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Sighting of Lesser false vampire bat (*Megaderma spasma*) from Central Gujarat, India
Ranjitsinh Devkar¹ and Kartik Upadhyay²

Abstract
Lesser False Vampire Bat (*Megaderma spasma*) has been reported from various locations in Indian subcontinent. In India, there are reports on its distribution from eastern, central and southern states. This report comprises of observations made on *M. spasma* roost located on the edge of Ratanmahal Wildlife Sanctuary, Gujarat. This roost comprised of 12 bats residing on the underside of a tall community water tank. Presence of wings of grasshoppers and partially eaten remains of unidentified insects strewned on the floor provided some evidence on diet preferences. This roost is currently being monitored on a seasonal basis.

Introduction
Chiropeterans form one of the largest congregations and comprise of 25% of the total existing mammalian species (Mickleburgh et al., 2002), yet they remain elusive due to their nocturnal behaviour and secretive lifestyle (Devkar et al. 2013). The forested areas of Central Gujarat (western India) comprises of dry deciduous habitats interspersed with agricultural fields and semi-arid landscapes (Mistry 1997; Devkar et al. 2011). Lesser false vampire bats (*Megaderma spasma*, Linnaeus, 1758) are widely distributed in south Asian region from Philippines to Brunei Darussalam stretching across Indonesia, Malaysia, Myanmar, Cambodia, Singapore, Sri Lanka, Bangladesh and India (Csorba et al. 2011). In India, its distribution has been reported from Andaman & Nicobar Islands, Andhra Pradesh, Assam, Goa, Karnataka, Kerala, Maharashtra, Meghalaya, Mizoram, Tamil Nadu, West Bengal (Molur et al. 2002) and Odisha (Debata et al. 2013).

Apart from an isolated report of Alam (2010) on sighting of *M. spasma* from Gir National Park and Sanctuary, there are no reports on its distribution in Gujarat.

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Study area and Methodology
A roost of Lesser false vampire bat (*Megaderma spasma*) was accidentally sighted during one of the routine bat awareness programmes in rural area of Central Gujarat on 3.11.2014 at 1030hrs. This roost was located at the base of a community water tank in Kanjeta village (22.576320 lat, 74.118522 long), Dist. Dahod, near Ratanmahal Wildlife Sanctuary, Gujarat. The water tank was located outside the Sanctuary limits and hence could be accessed frequently. Initial efforts to capture a single specimen with a hoop net failed due to the height of water tank and inaccessible location of the roost. Also, the bats would frequently change their location when disturbed making the task difficult. However, clear photographs and reference book (Bates and Harrison 1997) helped in confirming their identity as *Megaderma spasma*. Also, photographs were sent to Prof. G. Marimuthu at Madurai Kamraj University and further confirmation on its identity as *Megaderma spasma* was obtained.

Observations
*Megaderma spasma* belongs to the family Megadermatidae and looks distinctly different than other families of microchiropterans. Their body is covered with pale grey to grayish brown fur. Nose-leaf has a long dorsal lobe with stiffened central ridge and broad convex flaps on the sides. However, the overall body size and length of nose ridge is smaller than the Greater Indian False Vampire bat (*Megaderma lyra lyra*) (Menon 2014). Presence of very large and separated ear lobes in *M. spasma* makes it distinctly different from *M. lyra lyra* that has fused ear lobes. *M. spasma* are known to be insectivorous and predaceous on small bats and other small sized vertebrates. However, grasshoppers are their favoured diet in specific seasons (Menon 2014). In agreement with the published reports, our observations revealed presence of wings of grasshoppers and partially eaten remains of unidentified insects strewed on the floor. *M. spasma* are known to roost in small groups of 3 to 30. In our study, 12 bats were found roosting at this location. Preferred roost types include old buildings, temples, thatched huts, tiled roofs, hollow tree bark and mines (Molur et al. 2002). However, underside of tall water tanks can be considered as a possible addition to the roost preference of *M. spasma*. Right now, this roost is being monitored on a seasonal basis to assess population dynamics and food preferences of *M. spasma*.

Scientific information on factors influencing community structure of bats in fragmented habitats of western India is limited and hence, reports on their presence or absence from a particular geographical area is indeed valued.

Acknowledgements:
Financial assistance from Rufford’s Small Grants Foundation, U.K. and permission from the Gujarat State Biodiversity Board is specially acknowledged. Also, thanks to village Sarpanch Jaydipsinh Puvar and locals of village Kanjeta for valuable inputs. Help rendered by RSGF volunteers Rahul Bhatt and Mittal Patel is duly acknowledged.

References


First camera trap records of Indian Crested Porcupine, *Hystrix indica*
Kerr, 1792 from Papikonda National Park, Andhra Pradesh

Vikram Aditya¹ and T. Ganesh²

Abstract

The Indian Crested Porcupine *Hystrix indica* is a large rodent ranging across most of India and West Asia (Menon 2003, Alkon and Saltz 1988). No studies have been done on its presence and distribution in the Eastern Ghats. The present note is to report the first camera trap records of the occurrence of the *Hystrix indica* from the Papikonda National Park, in the northern Eastern Ghats of Andhra Pradesh.

Introduction

The genus *Hystrix* includes eight species of nocturnal, medium sized rodents equipped with quills, belonging to the Mammalian order Rodentia, ranging across Asia and Africa (Alkon and Saltz 1985, Alkon and Saltz 1988, Corbet 1978). The Indian Crested Porcupine *Hystrix indica* Kerr, 1792 is the only member of its genus found in India, and occurs widely throughout most of the country (Menon 2004, Johnsingh 2013). *H. indica* is classified as Least Concern by the IUCN with a stable population trend, although habitat loss could be potentially affecting their population. There have been few studies on their presence, distribution or ecology in the Eastern Ghats, and none in the northern Eastern Ghats (Srinivasulu and Nagulu 2002). The current note records the occurrence of *H. indica* through the first camera trap images in Papikonda National Park (NP), located in the northern Eastern Ghats in Andhra Pradesh.

Study area

Papikonda NP, located between 18°29'31"N - 19°10'53" N Latitude and 79°32' 28" - 83°14'0" E Longitude, is spread over 1,012 km² in the northern Eastern Ghats of Andhra Pradesh and straddles the Godavari River. The altitude varies from 20 m on the banks of the Godavari to 850 m. The dominant forest type here is moist deciduous, with some patches of semi-evergreen and dry deciduous forests (Champion and Seth 1968). Important forest flora include *Terminalia arjuna*, *Anogeissus latifolia*, *Tectona grandis* and *Artocarpus* spp (Champion and Seth 1968, Andhra Pradesh State of Forests Report 2013). Papikonda was first declared as a Wildlife Sanctuary in 1978 with an area covering 590.68 km² and was later upgraded as a National Park covering a total area of 1,012 km². No studies on mammals have been undertaken in Papikonda previously.

Methods

A camera trapping study is being undertaken currently by the authors to study the effects of landscape change on mammal diversity and distribution patterns across Papikonda NP. Trail Cam 8 mp Digital Infra Red camera traps were used. Systematic sampling was carried out in different elevation zones and habitat types across the Park. Five cameras were installed in selected grids, each measuring 2x2 km² for a period of 3 trap nights per camera. A total of 35 grids were surveyed between October 2014 and March 2015.

Results

The study recorded occurrence of Indian Crested Porcupines through camera trap images. The details of the camera trap photographs are provided in Table 1. The species was recorded in three different locations.

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sites on 3 camera traps. The first record was in dense moist deciduous forest at an elevation around 270 msl, close to a rocky stream with water. The second and third were recorded in low elevation moist deciduous forest at an altitude of 50 m, about 5 km south of the Godavari River. The presence of *H. indica* in moist deciduous forest indicates their preference for this habitat. Further research into their distribution in Papikonda NP and the larger northern Eastern Ghats landscape could help reveal more information about their habitat selection and ecology in this region.

### References:


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**Srinivasulu, C and V. Nagulu (2002).** Mammalian and Avian diversity of the Nallamala hills, Andhra Pradesh. *Zoos’ Print Journal* 17(1):675-684

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Table 1: Details of recorded presence of Indian Crested Porcupine *Hystrix indica* through camera trap images in Papikonda National Park

<table>
<thead>
<tr>
<th>S. No</th>
<th>Location</th>
<th>Date of observation</th>
<th>Time of observation</th>
<th>Number observed</th>
<th>Coordinates</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Near Koyyalagudem, Rampachodavaram range, Papikonda NP</td>
<td>19/01/2015</td>
<td>22:06:08 to 22:07:31</td>
<td>2</td>
<td>17°29'55.53&quot; N and 81°34'32.84&quot; E</td>
</tr>
<tr>
<td>2.</td>
<td>Rachamadugu, Kukunur Range, Papikonda NP</td>
<td>19/02/2015</td>
<td>21:02:24 to 21:02:32</td>
<td>1</td>
<td>17°24'32.03&quot; N and 81° 19'9.51&quot; E</td>
</tr>
</tbody>
</table>

**Indian Crested Porcupine *Hystrix indica* in location 3**
A first record of Albinism in Tomb Bat *Taphozous* sp. (Chiroptera: Emballonuridae) from India

Dhanya, V¹, Anil Mahabal² and Sanjay Thakur³

Albinism is a rare phenomenon in bats (Order:Chiroptera) and it occurs either partially or completely (Setzer 1950, Uieda 2000, and Hsu 2003). Within Chiroptera, the largest known albino cases were recorded in the family Vespertilionidae (Uieda 2000). There are number of records on albinism in various other species of bats throughout the world (e.g. Allen 1939, Setzer 1950, Herried and Davis 1960, Kahrau 1972, Khajuria 1973 and 1984, Howell 1980, Smith 1982, Karim 1983, Bhati 1988, Uieda 2000, Hsu 1997 and 2003, Aul and Marimuthu 2006, Devkar et al 2011).

During a visit to Red Fort, Delhi (28°39’22.80”N; 77°14’29.61”E), on 20th October 2010 the first author noticed a colony of bats in a narrow groove/crevice between stony walls of the fort. While photographing colony, a completely white bodied albino individual was noticed. Its eyes were reddish with tinge of orange; mouth, ears and fore arm were of orange to red in colour (Fig 1). The normal and albino bats from the colony were identified on the basis of photograph and all those essential visible characters appears to be of Tomb Bat or Sheath-Tailed Bat *Taphozous* sp. (Family: Emballonuridae). As the other essential characters to diagnose the species were not visible in the photograph thus the specific identity was not possible.

A perusal of pertinent literature revealed that in India, instances of albinism have been reported only in six species of bats viz. Fulvous Fruit Bat *Rousettus leschenaultii* (Family: Pteropodidae) by Karim (1983); Lesser Rat-tailed Bat *Rhinopoma h. hardwickei* by Khajuria (1973); Greater Rat-tailed Bat *Rhinopoma microphyllum kinneari* by Bhati (1988) and Devkar et al (2011), Leaf-nosed Bat *Hipposideros* sp. by Khajuria (1973), Indian Leaf-nosed Bat *H. lankadiva unitus* Khajuria (1984) and Diden Leaf-nosed Bat *H. diadema nicobarensis* Aul and Marimuthu 2006.

Therefore, the present sighting could be the first record of albinism in Tomb Bat *Taphozous* sp. and in the family Emballonuridae from India.

**Acknowledgements**

The authors are thankful to Dr. S.S. Talmale, Scientist, Zoological Survey of India, Jabalpur, Madhya Pradesh for kindly identifying the bat. We are also grateful to Dr R.M Sharma, Retired Scientist, Zoological Survey of India, Pune for critical reading of the manuscript.

**References**


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Continued on Page 9 ...
Study on Rodent Diversity (Mammalia:Rodentia) in and around Navegaon National Park, Gondia District of Maharashtra, India
G.T. Paliwal¹ and S.V. Bhandarkar²

Abstract
This report is based on investigation undertaken to study the rodent diversity of Navegaon National Park, district Gondia, Maharashtra state; conducted from January 2010 to December 2011. The study reports 14 rodent species under 10 genera of 3 families from the study area. The standard size live traps were used for trapping of the rodents, whereas arboreal rodents were observed with the help of binoculars.

Introduction: Rodentia is a largest order of mammals comprising 2277 species in 481 genera under 33 families (Wilson and Reeder 2005). Rodents include squirrels, rats, mice, voles, gerbils, hamsters, dormices, porcupines etc. They are all mainly herbivores and their modes of feeding habits include gnawing, scraping or nibbling. Rodents are economically important as some of them are serious pests destroying crops, fruit gardens, orchards, stored food grains. Moreover they cause damage to the properties of various kinds resulting in huge economic losses. Some of them are carriers of serious diseases like plague, leptospirosis, murine typhus, etc. They have high breeding rate and many show periodic increase in the population commencing with the availability of food.

Rodents are important link in food chain between plants and the carnivorous predators hence it plays an important role in ecosystems. One of the important things is that rodent species always prefer a specific habitat throughout its life than using the complex environmental measures that define a particular habitat. Hence, certain rodents can be used as indicator monitoring the distribution as well as the density to indicate the health of biotic system (William and Lidickes, 1989). The earliest consolidated accounts on Indian rodents are available from the works of Blyth (1863), Jerdon (1867), Sterndale (1884) and Blanford (1888, 1891); which were further enhanced by the mammalian survey of India, Myanmar and Ceylon through the collections during first quarter of 20th-century, organized by Bombay Natural History Society (BNHS). Later some of these reports were summarized in the form of key for identification & distribution by Wroughton (1918-1920). Out of 33 families of rodents found in the world, seven families namely Sciuridae, Dipodidae, Platacanthomyidae, Spalacidae, Cricetidae, Muridae and Hystricidae occur in India. Family Muridae is the largest family represented in India by 21 genera and 56 species followed by family Suiuridae having 13 genera and 27 species (Pradhan & Talmale, 2011). Navegaon National Park because of its habitat richness supports diversified fauna. Perusal of literature shows no consolidated account published on rodents is known from this study area. The present investigation reports 14 species under 10 genera of 03 families (Table 1).

Material and Methods
Study Area
Navegaon National park is one of the well known nature reserve in Vidarba, situated in Gondia district of eastern Maharashtra. It lies between 20 45’ to 20 2’ N and 80 5’ to 80 15’ E. The study area is located in Gondia wildlife division and surrounded by small villages. Villagers graze their cattle on the available grassland and forest area.

Methodology
Field surveys were carried out in the fringe areas of Navegaon national park to trap rodents. The presences of squirrels were ascertained by direct sightings, by hearing calls. To trap rodent other than arboreal, live traps were being used in different

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places. Small sized balls were made by mixing variety of grains with home-made peanut butter; which were placed inside the trap as bait for the rodents. Traps were placed before dusk and checked the next day morning. The arboreal species of rodents were observed with the help of binocular and noticed its diagnostic characters to come to the conclusion about its genus and species with the help of Menon (2003). After checking the traps animals were identified with the help of keys provided by Ellerman (1961), Prater (1971) and Agrawal (2000).

Results and Discussion
A few rodent species were observed with the help of binocular are Indian giant squirrel (*Ratufa indica*), Giant flying squirrel (*Petaurista philippensis*), Indian three striped palm squirrel (*Funambulus palmarum*), and Indian five striped squirrel (*Funambulus pennantii*). Among these Indian three striped palm squirrel was the most common species overall, irrespective of the density of trees, rest three species were observed in forest area only. Indian giant squirrel (*Ratufa indica*) is recently declared as state mammal of Maharashtra state. According to Indian Wildlife (Protection) Act 1972 it is categorized under Schedule-II. The extent of arboreality, preference of diet and nesting play an important role in abundance of squirrel and vulnerable to disturbance or modification of habitat due to different activities (Datta and Goyal, 2008). House mouse (*Mus musculus*) was found both in and outside of houses, garden and fields in vegetable garden. Little field mouse (*Mus booduga*) is found commonly in the places of fruit plants near the residence. *Rattus rattus* was found in human residential premises and storage, also found damage

![Fig. 2. Satellite view of Navegaon National Park](image)

Table 1. Systematic list of rodent species reported from Navegaon National Park.

<table>
<thead>
<tr>
<th>Sl.No</th>
<th>Species</th>
<th>Common Name</th>
<th>Local Name</th>
<th>Status in the Park</th>
<th>IWPA Status</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Ratufa indica centralis (Riley)</td>
<td>Indian Giant Squirrel</td>
<td>Shekru</td>
<td>R</td>
<td>Sch: II</td>
</tr>
<tr>
<td>2</td>
<td>Funambulus palmarum robertsoni (Wroughton)</td>
<td>Indian Three Striped Palm Squirrel</td>
<td>Patteri Khar</td>
<td>C</td>
<td>Sch: IV</td>
</tr>
<tr>
<td>3</td>
<td>Funambulus pennantii (Wroughton)</td>
<td>Indian Five Striped Squirrel</td>
<td>Parreri Khar</td>
<td>C</td>
<td>Sch: IV</td>
</tr>
<tr>
<td>4</td>
<td>Petaurista p. philippensis (Elliott)</td>
<td>Giant Flying Squirrel</td>
<td>Udanari Khar</td>
<td>R</td>
<td>Sch: III</td>
</tr>
<tr>
<td>5</td>
<td>Mus musculus castaneus (Waterhouse)</td>
<td>House Mouse</td>
<td>Undir</td>
<td>C</td>
<td>Sch: V</td>
</tr>
<tr>
<td>6</td>
<td>Mus b. booduga (Gray)</td>
<td>Little Field Mouse</td>
<td>Shetatil Undir</td>
<td>C</td>
<td>Sch: V</td>
</tr>
<tr>
<td>7</td>
<td>Mus philipsi (Wroughton)</td>
<td>Small Spiny Mouse</td>
<td>Undir</td>
<td>U</td>
<td>Sch: V</td>
</tr>
<tr>
<td>8</td>
<td>Rattus r. rufescens (Gray)</td>
<td>House Rat</td>
<td>Undir</td>
<td>C</td>
<td>Sch: V</td>
</tr>
<tr>
<td>9</td>
<td>Cremnomys blanfordi (Thomas)</td>
<td>Branford’s White Tailed Mouse</td>
<td>Undir</td>
<td>U</td>
<td>Sch: V</td>
</tr>
<tr>
<td>10</td>
<td>Golunda e. ellioti (Gray)</td>
<td>Indian Bush Rat</td>
<td>Undir</td>
<td>U</td>
<td>Sch: V</td>
</tr>
<tr>
<td>11</td>
<td>Bandicota b. bengalensis (Gray)</td>
<td>Lesser Bandicot</td>
<td>Ghus</td>
<td>C</td>
<td>Sch: V</td>
</tr>
<tr>
<td>12</td>
<td>Bandicota indica indica (Bechstein)</td>
<td>Greater Bandicot</td>
<td>Ghus</td>
<td>C</td>
<td>Sch: V</td>
</tr>
<tr>
<td>13</td>
<td>Tetra indica indica (Hardwicke)</td>
<td>Indian Antelope Rat</td>
<td>Gondedar Shepticha Undir</td>
<td>C</td>
<td>Sch: V</td>
</tr>
<tr>
<td>14</td>
<td>Hystrix indica (Kerr)</td>
<td>Indian Porcupine</td>
<td>Salinder</td>
<td>U</td>
<td>Sch: IV</td>
</tr>
</tbody>
</table>

Table 1. Systematic list of rodent species reported from Navegaon National Park.
storage on roof of residence. Lesser bandicot (Bandicota bengalensis) and greater bandicot (Bandicota indica) were found to the most abundant in rice as well as sugar cane fields. Bandicota bengalensis, Bandicota indica, Rattus rattus, Mus musculus, Mus booduga, are considered as pest in the area by locals and so they use to kill them whenever they look.

Acknowledgement
Authors are grateful to Dr. W.R. Bhandarkar, Ex Director of Centre for higher learning and Research in Zoology, Bramhapuri and officials of Navegaon National park for their valuable guidance and great support during study.

References


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New Roosting Locality of Indian Flying Fox (Pteropus giganteus) in Melselvanur-Keelselvanur Bird Sanctuary, Ramnathapuram District, Southern India
K. Narasimmarajan

Melselvanur-Keelselvanur is a famous location for the migratory birds situated in the Kadaladi Taluk (9° 13´N and 78° 32´E) of the Ramnathapuram District, Tamil Nadu. This place is being used for nesting for more than 100 years largely Pelicans (Pelecanus philippensis) and Painted Stork (Mycteria leucocephala). However many ground nesting birds like Yellow-wattled Lapwing (Vanellus malabaricus) are also found in this Bird Sanctuary. It is the centre point of this district and is one of the most important tourism destinations in the district [1].

On 07th December 2013, we conducted avifaunal survey in the melselvanur-Keelselvanur Bird Sanctuary (Fig.). During the survey, we came across few colonies of flying fox roosting in two Acacia nilotica trees. Populations of about 280 foxes were roosting in those trees (Table 1). The Indian flying Fox is listed as Least Concern (LC) in the IUCN Red List (IUCN 2014). Local forest officials said that this is the first time we observed the roosting site of flying fox in the Bird Sanctuary. Present observation clearly stated that the Acacia nilotica not only home to the migratory birds as well as the charismatic flying mammals. The Bird Sanctuary properly maintained by forest department, cattle grazing and fire wood collection is strictly prohibited within the sanctuary. Many villages found nearby Bird Sanctuary within the radius of 5km and banana (Musa acuminata) is partially cultivated by local people which may attract the foxes to roost in the sanctuary. Indigenous tribes are not found in this area and the local people are not harming to

Table: 1. Roost tree details of Indian Flying Fox recorded in Melselvanur-Keelselvanur Bird Sanctuary on 7th December 2013.

<table>
<thead>
<tr>
<th>Tree height in Meters</th>
<th>No. of trees</th>
<th>No. of roosting bats</th>
</tr>
</thead>
<tbody>
<tr>
<td>8-10</td>
<td>1</td>
<td>130</td>
</tr>
<tr>
<td>10-12</td>
<td>1</td>
<td>140</td>
</tr>
</tbody>
</table>

Fig. The Indian flying fox roosting in Acacia nilotica tree

Care Earth Trust, No. 3, 6th Street, Thillai Ganga Nagar, Nanganallur, Chennai. Department of Zoology, Madras Christian College, Chennai. Email: wildlife9protect@gmail.com
the roosting and/or bird nesting sites. In this area they could eat leaves and fruit of *Ficus bengalensis* and *Mangifera indica*, *Psidium guajava*, *Syzygium cumini*, nectar and flower of *Bombax* sp. They have also been known to feed on cultivated fruits such as *Mangifera indica* and *Musa acuminata*. Locally Flying Fox are important for seed dispersal (Shihan 2014). This new site record revealed that the Bird Sanctuary is now new home to this gregarious mammal.

**References**


Indians Flying Fox, *Pteropus giganteus* is one of the most common bat species in Bangladesh. This bat is the largest among all bat species found in the country which is the most visible chiropteran. During the day, they live in colony and roost on large trees that are usually located in abandoned place or such a place where human activities are relatively low. Although this bat species are still common in the country; however, many of the colonies are increasingly becoming homeless due to loss of their roosting sites, the relatively tall trees which are either being cut down to feed human demand or tree-holding land going to agricultural practice. As a result, their population continues to decline that has also been shown in the IUCN Red List.

This small note is meant to present a story of small colony of this bat that has spread over four large trees within a human dominated landscape during six year time period. I have been observing this colony (Fig. 1 & 2) almost every year since 2009, which is located in a forest-dependent village named Joymonir Ghol (N 22.366586°, E 89.638711°) adjacent to the Sundarbans northeast boundary. This year I visited the colony on 7 March 2015. In April 2009, the total number of estimated individual bats was 278 in one single Keora tree (*Sonneratia apetala*). This year the estimate has increased to 576 that live in three Keora trees and one Simul tree (*Bombax* sp.) spreading over about hundred yards. Villagers seem to be friendly to the colonies even though the bats make some inconvenience to them by excretion and commotion.
The impressively diverse bat fauna of the northeast India comprises about 65 species (Sinha, 1999; Bates and Harrison, 1997; Ruedi et al. 2012b) which is well over 50% of the 123 bat species known from India (Talmale and Pradhan, 2009; Ruedi et al., 2012a; Sanecha and Dookia, 2013). Among these species, about 29 species are reported from the political boundary of Assam (Sinha, 1999; Bates and Harrison, 1997, Boro et al. 2013). This apparently lower species diversity is partially because of fact that bat fauna of the state has not been explored satisfactorily. Except for Sinha (1999) who provided a consolidated account of the bats of entire north-east India and the work of Bates and Harrison (1997) for the Indian subcontinent, there is no published account on the bat diversity of Assam state. During the course of field work in Baksa district of Assam, the authors could collect several bat species a few of which have not been previously documented from the state. In this communication, *Myotis horsfieldii* is reported from Barangabari area adjacent to Manas National Park in Assam which is an addition to the bat fauna of the state. It may be mentioned that the present collection locality being juxtaposed to Manas National Park, it is highly probable that this species is present inside the Protected Area too. Borah et al., (2014) has documented nine species of bats inside the park area.

The Horsfield’s Myotis is distributed in South and Southeast Asia and southern China. In India, this species is recorded from Andaman and Nicobar Islands, Goa, Karnataka, Kerala, Madhya Pradesh,
wings to the hind feet is outer tail. The attachment point of the membrane especially along the scattered hairs are present on the hair on the dorsal surface, but membrane are dark and without roots (Fig 1). The other specimen fur is greyish with darker hair dark brown dorsum. The ventral specimen V/M/ERS/318 has deciduous forest. Specimens locality is surrounded by culvert joints. The collection reveal small roosting packs of 4-5 examination inside the culvert small watercourse. Close out of a concrete culvert over a were caught in a net while coming Two adult specimens (both males) than previously thought. This ascertained because the specimen ascertainment of bat species count of Assam stands at 30 species. It is worth mentioning that during our field surveys, we encountered an individual of a Tylonycteris bat (species identity was not ascertained because the specimen could not be retained). This genus is hitherto unknown from the state. In view of the serious lack of documentation of bat diversity of Assam, it is imperative the bat inventory of the state will go up significantly with intensive surveys.

Acknowledgement
Uttam Saikia is grateful to the Director, Zoological Survey of India for institutional support. He also expresses his gratitude to Dr. Gabor Csorba of Hungarian Natural History Museum and Dr. Manuel Ruedi of Natural History Museum of Geneva for confirming the identity of the specimens.

References

Table 1. External and cranial measurements of two specimens

<table>
<thead>
<tr>
<th></th>
<th>V/M/ERS/318</th>
<th>V/M/ERS/319</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>External</strong></td>
<td>FA-35.83, E-13.8, Tr-5.7, HF-8.9, Tb-16.9</td>
<td>FA-34.73, E-13.9, Tr-5.2, HF-8, Tb-17.1</td>
</tr>
<tr>
<td></td>
<td>5mt-33.4,4mt-34.91, 3mt-36.23.</td>
<td>5mt-33.17,4mt-34.91, 3mt-35.</td>
</tr>
<tr>
<td><strong>Cranial</strong></td>
<td>GTL-14.87, CBL-13.49, CCL-12.83mm, BB-7.15, PC-3.7, CM-3-5.4, CM-5.58, M-10.95, M-3-M-6.08, C-1-4.07mm</td>
<td>GTL-14.73, CBL-14, CCL-13.18mm, BB-7.21, PC-4, CM-3-5.37, CM-5.45, M-10.7, M-3-M-6.1, C-1-4.08mm</td>
</tr>
</tbody>
</table>

Maharashtra and Tamil Nadu (Bates and Harrison, 1997; Rosell-Ambal et al., 2008). Based on an immature specimen collected by H.W.Wells in 1920 from Jaintia Hills in Meghalaya, Das et al. (1995) reported this species from Meghalaya. To the best of our knowledge, the present record of this species also constitutes the second report of this species from the Northeastern India indicating that the species is more widely distributed in India than previously thought.

Two adult specimens (both males) were caught in a net while coming out of a concrete culvert over a small watercourse. Close examination inside the culvert reveal small roosting packs of 4-5 individuals inside the crevices of culvert joints. The collection locality is surrounded by deciduous forest. Specimens were deposited in Zoological Survey of India, Shillong.

The specimen V/M/ERS/318 has dark brown dorsum. The ventral fur is greyish with darker hair roots (Fig 1). The other specimen V/M/ERS/319 has a slightly paler dorsal colour. Wing and tail membrane are dark and without hair on the dorsal surface, but scattered hairs are present on the ventral surface of the tail membrane especially along the tail. The attachment point of the wings to the hind feet is outer metatarsal, a characteristic of this species (Fig 2). The external and cranial measurements of the specimens are given in the Table 1. (in mm)

With this addition, the current bat species count of Assam stands at 30 species. It is worth mentioning that during our field surveys, we encountered an individual of a Tylonycteris bat (species identity was not ascertained because the specimen could not be retained). This genus is hitherto unknown from the state. In view of the serious lack of documentation of bat diversity of Assam, it is imperative the bat inventory of the state will go up significantly with intensive surveys.

Acknowledgement
Uttam Saikia is grateful to the Director, Zoological Survey of India for institutional support. He also expresses his gratitude to Dr. Gabor Csorba of Hungarian Natural History Museum and Dr. Manuel Ruedi of Natural History Museum of Geneva for confirming the identity of the specimens.

References
Bats of Delhi
Rajlakshmi Mishra¹ and Sumit Dookia²

Delhi takes pride in positioning itself among one of the greenest capitals of the world. It has the distinction of being one of the few metros in the world that possesses a designated city forest. A home to more than 150 million people, at the same time also one of the most inhabited region since 3000 years and unfortunately has been gradually losing its green cover to the ever expanding urban sprawl. The green cover that is left in Delhi is on its ridge spread over an area of 7,777 hectares. The historic Moghul gardens, recently developed urban parks, farmlands, orchards, blocks of natural forests along river Yamuna, restored urban biodiversity parks, avenue plantations and Asola Bhatti Wildlife Sanctuary add further green.

The green cover in Delhi is home to a wide range of flora and fauna. A large number of resident birds make it their breeding ground. Whereas birds may be attributed with being the diurnal wings of Delhi, the capital also has huge populations of bats, a small group of mammals from the order chiroptera forming its nocturnal wings. Present checklist reports valid Indian chiropteran taxa upto subspecies level which includes 119 species and 100 subspecies under 39 genera belonging to 8 families (Simmons, 2005). As increasing development and urbanization is harming much of our indigenous wildlife and their movement, in surprising ways bats are able to adapt right along with us and few species opportunistically use our urban environments as new roosting habitats (Marimuthu et al. 1998), seeking new benefits and resources in our modern world. This is especially encouraging in the face of the serious threats that bats in the National Capital Region are facing — habitat loss and human disturbance being the most prominent.

Bats and their habitat matrix in Delhi
Bats forage readily in urban environments, taking advantage of clusters of insects drawn to streetlights and seeking untapped sources of food amongst urban parks and green roofs. Not only do bats forage in urban environments, but they are able to roost in them, too. So much so, that quite surprisingly a large

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Table 1: The updated list of species of bats found in Delhi: (Source: Srinivasulu and Srinivasulu, 2007)

<table>
<thead>
<tr>
<th>S. No.</th>
<th>Species</th>
<th>Family</th>
<th>Place of occurrence</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Rousettus leschenaulti</td>
<td>Pteropodidae</td>
<td>Wazirabad</td>
</tr>
<tr>
<td>2.</td>
<td>Pteropus giganteus</td>
<td>Pteropodidae</td>
<td>All over Delhi</td>
</tr>
<tr>
<td>3.</td>
<td>Cynopterus sphinx</td>
<td>Pteropodidae</td>
<td>Wazirabad</td>
</tr>
<tr>
<td>4.</td>
<td>Rhinopoma microphyllum</td>
<td>Rhinopomatidae</td>
<td>New Delhi</td>
</tr>
<tr>
<td>5.</td>
<td>Rhinopoma hardwickii</td>
<td>Rhinopomatidae</td>
<td>Qutab Minar Complex</td>
</tr>
<tr>
<td>6.</td>
<td>Taphozous melanopogon</td>
<td>Emballonuridae</td>
<td>Qutab Minar Complex</td>
</tr>
<tr>
<td>7.</td>
<td>Taphozous nudiventris</td>
<td>Emballonuridae</td>
<td>New Delhi</td>
</tr>
<tr>
<td>8.</td>
<td>Megaderma lyra</td>
<td>Megadermatidae</td>
<td>Humayun’s Tomb</td>
</tr>
<tr>
<td>9.</td>
<td>Rhinolophus lepidus</td>
<td>Rhinolophidae</td>
<td>Aravalli biodiversity Park</td>
</tr>
<tr>
<td>10.</td>
<td>Scotophilus heathii</td>
<td>Vespertilionidae</td>
<td>Wazirabad</td>
</tr>
<tr>
<td>11.</td>
<td>Pipistrellus coromandra</td>
<td>Vespertilionidae</td>
<td>Wazirabad</td>
</tr>
<tr>
<td>12.</td>
<td>Pipistrellus tenuis</td>
<td>Vespertilionidae</td>
<td>Wazirabad</td>
</tr>
<tr>
<td>13.</td>
<td>Tadarida aegyptiaca</td>
<td>Molossidae</td>
<td>Wazirabad</td>
</tr>
</tbody>
</table>

A colony of both insectivorous and fruit bats were found (Table 1) in a dilapidated Mughal era mosque in Khirki extension in Delhi, right opposite to the sprawling shopping malls in Saket. Around 12 to 13 species of bats have been reported from the capital though a lack of studies on the topic may suggest that there may be more yet to be documented. There is a huge gap in research on bats in Delhi. In the post-British time Brosset, a scientist from Bombay Natural History Society, surveyed mammals from Central and Western India and included Chiropterans from Delhi (Brosset 1962 abc). Apart from a few mentions in reports of Zoological Survey of India (Sinha, 1999), a recent updated checklist of bats from Delhi was published in 2010 (Srinivasulu and Srinivasulu, 2010). More studies could lead to much more interesting findings.

Ecosystem services

Bats that eat insects, pollinate flowers and disperse seeds play various roles in proper ecological functioning and maintaining the balance of nature, but the impact of their feeding behaviour remains entirely or mostly unknown for most of the world’s bat species, greatly hampering conservation efforts. Bats provide a number of essential ecosystem services such as insect regulation, pollination and seed dispersal and evidences suggest that they may act as an indicator of general ecosystem health (Vanitharani and Jeyapraba, 2011). They are great pollinators and seed dispersers of bananas, figs, mangoes, cashews and agave. They play a very important role in pollination of certain species of plants, which have flowers with special morphological modifications which help in ‘chiropterophily’ or bat-induced pollination. Delhi has many species of bat pollinated trees like Crescentia spp., Haplophragma spp., Kigelia spp. and more. Their dung or guano makes for top quality nitrogenous plant fertilizer and is also harvested for the same purpose. Some of the enzymes present in their droppings called ‘guano’ are used in cleansing agents for laundry detergents.

Indian culture and bats

Unfortunately, inspite of providing so many indirect benefits to man, in India, many people perceive fruit bats as “pests” and often have outright fear of them due to misconceptions about their life history and myths about their behaviour as a result of mythological folklores going around. This often leads to disturbance, complete destruction and eradication from roosts, and in some cases persecution. Although, there are places in India which have a different story to tell, where fruit bats are considered sacred. In some parts of south India, it is believed that bat community is serving as forest guard protecting some sacred groves and also has the religious belief that the Goddess Kali would punish if anybody hurt or kill the bats in the grove (Tangavelou et al. 2013).

Bats and the ‘Ebola Scare’

It is thought that fruit bats of the family Pteropodidae are natural Ebola virus hosts according to World Health Organization (WHO, 2014), though the virus is transmitted only through direct contact with body fluids of the infected animal. In case of any epidemic, precautionary measures are to be taken only by the human race. Fruit-bats are largely consumed as bush-meat in huge areas of Africa, an epicentre of Ebola infection, which has severe chances of transmitting the virus to humans. So, to reduce the risk of wildlife to human transmission, consumption of meat should be avoided completely. Other than that, bats do not live in close proximity to humans as such and they come in contact only when humans themselves intend them to. On the other hand, a study shows that bats can carry more than 100 different viruses, including Ebola, without being sick themselves. This opens the intriguing possibility that scientists might develop a strategy derived from the immune system of bats to fight or cure Ebola.

Awareness and outreach

Public education about the benefits of bats to our functioning ecology will be crucial in change the
deep-rooted view of bats from "pests" to beneficial parts of our ecosystem and in conserving these threatened animals by allowing them to utilize our urban habitats. It is the need of the hour that people especially farmers be educated about the ecosystem benefits provided by bats. This might be most successful by increasing the number of studies that estimate their economic value by accounting both their biological and ecological characteristics. Studies on bats in Delhi will also be beneficial in bridging the existing gap in research on bats.

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A Note on Small Mammals of Chuadanga District, Bangladesh

Tahsinur Rahman Shihan

Chuadanga district is situated in western part of Bangladesh. It lies between 23°35′13.67″ N latitude and 88°49′56.59″ E longitudes (Shihan 2014). This area is covered by many types of crop field, homestead vegetation, scattered unclassified weeds and grasses which support some small mammal species for their food, resting, roosting and breeding place. However, small mammals of Chuadanga district were not properly documented, so this work is an attempt to document the small mammal species of this district. The small mammals were documented randomly by visual, opportunistic observations, setting traps during December 2012 to March 2015. Identification of species, taxonomy and nomenclature were confirmed with the help of literatures by Khan (2015), Feeroz (2013) and Khan (2008).

A total of eight species (Table 1) of small mammals belonging to seven families were recorded from Chuadanga district. During the study period I found mostly *Pteropus giganteus*, *Funambulus pennantii* and *Funambulus pennantii* sparsely distributed throughout the district and *Pteropus giganteus* roost found only in one place called Badurtola. Beside, *Herpestes edwardsii* were found near the crop field and human settlement, they were found preying on both domestic hens and ducks. On the other hand *Pipistrellus coromandra* was found in human settlement and old trees as their roosting site. In the fruit season some of them were caught and died in the *Litchi chinensis* garden where the protecting net is set for avoiding fruit damage. *Megaderma lyra* was recorded in the old building and shady part of trees. *Mus musculus* was found in houses. *Suncus murinus* was found beside the human settlement where garbage was dumped. It is also distributed randomly throughout Chuadanga. *Vandeleuria oleracea* was caught in houses locally at night when they come in search for food. Its main habitat was trees beside human settlement, crop field and fruit orchard.

However, overall condition of small mammals in Chuadanga district remain balanced though on going population growth, development of human settlement, reduction in agricultural field and excessive use of insecticides, pesticides, chemical fertilizer in agricultural field cause great threat to small mammals. Proper management of small mammals is recommended for the maintenance of ecological balance in this district.

**Fig 1. Pteropus giganteus roost at Badurtola**

**Fig 2. Herpestes edwardsii**

**Fig 3. Mus musculus**

**Acknowledgements**

The author is grateful to Professor Dr. M. Monirul H. Khan, Professor Dr. Mohammed Mostafa Feeroz, Mohammad Ali Reza Khan,
Table 1: List of small mammals of Chuadanga district

<table>
<thead>
<tr>
<th>SL</th>
<th>Scientific Name</th>
<th>Common Name</th>
<th>Family</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Funambulus pennantii Wroughton, 1905</td>
<td>Northern Palm Squirrel</td>
<td>Sciuridae</td>
</tr>
<tr>
<td>2</td>
<td>Herpestes edwardsii E. Geoffroy Saint-Hilaire, 1818</td>
<td>Indian Grey Mongoose</td>
<td>Herpestidae</td>
</tr>
<tr>
<td>3</td>
<td>Megaderma lyra E. Geoffroy, 1810</td>
<td>Greater False Vampire Bat</td>
<td>Megadermatidae</td>
</tr>
<tr>
<td>4</td>
<td>Mus musculus Linnaeus, 1758</td>
<td>House Mouse</td>
<td>Muridae</td>
</tr>
<tr>
<td>5</td>
<td>Pipistrellus coromandra Gray, 1838</td>
<td>Indian Pipistrelle</td>
<td>Vespertilionidae</td>
</tr>
<tr>
<td>6</td>
<td>Pteropus giganteus Brunnich, 1782</td>
<td>Indian Flying Fox</td>
<td>Pteropodidae</td>
</tr>
<tr>
<td>7</td>
<td>Suncus murinus Linnaeus, 1766</td>
<td>Asian House Shrew</td>
<td>Soricidae</td>
</tr>
<tr>
<td>8</td>
<td>Vandeleuria oleracea Bennett, 1832</td>
<td>Asiatic Long-tailed Climbing Mouse</td>
<td>Muridae</td>
</tr>
</tbody>
</table>

Dr. Kamrul Hasan, Mr. Md. Abdul Aziz, Rohit Chakravarty and Geetanjali Dhar for their support.

References


Photos by Tahsinur Rahman Shihan
Sighting of Asian Small-clawed Otter: A new small mammal record from Thrumshingla National Park
Jangchuk Gyeltshen¹ and Chhimi Dorji²

Thrumshingla National Park is one of the Protected Areas which is located at the heart of Bhutan’s Protected Areas network. It encompasses an area of 905km² with presence of different ecotypes found in the country. The park lies within an elevational range of 800msl in the south to 4500msl in the north. There is subtropical broadleaf forest to the south and alpine grassland to the north. The park is connected to Jigme Singye Wangchuck, Royal Manas, Bomdeling and Jigme Dorji National Park through a string of Biological Corridors (Map 1).

The rapid assessment on flora and fauna in the park was first initiated in 1999-2001. The record shows that there are 622 plant species, 68 species of mammals and 337 species of birds in the park (Doji, et al. (2007). Thereafter, no specific survey has been conducted on the mammals in the park. Due to the presence of prey species in the two major rivers passing through the park, the park is therefore potentially known to occur Otters but only one species of Otter (Common Otter Lutra lutra) was recorded during the survey in 1999-2001. The recent sighting of Oriental Small-Clawed Otter or Asian Small-Clawed Otter (Aonyx cinerea) is a new record in the area and for the park. The park now has two species of Otters; Common Otter (Lutra lutra) and Oriental Small-Clawed Otter (Aonyx cinerea).

The Oriental Small-Clawed Otter was sighted at a place called Thridangbee (Map 2), under Mongar Dzongkhag (GPS coordinates) dated 3rd May 2014 which is approximately 500m away from the Morichu river (Map 2). The sighting of the animal was possible because the villager reported through telephone to our Park Range office, Lingmethang at 3:30PM.

Immediately, we rushed to the site and saw the animal was kept inside the bamboo woven

¹² Central Park Range Office, Thrumshingla National Park, Department of Forest and Park Services, Ministry of Agriculture, Royal Government of Bhutan.
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container nearby a house in agricultural field. A photograph of the animal was taken to help us in identification. The Book of Indian Animals (Prater, 2005), A Field Guide Book to the Mammals of Bhutan (Wangchuk et al. 2004) and internet websites are referred for identifying the animals. Later, it was confirmed that the Otter is an Oriental Small-Clawed Otter *Aonyx cinerea* (Fig 2). It is said to be the smallest Otter in the world weighing less than 5kg and this animal is found in Bangladesh, Burma, India, Southern China, Taiwan, Malaysia,
Indonesia, Singapore, the Philippines, Thailand, and Vietnam (Map 3). The animal is evaluated as Vulnerable on the IUCN Red List of the threatened Species. In Bhutan, the conservation status of this animal is not yet known. Wangchuk et al. (2004) reported that this species can be best seen along the lower parts of Manas and Sankosh.

Its paws are a distinctive feature, its claws not extending beyond the fleshy end pads of its partially webbed fingers and toes. The literature says that this Otter is found in irrigated rice fields and wander between patches of reeds and river debris and spend most of the its time on land unlike most other Otters. After confirmation of the species, the animal was released back safely into the Morichu river (Fig 4).

We monitored the movement of this Otter on the next day but failed to see. Some local people reported us that they have sighted Small-Clawed Otter alongside the river where we have released this animal. Even now, our park staffs are conducting patrolling and monitoring to prevent falling victims in the hands of people or being attack by wild and domesticated animals.

References


New roosting site of Indian flying fox (*Pteropus giganteus*) located at Bilasipara, Dhubri, Assam
Azad Ali

The roosting site is located near to the Bilasipara College of Bilasipara town in the Dhubri district of Assam and observed on 20 Jan 2015. Dhubri district is situated at the western part the lower reach of the Brahmaputra valley of Assam. Geographically the Bilasipara area lies between 26.23° N and 90.23° E. Prior to this, another roosting site was recorded at the Ranjeet Nagar area of the town in the year 2000. But presently the roost has been lying vacant as trees were cut down by the house owner for further construction in the campus.

This site was one of the locations for my studies Ph.D. and the monthly population of the site was monitored for three consecutive years (March 2000-Feb-2003). Mean monthly population of the site was recorded at 476.89 individuals of *P. giganteus* (Ali, 2013). The roosting trees were *Trewia nudiflora* (Velkor), *Anitoccephalus cadamba* (Kadam), *Mangifera indica* (Mango), *Bambusa* sp. (Bamboo), *Terminalia arjuna* (Arjun) and *Alstonia scholaris* (Sotiona). Major roosting tree species were *A. cadamba* and *Bambusa* sp. In the present roosting site, entire population was found in a cultivated Sissoo plantation (*Dalbergia sissoo*). Total population of the site was recorded at 139 on the day of survey at around 12:30 pm. I assume that the current population in the new location may be one of the fragmented, truncated population groups from the earlier roosting site. Continued observation is recommended for final ecological conclusion on the population size of the site.

Reference
Ali, A. (2013). Indian Flying Fox of Assam. Scholars’ Press, Germany. 136pp

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Graduate Trainings for Bat Research Techniques in Nepal
Pushpa Raj Acharya*

Friends of Nature, a non-governmental organization conducted wildlife research training during 1 to 22 December, 2014. Twenty graduate students were selected from various educational institutes of Nepal. The training was carried out in two sessions-theoretical session at Kathmandu and field session at Korak village development committee (VDC) of Chitwan district. Majority of people in the VDC comprised of Chepang ethnic community. Chepang is an indigenous community who is still practicing nature friendly i.e. aboriginal life styles across hilly terrace of Nepal.

We found good population of mass flowering Chiuri plant (*Bassia butyracea*) during the period. *Bassia butyracea* is a plant with great ethnobotanical values across Himalayan region. The seeds of *B. butyracea* extracted to produce butter for human use. Pollination ecology of *B. butyracea* is yet to be studied but we found Chepang people practicing fruit bat hunting at flowering patches of *B. butyracea*. Bat baits were noticed in every accessible flowering trees of *B. butyracea* in the VDC. Medium sized fruit bats such as *Eonycteris spelaea, Rousettus leschenaulti* and *Cynopterus sphinx* are common herbivorous bats of Nepal. The practice of selling bat meat as Chepang’s food culture is being popular in recent years. The graduate interns were informed about flowering phenology of *B. butyracea* and possible role of bats as pollinator for further study. Friends of Nature later announced that bats and rodents research unit to expand their organizational focus on bat studies in coming programs.

Environmental Graduate Himalayas (EGH), graduate student’s wing of Resources Himalaya, conducted another wildlife training course during March 12-22. Ten students participated. Four days theoretical session was held in Kathmandu while six days field course was taken at Bardia National Park, western Nepal. I taught the technique of bat capturing and handling for measurement. Three mist nets were set for two nights, seven individuals of bats were captured. The species were identified as *Cynopterus sphinx* and *Pipistrellus* spp.

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Recent Publications: Abstracts

Feeding behaviour of the Dawn bat (*Eonycteris spelaea*) promotes cross pollination of economically important plants in Southeast Asia
Pushpa Raj Acharya¹, Paul A Racey², Sunthorn Sothibandhu³, Sara Bumrungsri¹

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Abstract

*Eonycteris spelaea* is recognized as the principal pollinator of most chiropterophilous plants in SE Asia. The present study describes its feeding behaviour and clarifies its role in cross pollinating these highly self-incompatible plants. Ten individuals of *E. spelaea* were radio-tracked during the flowering period of durian (*Durio zibethmus*) and petai (*Parkia speaosa*) in an agricultural mosaic in southern Thailand. *Eonycteris spelaea* makes a mean of seven visits per hour to these trees and 80-86% of each feeding bout involves visits to multiple conspecific trees. During each visit, 93% of *D. zibethmus* stigmas and 50% of *P. speaosa* stigmas were loaded with conspecific pollen. *Eonycteris spelaea* was the most common bat visitor to the trees. High visitation frequency and conspecific pollen deposition by *E. spelaea* to *D. zibethmus* and *P. speaosa* indicates that this nectarivorous bat is an effective pollinator. Mixed planting of chiropterophilous trees in fruit orchards is recommended to ensure regular visits of *E. spelaea*. Protecting natural roost caves of *E. spelaea* is also essential in order to maintain the vital ecosystem service provided by these bats.


Identification, Isolation and Characterization of Enterococcus species (Gen Bank Accession No: KF777815) from Fecal Contents of *Pteropus giganteus*

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Gulab Bagh in Udaipur city contains around 20,000-25000 macrochiropterans and is one of the largest colony of *Pteropus giganteus* in Asiatric region. Investigations regarding bacterial pathogens with potential for mutual transmission between bats and humans are sparse. Gastrointestinal flora plays an important role in the health status of the host. In the present study Enterococcus species (KF777815) was identified, isolated and characterized from fecal contents of *Pteropus giganteus* inhabiting Gulab Bagh. Enterococcus species has been reported to be responsible for a number of debilitating conditions in humans such as infections of the urinary tract and also nosocomial infections, which could be life threatening in nature. The presence of this microorganism in the gastrointestinal tract of *Pteropus giganteus* delineates a novel mode of its transmission, not discussed till date.

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Small Mammals Conservation Education programmes in Tamil Nadu
Brawin Kumar*

Small mammals are to be found everywhere and we frequently encounter them in our backyards and other forested areas. Apart from the small size they are magnificent, glamorous creatures on Earth. Like other animals, they are also under threat for various man-made reasons such as habitat loss and hunting. In order to make people aware of the importance of conserving them, a series of awareness programmes were conducted in the following places.

Sruthi Vidhyadaya School, Sivakasi
A half-day bat conservation programme was conducted on 9 February 2014. The objective of the program was to understand the role of bats in the ecosystem. They were told about bat diversity frugivoros and insectivorous bats, the important bat facts, threats etc., Zoo Outreach Organization’s bat education packets was used. The students went through the bat posters, stickers and placard and the materials very much impressed them. A video on bats was also shown.

Kurumbapatti Zoological Park, Salem
Two-day exhibition was conducted to create awareness on the mammals of Eastern Ghats from 5-6 October 2014 during wildlife week. Various small mammal pictures were displayed in the exhibition. Zoo visitors including students from both school and colleges, public, zookeepers and other employees of the zoo visited the expo. They were told about the forest ecosystem, role of mammals in the forest and small mammals in Shevaroy Hills. Especially the school students were very enthusiastic to learn about them.

Govt. Middle School, Vinayagampatti, Salem
A half-day awareness program was conducted on 7 October 2014 for 63 students. Ms. Girija, Headmistress started the programme with brief introduction on wildlife. Information on small mammals found in Shevaroy hills was presented with the help of colour pictures and posters. They were also told about the types, distribution, and ecological role of bats, rats, pangolins, mongoose and squirrels. Video on forests was shown and group discussion held on common bats and rats found in their areas. The students took a pledge to conserve the small mammals.

Naanalkulam, KMTR, Tirunelveli
An awareness program was conducted on 9 October 2014 for the village youths to understand the amazing mammal pangolin. The program started with "know each other", followed by they were

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informed the list of small mammals found in this area. Then Indian Pangolin (*Manis crassicaudata*) picture was showed to them and very few identified it and said the Tamil name of this animal ie ‘Alungu’. Then more species information was given such as why it is called anteater, the Asian and African species, their habitat, size, food, adaptation, lifespan, ecological role, eyesight, distribution and threats especially on trade. They were divided in to groups and assigned to discuss the importance of the species. After a while, the head of the group came forward and shared their group thoughts on importance of saving this species. Pangolin stickers, photos, placards and stickers were distributed. A short video on pangolins was showed.

**KTP Higher Secondary School, Kanyakumari**

A program was conducted on 24 October 2014 for the students of 7 and 8 classes. The program started with the introduction of biodiversity of Tamil Nadu, classification of mammals and ecological role of selected small mammals. A short puzzle game was conducted based on small mammals such as squirrels, mongoose, hedgehogs, bats and pangolins. By using Zoo Outreach Organization’s bat education kits they were further told about bat facts, their importance, threats and conservation. They very much liked the ZOO’s bat poster and learned the major threats to bats contained in. They were asked about the small mammals found in their backyard and listed out on the black board and later explained about them. As an evaluation, the question and answer session was conducted to assess the students understanding on small mammals. Bat photo exhibition was set up at the classroom and video on bats and its role in pollination were shown.

**Sathya Surabi School, Kodaikanal**

On 12 November 2014, Palani Hills Conservation Council organized a workshop. A total of 89 students participated. The program started with five kingdoms of life, biodiversity in Western Ghats and diversity and distribution of mammals in Palani hills. Information on giant squirrel, mongoose, black-naped hare, were shared; and the bat and role of bats in ecosystem and bat types, threats were also explained as a story. Some of the kids shared the *Pteropus* colony in Kodaikanal villages. Followed by a bat painting session was conducted. And the bat education pockets were extensively used.

I extend my sincere thanks to Zoo Outreach Organization and Wildlife Information and Liaison Development Society, Coimbatore for the active support and for the education materials.
Species Diversity and Distribution of Rodents along the elevational gradients in Jigme Dorji National Park, Bhutan
Jangchuk Gyeltshen*

Abstract
Fifty Sherman traps were used for carrying out the study. A total of six transects were laid in six different habitat types along the elevational gradients. Traps were baited and kept for three consecutive nights in each habitat type. With 900 trap nights spent in six habitat types, six species of rodents were captured and identified. The number of individual capture was high for *Niviventer niviventer* (50.4%, n=64) and low for *Dremomys lokriah* (0.79%, n=1). From 6 habitat types, 127 individuals (25 Sikkim Mouse, *Mus pahari*; 64 White-bellied Rat, *Niviventer niviventer*; 4 Sikkim Rat, *Rattus sikkimensis*; 1 Orange-bellied Himalayan Squirrel, *Dremomys lokriah*; and 11 Common House Rat, *Rattus rattus* were captured. All the species except *Dremomys lokriah* were new record for the Park. Among six species, *Mus pahari* was the only species captured in warm broadleaved forest at the lowest elevation and *Niviventer eha* in mixed conifer and fir forest at the highest elevations (M= 2234.09, SD=563.259). *Mus pahari* was recorded only from a single site in the warm broadleaf forest. *Rattus rattus* was found only in dryland and likewise *Dremomys lokriah* in bamboo forest. Species richness (R=1.23) was high in the higher elevations and low (R=0) in the lower elevations. Species diversity was very low (H’=0.19-0.86) for all the habitat types. However, Evenness Index was very high (E=0.96) for dry land, medium for bamboo forest (H’=0.39) and low (E=0.28) for wetland. Statistical analyses showed that there were significant association between species diversity and habitat types, r=0.396, p<.001, between species and elevation, r=0.536, p<.001.

Introduction
Rodents play very important role in the forest ecosystem in dispersal of seed and spores, nutrient cycling and decomposition through consumption and shedding of vegetation and also play an important role in determining forest, structure, and succession of vegetation (Witmer, 2004). They provide an essential prey base for many species of predators. Many rodents, such as mice and voles, are important food sources for predators like raptors, snakes and other small felids, making them a vital part of the ecosystem (DW, n.d). Rodents are important

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environmental engineers, helping to spread pollen and seed, aerating the soil through their digging and burrowing activities, and in extreme cases (e.g. beavers), changing the whole nature of the landscape (Ken & Brown et al., 2003). Rodents are considered to be bio-indicators of habitats because of their short lifespan, rapid population dynamics and low level of pressure on their populations as result of hunting both by human and wild predators in comparison to large mammals (Alelu, 2010). Most rodents are prolific breeders and they often represent a significant amount of the animal biomass in forests and other natural ecosystems (Aplin et al., 2003).

In the world, there are 2277 rodent species in 481 genera under 33 families. They constitute 43% of the mammals on the earth (Molur et al., 2005). India has 103 species and 89 subspecies under 46 genera (ibid). Nepal has 43 species of rodents, of which one species is endemic to their country. Information on distribution, status and ecological role of small mammals in Bhutan is not well documented. No one had conducted survey ever since from the time when Wikramamayake carried out mammal survey in 1993 in Jigme Dorji National Park where he had listed 7 species of rodents. There is dearth of information on rodents with regard to species diversity and distribution of rodents along the elevation gradients in the park. Therefore, a study was initiated in JDNP with the main aim to fill up this gap. The study is expected to gain information on species diversity and distribution along the elevational gradients in six habitat types. The study is also expected to contribute towards conservation of rodents would further benefit in conservation of some of the globally threatened and endangered species of mammals like Snow leopard, Red fox, Tibetan wolf and other small carnivores, raptors and snakes that are here in the park.

Methods
The study was conducted in Rimchu and Lunana Park Range under Jigme Dorji National Park (Figure 1) from 18th January to 9th February 2013. This park is the second largest protected area in Bhutan. It is located in the northern part of Bhutan covering a total area of 4,316Km² with altitude ranging from 1400m to over 7000m. The park has

Fig 1. Map showing study site and the different habitat types along the elevational gradients selected for the study

<table>
<thead>
<tr>
<th>Species</th>
<th>Habitat type</th>
<th>Elevation Range</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mus pahari</td>
<td>Warm broadleaf forest</td>
<td>1551 -1684 m</td>
</tr>
<tr>
<td>Niviventer niviventer</td>
<td>Warm broadleaf forest, dry land</td>
<td>1551 – 3043 m</td>
</tr>
<tr>
<td>Rattus sikkimensis</td>
<td>Warm broadleaf, wetland</td>
<td>1692 – 2017 m</td>
</tr>
<tr>
<td>Rattus rattus</td>
<td>Dryland</td>
<td>2305 – 2327 m</td>
</tr>
<tr>
<td>Dremomys lokriah</td>
<td>Bamboo forest</td>
<td>2900 – 3016 m</td>
</tr>
<tr>
<td>Niviventer eha</td>
<td>Mixed conifer forest, fir forest</td>
<td>2953-2991 m</td>
</tr>
</tbody>
</table>

Table 1. Habitat type and elevational range of species found in six transects
eight of the eleven classified vegetation zones found in the country. Due to the presence of these different vegetation zones, the park has a striking array of floral and faunal diversity. More than 30 species of mammals, 300 species of birds, 1400 species of plants have been recorded, including several globally threatened species such as tiger, snow leopard, Himalayan musk deer, Takin, Himalayan black bear and Black-necked crane. The study area lies within geographical location of N 27°43’ 58.9”, E 89° 44’ 48.0” and N 27° 46’ 42.8”, E 89°46’ 58.5” with elevational range from 1551m-3378m. This trail has a sharp and gradual increase in elevation with good representation of vegetation types along the elevational gradients. Six belt transects with size of 250 x 30 m were laid in the study area in six different habitat types along the trail. These habitats are Warm broadleaf forest (Habitat-1), Wet land (Habitat-2), Dry land (Habitat-3), Bamboo thickets (Habitat-4), Mixed conifer forest (Habitat-5) and Fir forest (Habitat-6). Transect-1 or habitat-1 covers altitudinal range of 1551m-1694m with vegetation composition of warm broadleaf forest. Some of the dominant plant species in this habitat are Morus lavegata, Juglans regia, Celtis sp., Alnus nepalensis, Engelhardhia spicata, Macaranga postulata, Quercus lanata, Symplocos lucida, Eurya sp., and Quercus griffithi. Transect-2 or Habitat-2 covers altitudinal range of 1692-2017m with vegetation mainly composed of Artimesia sp. and small shrubs. It’s an open uncultivated field. Transect-4 or Habitat-4 covers altitudinal range of 2900m-2991m with vegetation composition of bamboo thickets mainly Yushania microphylla. Transect-5 or Habitat-5 covers altitudinal range of 2991m-2953m with vegetation composition of mostly Artimesia sp. and small shrubs. It’s an open uncultivated field. Transect-6 or Habitat-6 covers altitudinal range of 2851m-2900m with vegetation composition of bamboo thickets mainly Yushania microphylla.

<table>
<thead>
<tr>
<th>Habitat 1 (Warm broadleaf)</th>
<th>Habitat 2 (Wetland)</th>
<th>Habitat 3 (Dry land)</th>
<th>Habitat 4 (Bamboo thickets)</th>
<th>Habitat 5 (Mixed conifer forest)</th>
<th>Habitat 6 (Fir forest)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Shannon-Weiner H</td>
<td>0.86</td>
<td>0.66</td>
<td>0.27</td>
<td>0</td>
<td>0.19</td>
</tr>
<tr>
<td>Species Richness R</td>
<td>1.23</td>
<td>0.76</td>
<td>0.68</td>
<td>0.90</td>
<td>0</td>
</tr>
</tbody>
</table>
with vegetation composition of mixed conifer forest. Some of the dominant plant species noted in this habitat are *Tsuga dumosa*, *Yushania microphylla* and *Smilax* sp. with ground cover of mosses. Transect-6 or Habitat-6 covers elevation range of 2953m-3016m with vegetation type of fir forest. Some of the dominant plant species found in this habitat are *Rhododendron falconeri*, *Tsuga dumosa*, *Abies densa*, *Acer Campbelli* and *Betula utilis* with ground cover of mosses and *Yushania microphylla*.

Fifty Sherman traps of size 23x9x8cm were placed along the transects with trap to trap distance of 5 m apart. Peanut butter mixed in wheat seed, millet, maize, mustard, peanut and paddy were used as bait for the rodents. The traps were set in the afternoon and kept for three nights. Traps were checked every early morning and re-baited or reset traps. If found captured, rodents were handled carefully and identified based on examining external morphological features like general body proportion, colour and texture of the fur on the belly, flanks and back, size, shape and hairiness of the external ears, detailed patterning and hairiness of the tail, size and colour of the incisor teeth. 30cm scale was used for morphometric measurement and Pesola spring balance of 50g and 300g were used for measuring weight. Mean and Standard Deviation of Tail length, Ear length, Head length, Body length and Weight were calculated. Photographs were taken for each individuals captured at the site. Those captured animals were released at the site upon completion of recording necessary information.

A plot size of 10 x 10 m plots were laid at the captured sites to make an assessment on overstorey and understorey cover. One m$^2$ plots were used for assessing herbaceous, litters and bare rocks/soil cover. Visual estimation was done for assessing cover percentage for overstorey, understorey, herbaceous, litters and bare rocks/soil cover. Trees and shrubs with highest number of frequency recorded in each capture sites were considered as dominant plant species for each capture sites. Statistical analysis was done using SPSS and Biodiversity calculator. Species richness for each habitat types was calculated using the formula, $R = \frac{S-1}{\log N}$, where $R$= Species richness index, $S$= Total number of species, $N$= Total number of individuals of all the species in a given area.

**Results and Discussion**

**Trapping success**

A total of 127 individuals (25 Sikkim Mouse *Muspahari*, 64 White-bellied Rat *Niviventer niviventer*, 4 Sikkim Rat *Rattus sikkimensis*, 22 Little Himalayan Rat *Niviventer eha*, 1 Orange-bellied Himalayan Squirrel *Dremomys slokriah* and 11 Common House Squirrel *Dremomys slokriah*.}
Rat *Rattus rattus* were captured from the six habitat types (Figure 1). The trapping success was high in Habitat-1 in the warm broadleaf forest with trapping success of 84% \( (n = 42) \) followed by Habitat-3 in Dry land with trapping success of 58% \( (n = 29) \), Habitat-2 in Wetland with trapping success of 42% \( (n = 21) \), Habitat-5 in mixed conifer forest with trapping success of 34% \( (n = 17) \), Habitat-4 in Bamboo thicket with trapping success of 26% \( (n = 13) \) and at least capture success in Habitat-6 in the fir forest \( (10\%, n = 5) \). Overall, the trapping successes for the six habitat types during the entire period of trapping were 14% only.

**Species diversity, richness and evenness with respect to habitat types**

Six species of rodents were identified and listed from the total 900 trap nights spent in the six habitat types/transects along the elevational gradients in the park. Six species of rodents are Sikkim Mouse (*Mus pahari*), White-bellied Rat (*Niviventer niviventer*), Sikkim Rat (*Rattus sikkimensis*), Little Himalayan Rat (*Niviventer eha*), Orange-bellied Himalayan Squirrel (*Dremomys lokriah*) and Common House Rat (*Rattus rattus*). Four genera and six species were identified and listed (one species belonging to genus *Mus*, two species belonging to genus *Niviventer*, two species belonging to genus *Rattus* and one species belonging to genus *Dremomys*). Shrews belonging to order Insectivora were also caught in the traps. Among these, Asiatic Short-tailed Shrew (*Blarinella quadraticauda*) was a new record for Bhutan and Indian Long-tailed Shrew (*Soriculus leocops*) was a new record for both habitat and elevation wise in the park. The park has now new additional list of six species of rodents and two species of Shrews. Among six species of rodents identified from six habitat types, Sikkim Mouse (*Mus pahari*) was captured only in warm broadleaf forest (Habitat-1) within elevation range of 1551 -1684 m. This species was confirmed to be a restricted species found only in warm broadleaf forest. Three species of rodents: *Muspahari, Niviventer niviventer, Rattus sikkimensis* were captured from warm broadleaf forest (Habitat-1) which represents highest number of species \( (n = 3) \) and maximum individuals capture success of 33% \( (n = 42) \) when compared to other habitat types. The habitat types and elevational range of species captured in six different types are provided in Table.1.

Species richness for each habitat types was calculated using the formula, \( R = S-1/LogN \), where \( R = \) Species richness index, \( S = \) Total number of species, \( N = \) Total number of individuals of all the species in a given area. The result shows that species richness is higher in the lower elevations \( (R = 1.23) \) than in the higher elevations \( (R = 0) \).
This could be attributed to the rich diversity of plant species (n = 18) and the difference in the climatic condition of the habitats across elevation gradient.

Shannon Diversity Index and Evenness Index for six species of rodents in six habitats were calculated. The study result indicated that there was very low species diversity for all habitat types with highest diversity index (H = 0.86) for Habitat-1 (H = 0.66), Habitat-4 (H = 0.27), Habitat-2 (H = 0.19), Habitat-5 (H = 0) and Habitat-6 (H = 0). With respect to species richness, it was low (R = 0) in the highest elevations and high (R = 1.23) in the lowest elevations. Species evenness indices for six habitat types were different. Very high evenness index (E = 0.96) for Habitat-3, medium for Habitat-4 (H’ = 0.39) and low (E = 0.28) for habitat-2. Habitat-5 and Habitat-6 has only one species identified. That is why all values of diversity are ‘0’.

Statistical tests were performed to understand the correlation between habitat types and species, species and elevation, elevation and sexes. The statistical test shows that there was a linear correlation between species and habitat types, statistical test shows that there was a linear correlation between species and elevation, elevation and sexes. The correlation between habitat types and species, why all values of diversity are ‘0’. The result shows there was a strong strength of relationship between the species diversity of rodents and dominant plant species. The effect could be due to the food resources available in all the habitats. More food resources especially fruit bearing edible plants were seen in the lower habitats than in the higher habitats. More species were captured in warm broadleaf forest (32.8%) at lower elevation than in fir forest (3.9%) at higher elevation. Partial correlation test was performed to further understand the correlation between habitat and species without the influence of micro-habitats types. Still, the result shows there was a strong correlation between habitat type and species, r= 0.538 (p < .001). This indicates that habitat has effect on species diversity as well. The effect could be due to vegetation cover

Species taxonomy and distribution
A total individual of 127 rodents captured from six habitat types has been measured and weighed for identifying species (Table 3).

Species diversity and distribution with respect to dominant plant species
Statistical test were performed to understand the strength of relationship between the species diversity of rodents and dominant plant species. The result shows that there was a strong strength of correlation between species diversity and dominant plant species, r= .706 (p <.001). This indicates that there was an effect on species diversity depending on the presence of dominant plant species. All Mus pahari (n= 25) were captured only in dominated plant species of Mecaranga postulata in warm broadleaf forest with dominant ground vegetation of Diplazium esculentum and Elatostema sp. Similarly, Niviventer eha was captured in habitat-5 (n= 17) with dominant plant species of Tsuga domusa and ground cover vegetation of Smilax sp., and also captured in habitat-6 (n= 5) with dominant plant species of Abies densa and ground cover vegetation of mosses. Although Dremomys lokriah were sighted in habitat-5 and habitat-6 but captured only in bamboo forest. Number of captures were more in the captured site of overstorey average tree height of 29.7m (n= 124) and understorey average tree height of 10.8m (n= 122).

Species diversity and distribution with respect to vegetation cover
Vegetation cover class were noted at the capture sites. 1 denotes <15%; 2 denotes 15-40%; 3 denotes 41-65%; 4 denotes 66-90%; 5 denotes >90%). The numbers of individuals captured were successful between the vegetation cover class of 15-40% (41.88%) followed by >15% (28.21%), 4-65% (25.64%) and 66-90% (4.27%).

Table 3. Length and weight data of six captured species in six habitat types
(TL= Tail length, EL= Ear length, HL= Head length, BL= Body length, Wt= Weight)

<table>
<thead>
<tr>
<th>Species</th>
<th>TL1 (Cm) Mean+SD (n)</th>
<th>EL1 (Cm) Mean+SD (n)</th>
<th>HL1 (Cm) Mean+SD (n)</th>
<th>BL1 (Cm) Mean+SD (n)</th>
<th>Wt1 (g) Mean+SD (n)</th>
</tr>
</thead>
<tbody>
<tr>
<td>M.pahari</td>
<td>6.78+0.52 (25)</td>
<td>0.96+0.25 (25)</td>
<td>2.04+0.39 (25)</td>
<td>7.24+0.76 (25)</td>
<td>13.82+2.47 (25)</td>
</tr>
<tr>
<td>N.niviventer</td>
<td>16.66+1.85 (65)</td>
<td>1.41+0.47 (65)</td>
<td>3.19+0.88 (65)</td>
<td>11.15+3.47 (65)</td>
<td>134.7+57.78 (25)</td>
</tr>
<tr>
<td>R.sikkimensis</td>
<td>16.13+1.31 (3)</td>
<td>1.48+0.34 (3)</td>
<td>3.43+0.79 (3)</td>
<td>14.0+3.39 (3)</td>
<td>157.50+40.31 (3)</td>
</tr>
<tr>
<td>N.eha</td>
<td>15.59+1.30 (22)</td>
<td>1.35+0.53 (22)</td>
<td>3.18+0.48 (22)</td>
<td>12.27+1.43 (22)</td>
<td>134.82+54.32 (22)</td>
</tr>
<tr>
<td>R.rattus</td>
<td>13.77+0.94 (11)</td>
<td>2.53+3.18 (11)</td>
<td>3.18+0.46 (11)</td>
<td>12.71+1.01 (11)</td>
<td>180.0+8.94 (11)</td>
</tr>
<tr>
<td>D.lokriah</td>
<td>18.00 (1)</td>
<td>2.80 (1)</td>
<td>4.50 (1)</td>
<td>18.00 (1)</td>
<td>200.00 (1)</td>
</tr>
</tbody>
</table>
Further, the vegetation cover classes were statistically analyzed to understand the strength of relationship between species and vegetation cover class. The result shows that there was a significant correlation between vegetation cover class of understorey and the presence of species, \( r = 0.212 \) (\( p < 0.05 \)) but has no correlation between species and over-storey vegetation cover class, \( r = 0.177 \) (\( p > 0.05 \)). This points out that for the rodents, under-storey vegetation cover is most important than the over-storey vegetation cover. Under-storey cover can prevent rodents being exposed to predators and other dangers too. Corominas (2004) reported that vegetation cover also provide food resources for small mammals in the form of leaves, fruits, seeds or insects. There was no strong significant correlation between average under-storey height of plants and average over-storey height of the plants, \( r = 0.743 \) (\( p < 0.001 \)). This illustrates that irrespective of average height of overstorey and understorey of a forest, rodents are found if there is a good understorey cover.

### Conclusions

Ecological importance of rodents in the forest ecosystem is understood very less by many foresters and public. In fact, rodent represents major mammalian order on the earth. Conservation of wild carnivores and raptors. Due to the diverse habitat present in Jigme Dorji National Park (JDNP), the park seems to have more species of rodents which are still undiscovered. The present study has been focused only in two Park Ranges under JDNP. There are still three Park Range Offices left where such study couldn't cover. Covering those areas in both the seasons (winter & summer) would add more species list for the Park. Even, the current study couldn't cover alpine areas where some of the species were reported to be present.

In view of the above findings, the study recommends the following:

- Similar study should be initiated during summer season which would then supplement the present study conducted in winter season.
- Since this study couldn’t cover alpine areas, therefore, similar study is recommended for the alpine areas.
- *Mus pahari* (Sikkim Mouse) is confirmed to be the restricted species captured only in warm broadleaved forest. Therefore, to protect and conserve this species, further study is needed on the population status and habitat selection of Sikkim Mouse in the park. This would flag the current population status and conservation importance in its habitats.
- *Niviventer niviventer* (White bellied rat) have wide distribution range. Majority of individuals captured within study sites and outside study sites were White bellied rat. Therefore, study on ecology and distribution is felt necessary since this species may be important prey species for many of the iconic wild carnivores and raptors in the park.
- Strict monitoring and patrolling has to be carried out by the park management in the Sikkim Mouse habitat at Tsorim Zampa to reduce disturbance and habitat destruction by the human activities.
- Since many species present were found out to be long-tailed species, therefore use of Sherman trap size of 7.7 x 9.5 x 30.5 cm is recommended for trapping rodents in Bhutan. Sherman trap size of 23

### Table 4: Species list of rodents captured and identified from six habitat types

<table>
<thead>
<tr>
<th>Species (Common Name)</th>
<th>Order</th>
<th>Family</th>
<th>Subfamily</th>
<th>Distribution</th>
<th>Global status</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Orange bellied Himalayan Squirrel (Dremomys lokriah)</td>
<td>Rodentia</td>
<td>Soricidae</td>
<td>Callosciurinae</td>
<td>Bangladesh, Bhutan, India, Nepal</td>
<td>Least Concern</td>
</tr>
<tr>
<td>2. Himalayan White-bellied Rat (Niviventer niviventer)</td>
<td>Rodentia</td>
<td>Muridae</td>
<td>Murinae</td>
<td>Bhutan, India, Nepal</td>
<td>Least Concern</td>
</tr>
<tr>
<td>3. Little Himalayan Rat (Niviventer eha)</td>
<td>Rodentia</td>
<td>Muridae</td>
<td>Murinae</td>
<td>India, Nepal</td>
<td>Least Concern</td>
</tr>
<tr>
<td>4. Common House Rat (Rattus ratus)</td>
<td>Rodentia</td>
<td>Muridae</td>
<td>Murinae</td>
<td>India, Bangladesh, Nepal, Pakistan, Sri Lanka</td>
<td>Least Concern</td>
</tr>
<tr>
<td>5. Sikkim Rat (Rattus kikimensis)</td>
<td>Rodentia</td>
<td>Muridae</td>
<td>Murinae</td>
<td>India, Nepal</td>
<td>Least Concern</td>
</tr>
<tr>
<td>6. Sikkim mouse (<em>Mus pahari</em>)</td>
<td>Rodentia</td>
<td>Muridae</td>
<td>Murinae</td>
<td>Bhutan, India</td>
<td>Least Concern</td>
</tr>
</tbody>
</table>

### Insectivores identified at the study site

<table>
<thead>
<tr>
<th>Species (Common Name)</th>
<th>Order</th>
<th>Family</th>
<th>Subfamily</th>
<th>Distribution</th>
<th>Global status</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Asiatic Short-tailed Shrew (<em>Blarinella quadratricauda</em>)</td>
<td>Eulipotyphla</td>
<td>Soricidae</td>
<td>-</td>
<td>-</td>
<td>2019-2014</td>
</tr>
<tr>
<td>2. Indian Long-tailed Shrew (<em>Soriculus leucops</em>)</td>
<td>Soricomorpha</td>
<td>Soricidae</td>
<td>-</td>
<td>India, Nepal</td>
<td>2016 m</td>
</tr>
</tbody>
</table>
x 9 x 8 cm is best suited only for trapping Sikkim Mouse, Shrews and short-tailed species.

Acknowledgement
I am really grateful to Ngawang Norbu, Director of Ugyen Wang chuck Institute for Environmental Conservation and Mr. Phuntsho Thinley, Chief Forest Officer of Jigme Dorji National Park for granting fund and the Council of Renewable Natural Resources Research of Bhutan, Royal Government of Bhutan for approving my research proposal which is first of its kind in Bhutan. I would like to thank Dr. D.B Gurung, who has provided constant guidance and invaluable comments on my manuscript. My sincere thank is also extended to Namagay Dorji, Choki Gyeltshen from Jigme Dorji National Park who really took pain to support me in field data collection.

Reference


Persistence of circadian flight activity rhythm in the fulvous fruit bat, *Rousettus leschenaultii* under prolonged rearing conditions

Sreedevi Rajasekar, A. Madhavan, and S. Suthakar Isaac

**Introduction**

The fulvous fruit bat, *Rousettus leschenaultii* (Megachiroptera: Pteropodidae) is a medium sized bat species (Body weight 92.50g; forearm length is 83mm) found in a variety of habitats ranging from tropical moist forest to urban environments. This species roosts inside caves, old and ruined buildings, temples, forts and disused tunnels. It is very widely distributed in South Asia, southern China and Southeast Asia. It lives in colonies consisting of a few to several thousands (Sreenivasan and Bhat, 1974) and the colonies are often extremely noisy (Philips, 1980). *R. leschenaultii* uses tongue clicks as a crude form of echolocation while navigating in the dark. They feed on fruits and flowers by using sense of olfaction as seen in other megachiropteran bats. This bat plays an important ecological role as a nocturnal pollinator and seed disperser. It exhibits two breeding cycles in a year and bears a single young (Bates and Harrison 1997).

In 1994, a huge colony of *R. leschenaultii* consisting of about 15,000 individuals was observed in a temple premises at Cheranmahadevi in Tirunelveli district, (Chandrasekaran and Marimuthu 1994). In addition, 5 different colonies with a few thousands of individuals roosting in temples and old buildings were also observed in the study area. These colonies vanished in the vicinity within a short period due to renovation of these old structures and unavailability of preferred roosting sites. So we attempted to rear this bat species in semi-natural conditions for the purpose of rehabilitation and conservation. During rearing of this bat population, we could observe persistence of circadian flight activity rhythm continuously for years.

**Materials and Methods**

Field observations and survey of *Rousettus leschenaultii* were performed in Tirunelveli district since 1990 and captive rearing was carried out in Thrissur from 2000 to 2002, for the purpose of convenience. In this study, 5 specimens (3 females and 2 males) were brought from Palayamkottai to Thrissur on October 1999. These bats were placed in wire-mesh cage (dimension 3m x 2m x 1.3m). The cage was kept in an open courtyard of a house with a tile roof. Drinking water was kept on the floor *ad libitum* and plantain slices were provided on the floor daily at about 6 p.m. All the females were with pups on 05.02.2000 and again with pups on 29.06.2000 during second parturition. The captive population increased to 12 bats on 16.08.2001 and subsequently to 19 individuals on 31.12.2002.

Temperature, humidity and weather conditions were recorded every day morning inside the cage. Humidity in the day ranged from 95.32 to 98.64% and night from 95.29 to 99.15%. Day and night temperature during study period ranged between min 22.45°C and max 36°C and min 22.36°C and max 31.53°C respectively. Bats emerged from the inner upper chamber to the open space of the cage every night for feeding the fruits. The timings of emergence of first bat and return of last bat were observed and recorded for a period of three consecutive years from 2000 to 2002 at weekly interval and correlated with the timings of sunset and sunrise respectively.

**Results**

This study reveals that in the captive colony of *Rousettus leschenaultii*, the timings of emergence of first bat keep pace with the timings of sunset. Similarly, the timings of return of the last bat keep pace with the timings of sunrise. The circadian periodicity of flight activity of the colony was ca. 24 hours as seen in the natural habitats. A linear pattern was demonstrated in the time of emergence of the first bat in relation to time of sunset (y=1.1012x-0.0645; R=0.946), and the time of return of last bat to the time of sunrise (y=0.733x +0.0608; R=0.878). During the breeding seasons, the bats emerge later and return earlier while compared to the other months of the year. The flight activity rhythm and the circadian periodicity were also persisted throughout the study period of three years from 2000 to 2002 (Figure 1). Moreover, the fulvous fruit bats, *R. leschenaultii*, were healthy and well adapted to the captive conditions, feeding on the local available fruits and breeding during the seasons as found in the wild populations.

**Discussion**

The light-dark cycle is the most powerful entraining agent in synchronizing the activity-rest patterns of animals especially the higher vertebrates (Aschoff et al. 1982). The timings of sunset and sunrise and the onset and end of activity of the animals are used as reference points to compare and demonstrate seasonal changes in their phase relationship (Aschoff et al. 1972; Chandrashekaran et al. 1983). In the wild, a similar pattern has been observed, in

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2Research Department of Zoology, St. John’s College, Palayamkottai, Tamil Nadu. E.mail: isaacsuthakar@yahoo.com
the timings of emergence and return of foraging flight activity of *R. leschenaultii* as reported by King Immanuel (2002). In addition, the variation in emergence and return activity was influenced by the breeding season as reported for *Pteropus giganteus* in the wild environment (Suthakar Isaac and Sudhakaran, 2005).

This species is more suitable for captive rearing and it is a good research specimen as this species can survive well in captive conditions and accept the local seasonal fruits. This bat also breeds twice a year in captivity as seen in the wild populations. So this bat species can be bred and rehabilitated where these bat populations are dwindling and used as research specimen. Recently, this fulvous fruit bat has been used as non-primate laboratory models to study menstruation and menstrual dysfunction (Zhang et al 2007).

In South Asia, while majority of populations are generally stable, this species is locally threatened by human interference to roosting sites due to tourism related developmental activities, loss of preferred roosting sites, persecution by humans by means of poisoning, fumigation activities and stoning, hunting for medicinal purposes and local consumption. It is classified as a vermin under Schedule V of the Indian Wildlife (Protection) Act. In spite, it has been recorded from protected areas in India like Namdapha Biosphere in Arunachal Pradesh, Nagarhole Wildlife Sanctuary in Karnataka, Sambalpur Wildlife Sanctuary in Orissa, Indravathi National Park in Chattisgarh, Kanha National Park in Madhya Pradesh. This species should be monitored periodically to record changes in population dynamics and awareness activities are to be taken up to mitigate threats to this species.

References:

Continued on Page 39...
Distributional Records of Painted Bat Kerivoula picta in Maharashtra: A Review with Additions from Satara District

Anil Mahabal¹, Amit Sayyed², Shrikant Jadhav³ and B.V. Jadhav⁴

Painted Bat Kerivoula picta (Pallas, 1767) (Vespertilionidae: Chiroptera) is relatively smallest bat, comparable with the size of a large moth. It flies with up and down flutter like a moth. Fur is bright orange on dorsal surface and warm buff on ventral surface with bright orange and black wings, makes this bat unmistakable. It has hairy face with large, funnel- shaped ears. Despite of their bright colours, they are camouflaged in dead down- hanging leaves of banana plants or other similar hiding places where they roost during the daytime either singly or occasionally in pairs. They feed on small insects (Prater 1971, Bates & Harrison 1997, Menon 2003, Johnsingh & Manjrekar (Eds) 2013). These bats are listed as Least Concern as per The IUCN Red List of Threatened Species (2014).

Painted Bats are distributed in Indian Subcontinent mostly in south-east Asia, Sri Lanka, Bangladesh and India. State-wise distribution in India is in Assam, Sikkim, West Bengal, Orissa, Andhra Pradesh, Tamil Nadu, Kerala, Karnataka, Goa, Maharashtra and Rajasthan (Bates & Harrison 1997, Alfred et al 2006, Pradhan & Talmale, 2012). Menon (2003) has indicated that they occurred in forest of Western Ghats and Assam. In all the above mentioned states there are hardly one or two records of their occurrence (Bates & Harrison 1997). However, in the state of Maharashtra ten previous records are available, mostly from Mumbai region, two from Satara and one each from Pune and Thane districts (Table 1a).

There was a news (with photograph) in "Lokmat"- a Marathi Newspaper, Satara on 29th April, 2015 that a local person observed a Painted Bat on the banana plant. So, the second author (AS) visited the place called Hamdabad village next evening on 30th April, 2015 and he confirmed the occurrence of the Painted Bat. Hence, it was then decided to undertake preliminary survey in and around Satara to locate the presence of these bats, if any. During 5th to 18th May, 2015 surveys were carried out particularly in localities like Ajinkyatara Fort, Sajjangarh, Thoseghar, Chalkewadi, Patan and areas between these hill ranges. Out of all these localities, Painted Bats were observed only in the area of Thoseghar village, on 16th May, 2015. Besides this, recently a specimen collected at Patan, Satara district by the 4th author (BVJ) has been deposited in the collection of Zoological Survey of India, Pune. All these recent additional records from Satara district have been compiled in the (Table 1b).

A perusal of literature revealed that there is no much information available on distributional records of Painted Bats from Maharashtra as well as from different parts of India. Recently, Korad & Yardi (2004) and Korad et al (2010) have recorded many bat species during their surveys in Pune city and Pune district respectively. However, there are no sightings of any Painted Bat from these surveys. Bates & Harrison (1997) have indicated that the Painted Bats are widely distributed. It seems that these bats have very patchy distribution in all over India. Hence, there is a need to undertake systematic surveys to study their distributional status, population ecology, breeding habits (except a note by Ramachandran & Jayson, 1994) throughout the India and particularly in Jalgaon and Dhulia districts (where huge areas are under banana plantations) as well as in coastal and Western Ghats districts of Maharashtra state.

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Authors are thankful to Dr. P.S. Bhatnagar and Dr. S.S. Talmale, Scientists, Zoological Survey of India, Pune and Jabalpur for their valuable suggestions. Authors are also thankful to Mr. Rajiv Mule Sub-Editor of “Lokmat” Satara for the information; Abhijit Nale, Datta Chavan, Vinay Chavan, Rahul Thombare, Atul Rajmane and Jitendra Patole team of Wildlife Protection and Research Society Satara, Maharashtra, for their support in the field work.

References


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⁴Asstt. Professor, Department of Zoology Balasaheb Desai College, Patan, Satara district, Maharashtra
### Table 1. Distributional Records of Painted Bats in Maharashtra

1a) Previous district-wise records:

<table>
<thead>
<tr>
<th>Sr. No.</th>
<th>Locality and Co-ordinates</th>
<th>District</th>
<th>Date</th>
<th>No. &amp; Sex</th>
<th>Reference/ Remarks</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Bombay</td>
<td>Mumbai</td>
<td>-</td>
<td>-</td>
<td>Blanford (1888-91)</td>
</tr>
<tr>
<td>2</td>
<td>Bombay (Santacruz)</td>
<td>Mumbai Suburban</td>
<td>1912</td>
<td>♀, ♂</td>
<td>Brosset (1962)</td>
</tr>
<tr>
<td>3</td>
<td>Borivali station</td>
<td>Mumbai Suburban</td>
<td>02/09/1913</td>
<td>♂</td>
<td>Brosset (1962)</td>
</tr>
<tr>
<td>4</td>
<td>Juhu</td>
<td>Mumbai Suburban</td>
<td>-</td>
<td>1 unsexed</td>
<td>In collection of BNHS, Mumbai and Talmale (2007)</td>
</tr>
<tr>
<td>5</td>
<td>Gorai, Borivali</td>
<td>Mumbai Suburban</td>
<td>04/05/1967</td>
<td>1unsexed</td>
<td>In collection of BNHS, Mumbai and Talmale (2007)</td>
</tr>
<tr>
<td>7</td>
<td>Dahanu</td>
<td>Thane</td>
<td>04/01/1999</td>
<td>♂</td>
<td>In collection of BNHS, Mumbai; Gavand &amp; Chaturvedi (1999) and Talmale (2007)</td>
</tr>
<tr>
<td>8</td>
<td>Khandala</td>
<td>Pune</td>
<td>-</td>
<td>1♀</td>
<td>Brosset (1962)</td>
</tr>
<tr>
<td>9</td>
<td>Ghatmatha</td>
<td>Satara</td>
<td>-</td>
<td>-</td>
<td>Wroughton (1916)</td>
</tr>
<tr>
<td>10</td>
<td>Satara</td>
<td>Satara</td>
<td>-</td>
<td>-</td>
<td>Brosset (1962)</td>
</tr>
</tbody>
</table>

1b) Recent additional records

<table>
<thead>
<tr>
<th>Sr. No.</th>
<th>Locality and Co-ordinates</th>
<th>District</th>
<th>Date</th>
<th>No. &amp; Sex</th>
<th>Reference/ Remarks</th>
</tr>
</thead>
<tbody>
<tr>
<td>11</td>
<td>Patan</td>
<td>Satara</td>
<td>10/02/2013</td>
<td>1 unsexed</td>
<td>In collection of ZSI, Pune. Specimen no: WRC/ M/859, collected by 4th author (BVJ)</td>
</tr>
<tr>
<td>12</td>
<td>Hamadabad village, 3kms from NW of Satara city</td>
<td>Satara</td>
<td>30/04/2015</td>
<td>1 unsexed</td>
<td>In Nilgiri tree with family party of fruit bats- observed by 2nd author (AS)</td>
</tr>
<tr>
<td>13</td>
<td>Thosegarh village (17° 35' 57.24&quot; N, 73° 51' 2.59&quot; E)</td>
<td>Satara</td>
<td>16/05/2015</td>
<td>2 unsexed</td>
<td>Observed by 2nd author (AS) and team of WLPRS, Satara</td>
</tr>
</tbody>
</table>


... Continued from Page 37


Small Mammal Mail

SMM is a web-based bi-annual Newsletter celebrating the most useful yet most neglected Mammals for both CCINSA & RISCINSA -- Chiroptera, Rodent, Insectivore, & Scandentia Conservation and Information Networks of South Asia.

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