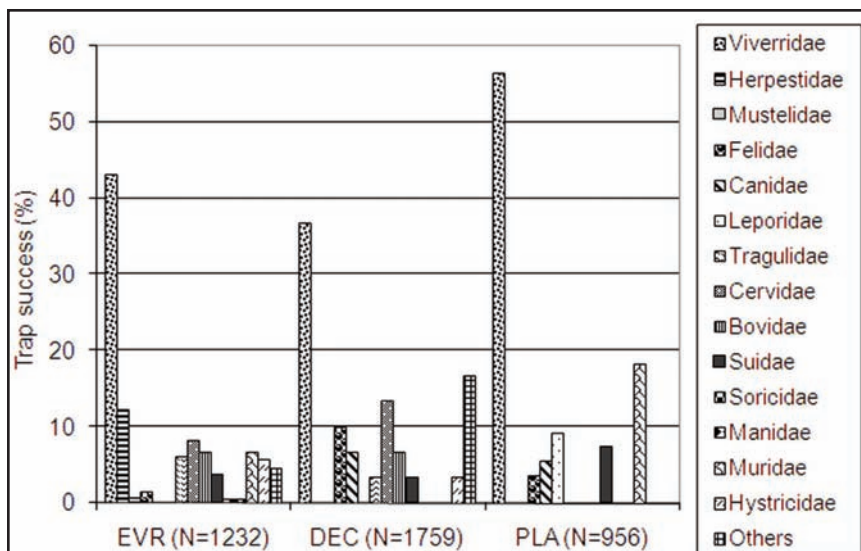
**Sampling Effort:**

EVR- Evergreen Forest (N=1232)

DEC- Deciduous Forest (N=1759)

PLA- Plantations(Ailanthus, cashew and Areca-nut) (N=956)

Note: Day time captured photos of stripe-necked mongoose and spotted deer have not been shown here.



**Fig. 26 Habitatwise camera trapping success at family and order level**

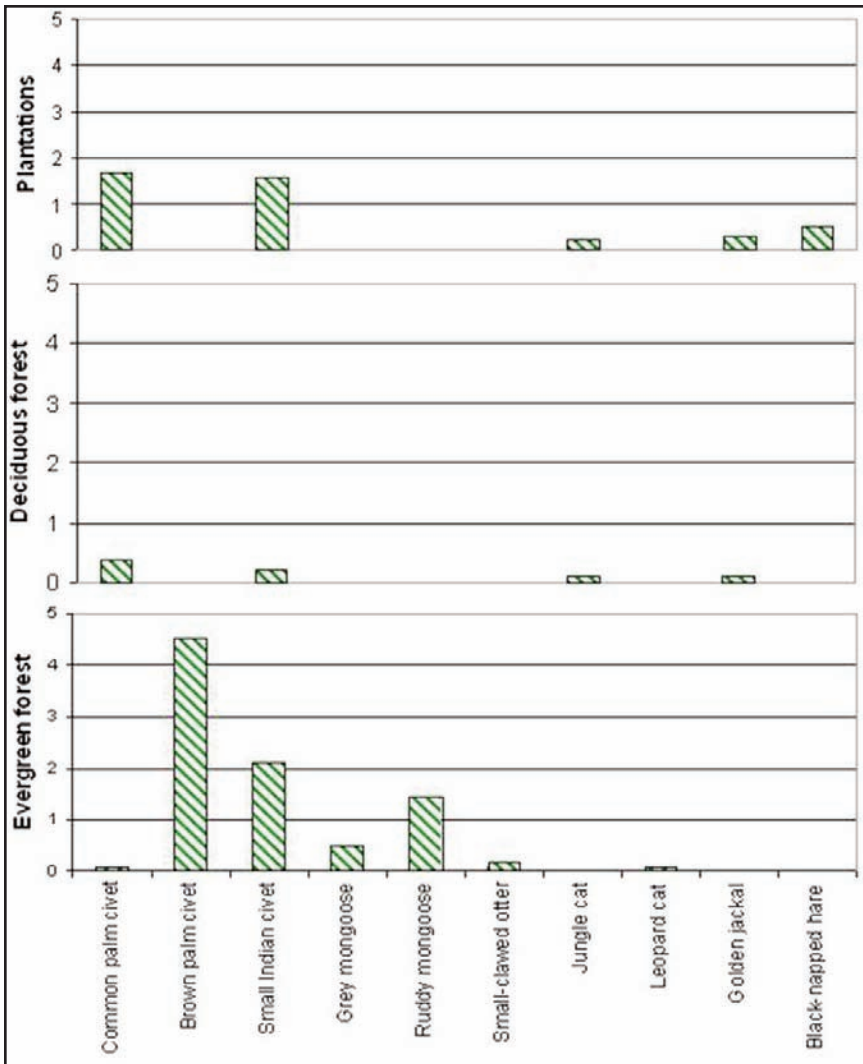
(Daytime captures: common langur, bonnet macaque, lion-tailed macaque, sloth bear, elephant)

Though viverrids, felids and rodents were represented in all the three vegetation types, the species composition was different. While all the trappings of brown palm civet was restricted to evergreen forests, that of the common palm civet was almost entirely from deciduous forests and plantations. Among felids, all images of jungle cat were obtained from deciduous forests and plantations (0.3%), but those of leopard cat (0.1%) from evergreen forests. Among big cats, the only picture of the tiger came from Biligiri Rangan Temple WLS (Fig.27), while leopards (including a black panther) were photographed from Someshwara WLS. Hare was



**Fig. 27 The only picture of the tiger came from the Billigiri Rangan Temple WLS**

photographed only from plantations, while the wild boar was recorded from all vegetation types. Otters, mongooses, leopard cat and sloth bears were photo-trapped only from evergreen/semi-evergreen forests (Fig. 28).



**Fig. 28 Trapping success of common small mammals in different vegetation types (excluding the rainy nights)**

Hunters with hunting dogs and NWFP (Non wood forest produce) collectors were encountered during the survey in Kalikavu range in

Kerala and Someshwara WLS in Karnataka (Fig. 29). In Peppara WLS, the resident Kani tribes also appeared to be involved in hunting as evident from the presence of hunting dogs, bows, bark-snares and stone-fall traps.



**Fig. 29 Hunters with their dogs photographed during the day near Someshwara, Karnataka (top) and photo-trapped at night in Kalikavu range, Kerala (middle). NWFP collectors photo-trapped at night in Someshwara WLS.**

**(ii) Trap success in disturbed and undisturbed habitats**

In Kerala the trapping effort was more in disturbed forests (1139 trap-nights) than in undisturbed forest areas (687 trap-nights). In Karnataka almost all the trapping efforts were in undisturbed evergreen, semi-

evergreen and dry deciduous forests. Trapping success was significantly high in undisturbed evergreen forests, the difference between disturbed and undisturbed areas being 1.9% and 17.5% respectively ( $t=3.1$ ,  $p<0.05$ ). The difference was 0.5% and 2.1% in the case of deciduous forests ( $t=2.68$ ,  $p<0.05$ ); the areas covered being the moist deciduous forests in Peppara WLS and isolated patches in Malapuram and Kannavam, and dry deciduous forests in Biligiri Rangan WLS. In the case of plantations, abandoned ones harboured more wildlife (8.3% trap success) than managed plantations (2.9%) ( $t=2.24$ ,  $p<0.05$ ). Managed plantations covered during this survey were mainly cashew and areca, and the unmanaged or abandoned plantations were that of cashew and *Ailanthus*, all in Kerala. In Karnataka no camera trapping was conducted in plantations. The common palm civet was photo-trapped in this state only from the disturbed semi-evergreen forests of Biligiri Rangan WLS. But for this only disturbed forest type, all the other camera trappings in Karnataka were carried out in undisturbed forests. Among carnivores, trapping success in the undisturbed forest areas of Karnataka was the highest for brown palm civet (6%), followed by the three species of mongooses (see Fig. 30).

Trap success of common palm civet was higher in disturbed forests than in undisturbed forest (evergreen and deciduous forests). Barking deer, sambar deer, mouse deer, porcupine, gaur and elephant were photographed only from undisturbed forest in protected areas (Table.7). As far as plantations are concerned (cashew, areca nut), common palm civet, bandicoot, field rat, black-napped hare and small Indian civet were the species photo-trapped. Since all the confirmed reports of Malabar civet have come from plantations and remnant deciduous patches of Malappuram district in Kerala, a considerable proportion of the survey period was spent there (N=1728). Overall trapping success in plantations was different between managed (2.9%) and abandoned (8.3%) ones, the reason being the presence/absence and abundance of certain species (Fig. 31).

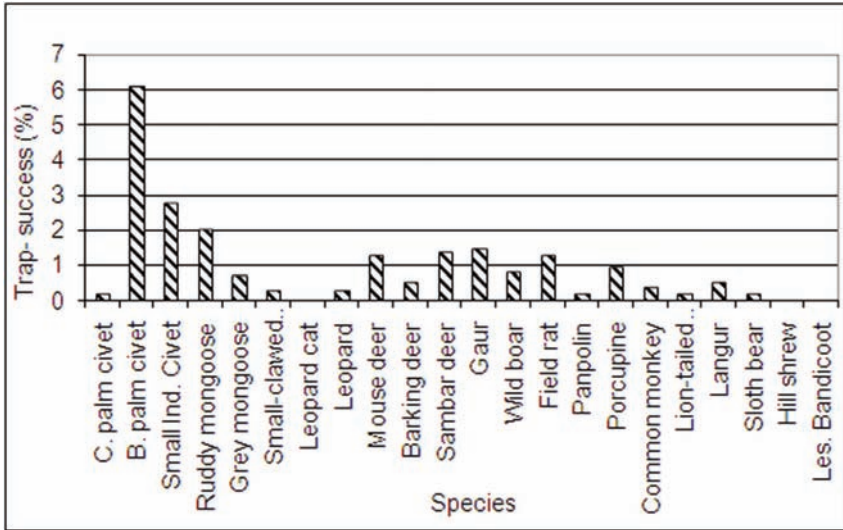


Fig. 30 Trap success of species in undisturbed forests of Karnataka

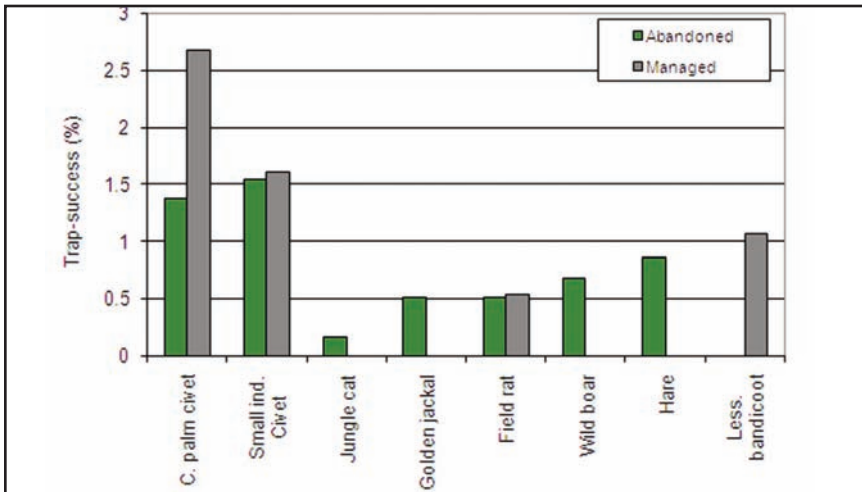


Fig. 31 Trap success of species in managed and abandoned plantations



Table 7 Trap success &amp; species photographed in disturbed &amp; undisturbed forests.

Disturbed				Undisturbed			
Total trap-nights	Trap success	Species	No. of animals	Total trap-nights	Trap success	Species	No. of Animals
311	1.9%	Small Indian civet	1	921	17.5%	Common palm civet	1
		Leopard cat	1			Brown palm civet	56
		Mouse deer	1			Small Indian civet	25
		Porcupine	1			Gray mongoose	6
		Field rat	1			Ruddy mongoose	18
		Bandicoot	1			Small clawed otter	2
		Hill shrew	1			Leopard	2
						Mouse deer	11
						Barking deer	4
						Sambar deer	12
						Gaur	13
						Wild boar	7
						Field rat	13
						Porcupine	8
						Common macaque	3
						Loin-tailed macaque	1
						Hanuman langur	4
						Sloth bear	1
						Pangolin	1

Evergreen forests

Disturbed					Undisturbed							
Total trap-nights	Trap success	Species	No. of animals	Total trap-nights	Trap success	Species	No. of Animals					
Deciduous forests					1048	0.5%	Common palm civet	3	711	1.7%	Common palm civet	4
							Jungle cat	2			Jackal	2
											Small Indian civet	4
											Porcupine	1
											Elephant	4
											Tiger	1
											Mouse deer	1
											Barking deer	3
											Sloth bear	1
											Wild boar	1
Plantations											Sambar deer	1
											Gaur	2
					582	2.9%	Common palm civet	10	374	8.3%	Common palm civet	8
							Small Indian civet	6			Small Indian civet	9
							Field rat	2			Jungle cat	1
							Lesser. bandicoot	4			Golden jackal	3
											Wild boar	4
											Hare	5
											Field rat	3

Note: Day time captured photos of stripe-necked mongoose and spotted deer have not been shown here.

**(iii) Effect of lures, baits and trap locations**

Other factors that affected trapping success were the trap location, lure and baits. Since “bait” alone was not good enough to attract animals, two types of lures were used to attract the animals, namely “Alley cat” and “Saber Tooth”. In the beginning both lures were tried in two cameras each for 60 trap days. As animals were attracted more towards “saber tooth”, the use of “Alley cat” was subsequent withheld. As a results, 93% of the 3719 trap-nights had “Saber tooth” as the lure, at times supplemented with baits such as fish, banana and chicken waste.

Data on the camera trap locations were clumped into 8 categories such as (i) animal trails, (ii) human trails, (iii) forest roads, (iv) water bodies, (v) thickets, (vi) defecation sites, (vii) forest edges and (viii) dens (Fig 32).



**Fig. 32 Some of the camera trapping locations in Kerala (clockwise); Thickets, animal trail, lavatory sites and dens**

There was a significant difference in trapping success between trapping locations in Kerala. Trapping success was negatively correlated to distance from water source ( $r = -0.039$ ;  $P = 0.05$ ) and positively but weakly correlated with distance from village ( $r = 0.002$ ;  $P = 0.01$ ). There was no significant relationship between trapping success and trapping locations in Karnataka as most (89.1%) of the camera traps were placed very near to water source.

Though majority of the traps were placed along animal trails (54%), overall trapping success was high near water body (12.6%) closely followed by forest roads (10.7%). (Table 4.8). Since most of the camera trapping sites in Kerala was along animal trails, 53.7% of the trapping success was obtained from this. On the contrary, 53.8% of the animals in Karnataka came from locations near to the water bodies.

**Table 8. Trapping success in relation to camera location**

SI. No.	Locations trap-nights	No: of trap-nights	Percent	Trap success (%)
1.	Animal Trail	2130	54.0	5.3
2	Water Bodies	747	18.9	12.6
3	Forest Edge	499	12.6	1.0
4	Bush	270	6.8	7.0
5	Human Path	70	1.8	2.9
6	Lavatory site	103	2.6	0.0
7	Near Den	100	2.5	3.0
8	Forest Road	28	0.7	10.7
	<b>Overall</b>	<b>3947</b>	<b>100.0</b>	<b>7.1</b>

## 5. DISCUSSION

The 18 months of camera trapping in seven intensive camera-trapping areas of Karnataka and Kerala could register only 282 individuals of 29 species of mammals and not the Malabar civet. The camera trapping survey not only failed to trap the rare Malabar civet but also some of the common species of carnivores like the wild dog (*Cuon alpinus*) known to occur in some of the areas surveyed. The reason for failing to record this species is, however, unclear. Of all four species of the genus *Viverra*, it is only the Malabar civet which has a very restricted distribution range and also the rarest. The rarity is further compounded by the fact that most of the coastal forests of the Travancore and Malabar coasts which are considered to be the species' stronghold (Jerdon, 1874; Prater, 1948; Rai and Kumar, 1993a) have disappeared for ever.

All the historical records of Malabar civet, be it specimens or old publications (Jerdon, 1874; Pocock, 1939; Kurup, 1987; Ashraf *et al*, 1993), have come from Travancore and Malabar, the coastal/lowland tracts of Western Ghats, Kerala. All the confirmed reports of MBC have also come from secondary forests and plantations of lowland Western Ghats (Kurup, 1987; Ashraf, *et al*, 1993). Previous surveys have indicated that the Malabar civet is probably confined to the lowland riparian forests (Rai and Kumar, 1993b; Kumar *et al*, 1999) and that the species is probably dependent on shallow water courses for foraging at night (Ashraf *et al*, 1993). Malabar civet's closest relative, the large-spotted civet (*V. megaspila*) is also known to inhabit lowland forests (Zaw *et al*, 2008). The two camera trap photos the authors obtained were between 30-280 meters of lowland plain. The fact that the present survey failed to obtain even a single photograph of the Malabar civet from areas where it is sympatric with the commoner Small Indian and common palm civets only goes on to show that the animals that were caught from these areas in the past were individuals of remnant populations struggling to survive

in the modified environment. The existing Malabar civet populations, if any, along its distribution range are therefore relict populations inhabiting sub-optimal habitats along the foothills and lower slopes of Western Ghats (see also Ashraf *et al*, 1993 and Kumar *et al*, 1999).

It could be hypothesized that the Malabar civet suffered two major setbacks since the 18<sup>th</sup> century A.D. One was the large scale conversion of the coastal tropical forests for planting cashew (*Anacardium occidentale*) probably during the late 19<sup>th</sup> century, couple of centuries after the Portuguese introduced in the late 16<sup>th</sup> century A.D. During this time, the species was still common as Jerdon (1874) reported many specimens he procured from Travancore and Tellichery. It is possible that these specimens were procured during the process of clearing forests for planting the cashew crop. Strangely by the beginning of the 20<sup>th</sup> century itself the species was considered rare and nearing extinction (Prater, 1948). The second setback happened during the 20<sup>th</sup> century (during 70s and 80s) when these largely unmanaged cashew plantations which acted as a refuge for the Malabar civet were cleared for planting rubber (*Hevea brasiliensis*). Rubber plantations being close-canopied do not encourage any undergrowth that are crucial as retiring sites for a terrestrial species like the Malabar civet (Ashraf *et al*, 1993; Kumar *et al*, 1999). It is pertinent to point out that it was during one of these clearance operations of cashew plantations and relict forest patches for planting rubber when two animals were caught in Elayur in Malappuram district, leading to its rediscovery (Kurup, 1987).

The large-spotted civet (*V. megaspila*), with which the Malabar civet was once considered a subspecies, is also threatened due to conversion of lowland forest to plantations of oil palm, sugar cane and others (Zaw *et al*, 2008). However, the large Indian civet (*V. zibetha*), the only other large civet of the genus *Viverra* found in India, inhabits a wide range of altitudes, 30 to 1,570 m in Myanmar (Zaw, *et al*, 2008). The fourth species

of this genus *Viverra*, the Malayan civet (*V. tangalunga*) is also common in the wild as evident from its choice of a diversity of habitats (Wemmer and Watling, 1986) and high capture rates in live traps (Jennings *et al*, 2006).

The reason why only a select number of individuals in Karnataka identified the Malabar civet could be due to the comparatively lower human population density and the fewer number of local hunters (using dogs) than in Kerala. The one common name “Hedebala Bekku” reported by Kumri Marathi tribe from Mookambika (Udupi Dt.) appears to be a very local name. The other names “Kallu Suniga and Kallu Bekku” obtained from a hunter near Someshwara proved to be those of the stripe-necked mongoose. In light of these recent findings, the earlier mention of several local names for the species (Jawadi/Jawadiyo, Bal/Mangala Kutri) by Rai and Kumar (1993a) from Puttur, Naravi, Kudremukh, Someshwara, Mookambika and Sharavathy areas proved to be incorrect. Most of these names turned out to be that of small Indian civet.

As far as the common names for Malabar civet in Kerala is concerned, at least four different names are in use, namely Jawad, Kannan Chandu, Perum verugu and Vengala verugu. While the name ‘Jawad’ is popular among non-tribes, especially hunters and Ayurvedic physicians of Malabar (Malappuram and Calicut), all the other names are exclusively used by different forest tribes. It is pertinent to point out that the word ‘civet’ is derived from the Arabic word “*zabad*” which literally means (fragrant) “musk”. This is an obvious reference to the “civet musk” obtained from the perineal ‘civet gland’ of the African civet (*Civettictis civetta*), the most common species of civet used in the commercial civet extraction (Tsegaye, 2008). The species name of the large Indian civet *V. zibetha* is obviously based on the word “*zabad*”. The word ‘*zabad*’ in Arabic therefore refers to both the glandular secretion ‘musk’ as well as the animal, as is the case with the English word “civet”. Given the history

of Arabian traders frequenting coastal Kerala even before the advent of Islam, it is not surprising to see the Malabar civet being referred as “Jawad” by the predominant Muslim community of Malappuram and Calicut districts.

There are four possible sightings of the Malabar civet reported from Karnataka, namely Kudremukh (Karanth, 1986), Karwar (Theodore Bhaskar, *pers. com.*), Biligiri Rangan Temple Wildlife Sanctuary (Aparajita Dutta, *pers. com.*) and Coorg (Sanjay Molur, *pers. com.*). Though all these sightings have come from well-known naturalists and biologists, there is no photographic or other documentary evidences available to support their sightings. The fact that tribes and hunting populace in Karnataka did not readily recognize the Malabar civet as opposed to the those in Kerala only goes on to show that the occurrence of this species in the surveyed areas of Karnataka is questionable. This is a disappointing news considering the presence of well protected extensive lowland forests in Honnavara Reserve Forest, and Someshwara, Mookambika and Sharavathi Wildlife Sanctuaries. Moreover, three months of camera trapping (222 trap-nights) in Someshwara Wildlife Sanctuary in Karnataka which has excellent lowland rainforests (altitude 75 m. MSL) also failed to establish the presence of the Malabar civet.

Studies on viverrid ecology have shown that the home ranges of omnivorous viverrids can be overlapping as they are not typically territorial (Grassman, *et al* 2005), vary depending on habitat productivity (Joshi *et al*, 1995), dietary habits and body size (Rabinowitz, 1991). While such a dietary flexibility of terrestrial viverrids of the genus *V. zibetha* and *V. tangalunga* are known to facilitate their survival even under changing habitat conditions (Colon, 1999; Zaw, *et al*, 2008), it is indeed perplexing to know that the Malabar civet and possibly also the large-spotted civet (*V. megaspila*) are an exception to this theory. Though the large-spotted civet is said to be threatened, its conservation status is more secure than



the Malabar civet as it has a considerably wider distribution range (Laos, Thailand, Vietnam, Kampuchea and parts of Malaysia) and has a breeding captive population established in Bangkok Zoo (Schreiber *et al*, 1989). The Malabar civet appears to be extremely rare even in the protected habitats in Peppara and Periya from where it is reportedly sighted by local tribes. As Tobler *et al*, (2008) stated, elusive species are often missed out during mammalian inventories or only reported from interviews with local people.

Recent theoretical and empirical camera trapping studies suggest that a camera based encounter rate can be used as an index of relative abundance (Yasuda, 2004; Carbone *et al*, 2001, 2002; Brien *et al*, 2003). Till the recently carried out study on the abundance of small carnivores in fragmented forests (Mudappa, *et al*, 2007), there was hardly any information on the ecology of small carnivores in Western Ghats. Trapping success during this survey was considerably low (7.1% per trap night) when compared to the success achieved by earlier studies in the Western Ghats as well as other tropical southeast Asian tropical forests. When rainy nights were excluded, the trapping success increased to 27% per trap-night which is still less than the 41% trapping success of small carnivores achieved in Kalakkad Mundanthurai Tiger Reserve (KMTR) (Mudappa, *et al*, 2007). However, when only the figures of the Someshwara Wildlife Sanctuary, which is also a rainforest like KMTR, were taken into consideration, the trapping success increased to 36.9%. As reported by earlier studies (Mudappa, *et al*, 2007; Kumar and Yoganand, 1999), rainforests harbour a great abundance of civets than deciduous forests. In terms of species richness, the evergreen forests supported more species than other vegetation types covered during this survey (22 species). The maximum number of animals photo-trapped was also from the evergreen forests (70%) though the sampling effort here was only 31% of all the three vegetation types. Though trapping success was higher in plantations (5.8%) than in DEC forests (1.7%), in

terms of species richness the plantations supported less (mere 8 species when compared to 13 from deciduous forests).

Habitat disturbance and illegal hunting appear to have an effect on species diversity and abundance as evident from the low trapping success in disturbed forests during this survey. For instance, the disturbed semi-evergreen forests in Sharavati WLS in Karnataka and the disturbed evergreen forests in Peppara WLS were covered roughly during the same pre-monsoon period and with similar trapping effort (579 and 499 trap-nights respectively). When rainy nights were removed from the analysis, the trapping success for the disturbed semi-evergreen forests of Sharavati WLS increased to 18.8%, while that of Peppara went up to only 1.1%. Habitat disturbance and the illegal hunting by the local Kani tribes living in Podiyakkala in Peppara WLS could be the reason for such a low trapping success.

The most commonly encountered viverids during this two year survey period in the evergreen and deciduous forests were the palm civets of the genus *Paradoxurus*: brown palm civet (*P. jerdoni*) in undisturbed evergreen forests and common palm civet (*P. hermaphroditus*) in deciduous forests and plantations. Mudappa *et al*, (2007) also recorded the common palm civet frequently in drier deciduous forests and never in rainforests. The only semi-evergreen forest where this species was photo-trapped during the present study was from the disturbed forests near Podiakkala settlements of *Kani* tribes in Peppara WLS. This species is undoubtedly versatile in adapting to survive in modified habitats in and around human habitations. Presence of a common palm civet in an evergreen or semi-evergreen forest could therefore be taken as an indication of disturbance or an evidence of proximity to human habitations. While the brown palm civet accounted for 80% of the camera trapping success during the small carnivore study conducted earlier in KMTR, it accounted for 65.1% of the carnivores trapped in Someshwara

WLS. This KMTR and Anaimalais study which came from mid and higher elevations rainforests (600 to 1200 meters) also revealed that the capture rate of brown palm civet was significantly positively related with altitude. The present survey in Someshwara Wildlife Sanctuary has established that the species could be found in evergreen forests as low as 75-100 meters also, with a trap success of 39.7% as opposed to 57.9%, 32.2% and 20.6% trap successes reported by Mudappa *et al* (2007) at elevations of 1250, 1000 and 750 meters respectively.

Small Indian civet was the only species of small carnivore photo-trapped from almost all vegetation types and all survey sites. The species was equally well represented in all vegetation types, forming 13.3% of the animals trapped in both evergreen and deciduous forests, and 27.3% of the animals in plantations. The species is undoubtedly the most adapted small carnivore to survive in all types of habitats.

## **6. RECOMMENDATIONS**

Failure to photograph the Malabar civet cannot be taken as an indication of the species' extinction in the surveyed areas and rest of the areas of lowland Western Ghats. Even extensive camera trapping surveys focused on a particular area have failed to trap all the species known to occur in the area. While evaluating the camera trap for inventory of terrestrial rainforest mammals in Peru, Tobler *et al*, (2008) in their two years of about 2,000 trap days could record only 75-86% of the large and medium-sized terrestrial mammals known to inhabit the area. They concluded that camera spacing and total survey area had little influence on the species recorded and only an increase in survey effort by increasing the number of traps and duration of the survey would succeed in recording the more elusive species.

Habitats similar to those found in Elayur and Poogode, from where the

only known specimens have come from (Kurup, 1987; Ashraf, *et al*, 1993), are still found in many parts of Kerala. There are still less disturbed or abandoned plantations bordering patches of deciduous and semi-evergreen forests present in coastal Kerala. This is apart from many of the undisturbed extensive lowland evergreen forests in Periya Reserve Forest (Kannur Division), and Peppara and Neyyar wildlife sanctuaries that might still harbour the species. The present survey could manage only 127 trap-nights in Periya, and in Peppara, most of the 499 trap-nights were affected by rain. Extensive and prolonged period, of camera trapping in one of these areas is an option in the future.

The choice of lure could have also had a bearing on the trapping success of the Malabar civet. In Sarawak, for instance, eight different types of lure were used for camera trapping, but only one “Magna Glan” lure was effective during monsoons (Giman, *et al*, 2007). The pre-monsoon showers in April-May brought down the trapping success during this survey. The suitability of “Magna” lure could be investigated if camera trapping is considered an option for future surveys.

Considering the rarity and elusive nature of the Malabar civet, it is important to look for alternate methods to establish its presence. Since transect surveys and camera trappings have failed in realizing the objective of this survey, other methods that could be tried are the DNA extraction from scats and tracking the civets using trained scent-detection dogs. The technique of using scent dogs to search rare animals has been proved to be effective in studying mammals and birds (Browne *et al*, 2006). Trained sniffer dogs have been used to locate and monitor endangered carnivores that naturally exist in low densities. In the case of Malabar civet, the dogs will have to be trained with the skin available at museums in Kerala.

Since all reports of the Malabar civet's occurrence come from Kerala,

future efforts to survey this species should be focused in this state. Of particular importance are the lowland evergreen and semi-evergreen forests in Peppara WLS, Neyyar WLS and foothills of Ponmudi in Trivandrum district where prospects of finding the civet are the greatest.

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## Appendix I

### Interview Data Sheet Wildlife Trust of India

#### Malabar civet conservation survey

Name			
Age	District		
GPS location	Taluk		
GPS altitude	Village		
Distance from sea shore			
Human settlements	Low	Medium	High
Nearest Forest (Name)			
Distance to Forest (in km)			

Category (tick)
<input type="checkbox"/> Hunter
<input type="checkbox"/> Civet rearer
<input type="checkbox"/> Ayurvedic person
<input type="checkbox"/> Forest Dept. person
<input type="checkbox"/> Wildlifer/ Naturalist
<input type="checkbox"/> Tribal
<input type="checkbox"/> General public

#### Vegetation of the area (tick the correct box)

<input type="checkbox"/>	Dominated by plantations
<input type="checkbox"/>	Dominated by settlements, agriculture & plantations
<input type="checkbox"/>	Dominated by forest
<input type="checkbox"/>	Intermix of private forests and plantations
<input type="checkbox"/>	Others (specify: _____ )

If it is a forest.. (U can tick more than one one)

<input type="checkbox"/>	Evergreen
<input type="checkbox"/>	Semi-evergreen
<input type="checkbox"/>	Moist deciduous
<input type="checkbox"/>	Dry deciduous
<input type="checkbox"/>	Others-specify: _____

If it is a plantation .. (U can tick more than one)

<input type="checkbox"/>	Cashew
<input type="checkbox"/>	Rubber
<input type="checkbox"/>	Coffee
<input type="checkbox"/>	Tea
<input type="checkbox"/>	Others- specify: _____

Suitability of the area for camera trapping: Very high/Could be tried/ Low

No	Questions	
1	Does he recognize the M. civet?	Yes/No
2	If yes, then how does he know?	
	a. Heard from others	
	b. Seen it in the wild	
	c. Hunted in the past	
	d. Reared one in the past	
	e. Others:	

If he is a hunter, does he use dogs?	
Yes / No	
If the answer is 'Yes to (b), (c) or (d), then ....	
How often sighted?	Rare/ Not so rare
When was last sighted?	
How many times hunted?	
When last hunted?	
Do u have a skin/trophy?	Yes/No/ Had 1

Notes: \_\_\_\_\_

**Appendix II**  
**Malabar Civet Conservation Project - WTI**  
**Trapping Data Sheet**  
**(Live/Camera)**

**Date:**                      **GPS location:**

Parameters	Details
Location	
Habitat type	
Extent of the forest/plantation	
Trap number	
Trap location	Forest trail/Forest
Trap placing time	
Time of trap removed	
Name of the bait used	Animal/ vegetable/ both/ commercial lure
Near by microhabitat	
Terrain	
Altitude	
Climate (Sunny/cloudy/rainy/drizzling)	
Distance from the village	
Distance from water source	

**Result**

I. Animal trapped / No animal /Trap moved  
 II Animal tranquilized:

**II. Indirect evidences**

**Pugmarks:** yes /no                      Name of the species:

**Scats:** yes /no

**III. Malabar civet/other animal trapped**

Name of the Species:

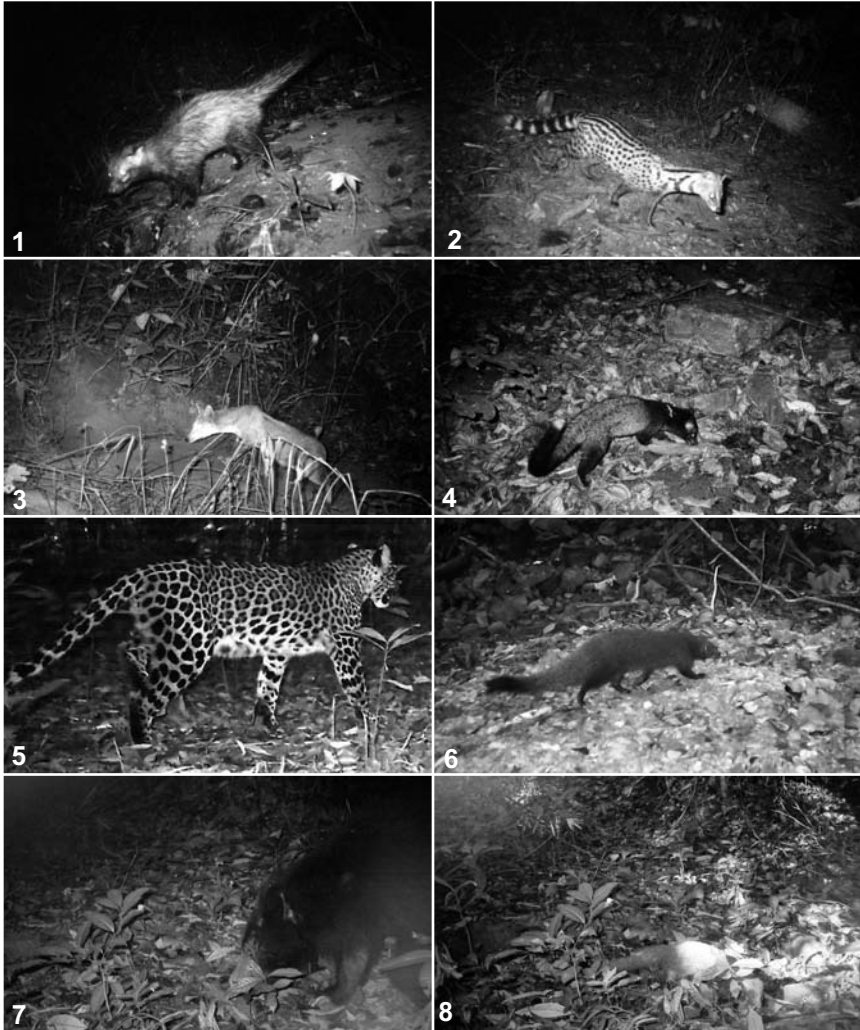
Age of the animal:

Sex:

Weight:

**Remark**

**Appendix III**  
**Mammals photographed from camera trapping survey**



No.1,2,&3 Common palm civet, Small Indian civet, Jackal – Malappuram, Kerala  
No.4,5 &6 Brown palm civet, Leopard, Ruddy mongoose – Someshwara, Karnataka  
No. 7 & 8 Sloth bear, Grey mongoose – Sharavathi WLS, Karnataka



No. 9 Porcupine – Sharavathi WLS, Karnataka

No. 10, 11&12 Stripe-necked mongoose, Spotted deer, Tiger – Biligiri Rangan WLS

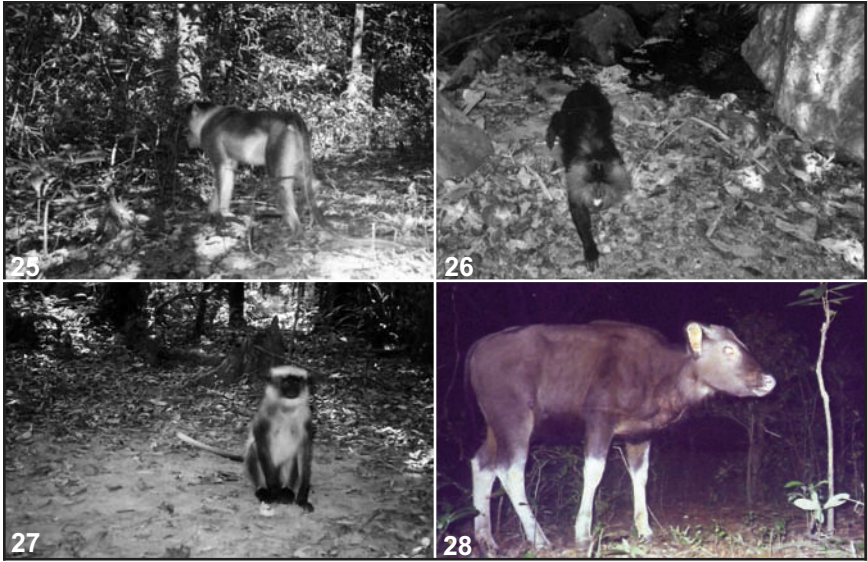
No. 13,14 & 15 Leopard cat, Small-clawed otter, Pangolin – Someshwara WLS

No. 16 Hill shrew – Periya, Wayanad, Kerala



No. 17&18 Sambar deer, Black-napped hare – Periya, Wayanad, Kerala  
No. 19,20&21 Lesser bandicoot, Jungle cat, Wild boar – Elayur, Kannavam, Kerala  
No. 22,23&24 Mouse deer, Barking deer, Field mouse –Someshwara WLS,Karnataka





No. 25,26,27, Bonnet macaque, Lion-tailed macaque, Common langur –  
Someshwara WLS

No. 28 Gaur sub-adult – Someshwara WLS

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Considered among the rarest of Indian mammals, the mysterious Malabar civet (*Viverra civettina*) has proven a challenging subject to conservationists attempting to study its status and distribution in the Western Ghats. With no photographs of live individuals ever recorded, very few among even the local community are aware of its existence.

This report is an outcome of a two-year long conservation survey - funded by the Ministry of Environment and Forests, Government of India and implemented by the Wildlife Trust of India (WTI) - conducted to establish the presence of this elusive viverrid in lowland Western Ghats in the south Indian states of Kerala and Karnataka.



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