Small Mammal Mail

Newsletter celebrating the most useful yet most neglected Mammals

for CCINSA & RISCINSA -- Chiroptera, Rodentia, Insectivora, & Scandentia

Conservation and Information Networks of South Asia

Volume 4 Number 2 **ISSN 2230-7087** **DECEMBER 2012**

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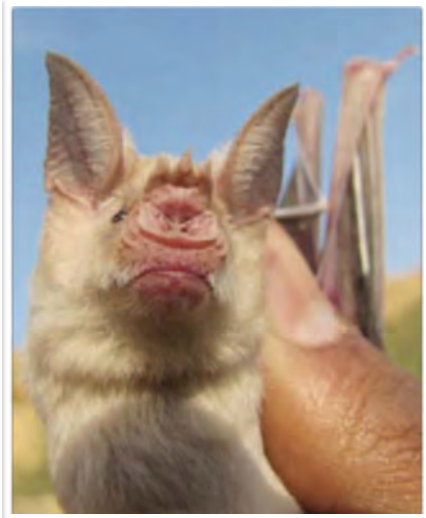

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EDITORIAL

Dear Small Mammal Friends :

We completely missed out on our half year issue of Small Mammal Mail. We got only a few contributions. I hope by now you might have some activities to report or articles to contribute. We will use these for a December issue if we get enough. If not, do you think we should continue Small Mammal Mail? I would like to do so.

If we can fill a December issue in 2012, that will still be two issues this year and we will have a mid-year (May or June) issue and a December issue for 2013.

Earlier we had two newsletters, one for bats and one for rodents but we combined them as most members were interested in both topics -- bats and rodents -- and it made a better newsletter.

I look forward to hear from you ... hopefully an email accompanied by an announcement, an article, an activity, etc.

Best wishes
Sally Walker for Small Mammal Mail

Dear Sally and Latha,

I am of the opinion that we should keep the Small Mammal Mail going. This is the only Newsletter of standard that caters to the Volant and Non-volant Small Mammals of the region.

I feel that the submissions have declined as more and more of the contributors have to wait too long (six months) to see their contributions in print or in pdf format. This may one of the major reasons behind the waning interest and to counteract this, we could plan a monthly update of the submitted notes/news as pdfs on to the ZOO/Newsletters website for the period of January to June and July to December every year.

Like, say we get two notes/news in January 2013, we get the manuscripts reviewed and once the revised ms has been received we host the pdfs on to the Issue 1 (January-June period) of 2013, by March 2013. And lo, the contributor feels happy to see his contribution processed within short span and would contribute regularly in future. Depending upon the number of contributions, review and submission of the revised ms, we continue to publish the pdfs as part of Issue 1 till 30th June, and all the other manuscripts processed later will be published as part of Issue 2. This way we can ensure that the waiting period could be minimized and more and more notes/news items will be contributed.

The same suggestion might hold good with other Newsletters too. I am herewith attaching two notes for inclusion in Small Mammal Mail.

Chelama Srinivasulu

Hello Sally,
I hope this finds you well. Would you be able to add the co-chairs of the SSC Small Mammal Specialist Group to Small Mammal Mail? I think they would find it very useful.

They are:
Richard Young – Richard.Young@durrell.org
Tom Lacher - telacher@nature.tamu.edu
I have copied them here., Best wishes,

Simon N. Stuart PhD, Chair
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Dear Madam,

Cordial Greetings.

I feel Small Mammal mail is very much needed and essential. It creates a platform to discuss and publish some of the small research matters which are important. It is a newsletter for the local bat researcher in India. So let us have at least biannually.

Here, I attach an observation - important and interesting to be published in Small mammal mail. Please publish it.

Sincerely,
S. Suthakar Isaac <isaacsuthakar@yahoo.com

Dear Readers

We received many other letters and many of them were accompanied by articles. It wasn't so difficult to collect enough material for a reasonable newsletter. I am inclined to continue as before. However, Srinivasalu has suggested a different way. It is up to you readers which method you want. For my part, I don't mind begging, pleading and threatening in order to get enough articles for this newsletter. Thanks for your interest and cooperation.

Best wishes,
Sally Walker, Editor, Small Mammal Mail

First Record of habitat sharing of *Eonycteris spelaea* and *Rousettus leschenaultii* in Nepal and Highest Elevation of Occurrence of *E. spelaea* in the World

Sanjan Thapa[1*], Dibya Raj Dahal[1, 2] and Santoshi Pokhrel[2]

There are three species of Dawn Bat namely, Greater Dawn Bat (*Eonycteris major*), Philippine Dawn Bat (*Eonycteris robusta*) and Dawn Bat (*Eonycteis spelaea*) (IUCN 2011). However, only *Eonycteris spelaea* is distributed in Nepal (Acharya *et al.* 2010) and in other South Asian countries (Srinivasulu *et al.* 2010).

E. spelaea ranges widely from northern South Asia, into southern China, and much of Southeast Asia (Francis *et al.* 2008). In South Asia it is known from India (Andaman and Nicobar Islands, Andhra Pradesh, Assam, Karnataka, Manipur, Meghalaya, Mizoram, Nagaland, Sikkim, Tamil Nadu (Vanitharani *et al.* 2005) and Uttaranchal, and Nepal (far western Nepal) (Molur *et al.* 2002).

Myers *et al*. (2000) recorded *E. spelaea* for the first time from Nepal. They collected two males, one of which was collected "among banana plants near houses" the other in a net set adjacent to a stream in a ravine from two sites of Chitwan National Park (CNP); In the vicinity of The Nepal Conservation Research and Training Center (84°29.5'E, 27°34.2' N), Sauraha, at an elevation of 200m and Dhangari Khola (84°11.5' E, 27°32.2' N), Tiger Tops, 33 km West of Sauraha (Acharya *et al.* 2010; Pearch 2011). It was mistnetted at Tiger tops in Chitwan National Park (Dahal *et al.* 2011).

Ten species of *Rousettus* are there in the world (IUCN 2011). Only two species are distributed in South Asia namely *R. aegyptiacus* Egyptian Fruit bat and *R. leschenaultii* Leschenault's Rousette (Srinivasulu *et al.* 2010). Only one species *R. leschenaultii* is reported from Nepal (Acharya *et al.* 2010).

This species is very widely distributed in South Asia, southern China and Southeast Asia (Bates and Helgen 2008). In South Asia, it is presently known from Bangladesh (Chittagong, Dakha, Khulna and Sylhet divisions), Bhutan (Panjurmane), India (Chattisgarh, Goa, Gujarat, Himachal Pradesh, Jammu and Kashmir, Jharkhand, Karnataka, Kerala, Madhya Pradesh, Maharashtra, Meghalaya, Mizoram, Nagaland, Orissa, Rajasthan, Sikkim, Tamil Nadu, Tripura, Uttaranchal, Uttar Pradesh and West Bengal), Nepal (Central and Western Nepal), Pakistan (North West Frontier Province, Punjab and Sind) and Sri Lanka (Central, Eastern, North Central, North Western, Sabaragamuwa, Southern, Uva and Western provinces) (Molur *et al.* 2002).

Up: Fruit bat colony in main cave, Halesi, Khotang district.
Down: Left; Inside the main cave, Halesi, Khotang district Right; Bhairav cave, Halesi, Khotang district

In Nepal; It has been reported from Boitari (Probably in Gorkha district) (84°37' E, 28°01' N) (Fry 1925); Kathmandu (Scully 1887); Tumlingtar (Field Museum of Natural History, Chicago) (Bates and Harrison 1997). A female specimen was collected from 25 km South of Jomsom (83°39' E, 28°36' N) in Eastern slope of Kaligandaki Valley (Csorba *et al.* 1999). It was also reported from Dhangari Khola (84°11.5' E, 27°32.2' N), Tiger Tops, 33 km West of Sauraha, Chitwan National Park (Myers *et al.* 2000). The species was observed in World Peace Cave, Pokhara (Daniel 2008); A cave in North-west face of the the hill adjacent to Tamor River, Tarikhet, Phurumbu V.D.C., Taplejung district (Acharya 2010). Few individuals were killed and even sold to shops at Shaktikor V.D.C., Chitwan District (Dahal *et al.* 2011). Two specimens from Chobhar Gorge are deposited at Royal Ontario Museum, Ontario, Canada (ROM 74734 and ROM 74735); Worth & Shah (1969) recorded from Pokhara (Pearch, 2011).

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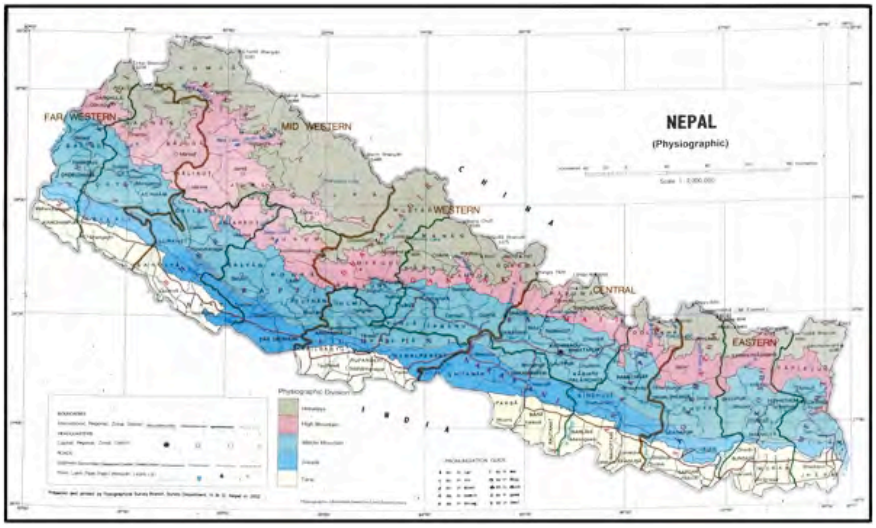

Map showing Nepal and site of occurrence of association (yellow spot)

Observation and Mistnetting

On January 24, 2012, a colony of large bats roosting was observed with the focused light inside the Bhairav Cave, Halesi, Mahadevsthan-4, Khotang district at 27° 11′ 33.2″ N 86° 37′ 20.4″ E at an elevation of 1373m a.s.l. in mid-hills of eastern Nepal. Chattering sound was conspicuously heard. However, the colony could not be photographed and bats could not be identified as the colony was roosting very high at difficult part of the top of the roof of the cave.

In order to identify the species roosting there, a mistnet 9m*3m was opened at the entrance of the cave on January 25. One adult male of *E. spelaea* was caught in the mistnet at 17:40hr and two adult females were captured at 18:10hr and 18:20hr. One adult female and one young male *R. leschenaulti* was mistnetted at 18:25hr and 18:37hr, respectively. The colony size was estimated to be hundreds of fruit bats. However, population of species could not be estimated.

Discussion and Conclusion

Eonycteris spelaea was found plentiful roosting in a cave at Tagoot, Myanmar, which is co-habited with other fruit bats and Emballonuridae (Wroughton 1915). Bhat *et al.* (1980) noted that this species formed compact cluster amidst the predominant *R. leschenaultii* in India. It was also found associated with *R. leschenaultii* throughout the year and *Hipposideros lankadiva* and *H. speoris* during latter species breeding colonies (Bates and Harrison 1997). This species is a cave roosting bat forming compact clusters and cohabits with other bats (Francis *et al.* 2008).

In Vietnam both species are widespread and form large colonies, and frequently occupy the same roost sites (Furey and Infield 2005; Furey *et al.* 2011). However, In Nepal *R. leschenaultii* and *Eonycteris spelaea* was separately recorded. This is the first record of the habitat sharing between these two species in Nepal.

This is also the northernmost and highest elevation records of the two species association. *E. spelaea* has been estimated to occur from sea level to 1,000 m a.s.l. (Francis *et al.* 2008). This study records the species from 1373m a.s.l. Therefore, this study locality is not only the highest elevation locality for the association, but also highest elevation record of *Eonycteris spelaea* in the world.

Acknowledgements

We would like to honor esteem acknowledgement to The Rufford Small Grants Foundation for the financial support to the project; Prof. Paul A. Racey, Co-Chair, IUCN SSC Chiroptera Specialist Group for continuous guidance, advice, and support. We would like to express

Up: Observing bat roost in Bhairav cave, Halesi, Khotang district
Down: Left; *Eonycteris spelaea* captured Right; *Rousettus leschenaultii* captured, at the entrance of Bhairav cave, Halesi, Khotang district

hearty thanks to Dr. Stephen Rossiter, Queen Mary University of London, UK; Dr. B.A. Daniel, Scientist, Zoo Outreach Organization, Coimbatore, India; and Mrs. Geeta Shrestha, Business Service Center, Kathmandu, Nepal for the strong recommendations to the project.

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A note on the named forms of the genus *Ratufa* Gray, 1867 (Mammalia, Sciuridae)

C. Srinivasulu*

The genus *Ratufa* was established by Gray in 1867 with *Sciurus indicus* Erxleben as the type species. The original characterization of *Ratufa* as given by Gray as "Tail elongate, longer than the body and head; large-sized" does not provide a satisfactory diagnosis and the forms belonging to this genus can be diagnosed based on the combination for the following cranial characters – absence of transbullar septae in the chambers of the auditory bullae; complete ankylosation of saggital and fronto-parietal sutures in adults; location of squamosa-alisphenoid suture about half-way between the third upper molar and the posterior margin of the base of the zygomatic process of the squamosal; short palatines; and vertical lateral lip of the infraorbital foramen. Gray's description and placement of *Ratufa* was that of subgeneric nature as it was placed under the genus *Sciurus* Linnaeus, 1758 and other currently recognized species under the genus *Ratufa* Gray, 1867 were placed under subgenus *Rukaia* Gray, 1867 under genus *Macroxus* Cuvier, 1823.

There are currently four species of *Ratufa*, of which three species are found in South Asia, mainly from Sri Lanka, India, Nepal, Bhutan and Bangladesh. Through this note, I intend to provide information on the named forms of *Ratufa* from South Asia and their current status.

***Ratufa macroura* (Pennant, 1769)**

The first description of a large-bodied squirrel from India that has later been assigned to the genus *Ratufa* was that by Pennant in 1769 who described *Sciurus macrourus* [currently recognized as *Ratufa macroura* (Pennant, 1769), Grizzled Giant Squirrel, also known as Sri Lankan Giant Squirrel] based on specimens from "Ceylon and Malabar". The type locality has been later restricted to "the highland jungles of the Central and Uva Provinces" by Phillips in 1933. The type is presumably lost. Another unassigned nomen *Sciurus zeylanicus* Ray, 1693 has also been included as a senior synonym of *Ratufa macroura* (Pennant, 1769). Ray (1963) on page 215 provides a very short description of the specimen from Leiden Museum. Nothing is known about this *nomen*/taxon, excepting its inclusion in synonymy of Grizzled Giant Squirrel. *Ratufa macroura* (Pennant, 1769) is endemic to South Asia with range restricted to Sri Lanka and southern India (Tamil Nadu and Kerala), where it over laps with that of *Ratufa indica maxima* (Schreber, 1784). Besides the nominate form, two subspecies, namely, *R. m. melanochra* Thomas and Wroughton, 1915 and *R. m. dandolena* Thomas and Wroughton, 1915, are recognized (Srinivasulu and Srinivasulu 2012). The former subspecies was described based on type (housed in British Museum, Reg. No. 15.7.1.4) from Kottawa, Southern Province, Ceylon (presently known as Sri Lanka), while the later is based on type (housed in British Museum, Reg. No. 15.7.1.5) from Wellawaya, Uva Province, Ceylon. Other names that have been listed in synonymy of this species are *Sciurus ceylonicus* Erxleben, 1777; *Sciurus ceylonica* Erxleben, 1777; *Sciurus ceilonensis* Boddaert, 1785; *Sciurus macrourus* var. *montanus* Kelaart, 1852; *Sciurus macrourus* var. *montana* Kelaart, 1852; *Sciurus macrourus* Blanford, 1891 and *Sciurus macroura* Blanford, 1891 are misspellings or alternative names proposed for *Ratufa macroura macroura* (Pennant, 1769). The type specimen of Blyth's *nomen Sciurus tennentii* Blyth, 1849 remains unknown (Robinson and Kloss 1918; Moore and Tate 1965). Blyth's *nomen albipes* from an unknown type locality is also assigned to the synonymy of *Ratufa macroura* (Pennant, 1769), and the type that was once in Medical College, Calcutta (Kolkata), probably now not in existence. Another form/*nomen*, *R. m. sinhala* Phillips, 1931 is also known based on type (housed in British Museum, Reg. No. 31.1.12.3) from Nikawewa, near Kantalai, North Central Province, Ceylon. Owing to the character overlaps of the 'lowland' *sinhala* and the 'upland' *macroura*, the *nomen R. m. sinhala* Phillips, 1931 is listed as a junior synonym of *Ratufa macroura dandolena* Thomas and Wroughton, 1915.

***Ratufa indica* (Erxleben, 1777)**

Ratufa indica (Erxleben, 1777) [Indian Giant Squirrel, also known as Malabar Giant Squirrel] is an Indian endemic species with range known from Andhra Pradesh, Chhattisgarh, Goa, Gujarat, Jharkhand, Karnataka, Kerala, Madhya Pradesh, Maharashtra, Orissa and Tamil Nadu. Erxleben's description of the *Sciurus indica* is perhaps based on Pennant's description of a species published in 1771 based on a "stuffed skin" that "inhabits Bombay". Two more names, *Sciurus purpureus* Zimmermann, 1777 and *Sciurus bombayus* Boddaert, 1785, proposed subsequently are, by the analysis of the Latin description, are based on the English description of Pennant's Bombay Squirrel. The types of *Sciurus indicus* Erxleben, 1777; *Sciurus purpureus* Zimmermann, 1777 and *Sciurus bombayus* Boddaert, 1785 are untraceable. Sykes in 1831 described *Sciurus elphinstoni* based on types (housed in British Museum, Reg. No. 79.11.21.578-579 and 16.3.9.12) from "Dekkan, India" and from "Western Ghats, Dekkan, India". This *nomen* has been listed in synonymy of *Ratufa indica indica* (Erxleben, 1777) as there are no new materials to prove the consistent characteristic of hazel dorsal pelage and half white tail being present in the area from which it has been reported. *Sciurus elphinstonei* Sykes, 1831 is a misspelling. Blanford in 1897 described *Sciurus indicus* var. *dealbatus* based on type (housed in British Museum, Reg. No. 96.11.7.6) from Mahal, Dangs, India. This taxon was based on three specimens collected originally and further enhanced collections, of six specimens from the type locality as well as the nearby two localities, have led to some experts to retain it has a distinct subspecies (nevertheless, see Abdulali and Daniels, 1952). Owing to paucity of new material as well as sighting records, the taxonomic status needs to be revisited and revised as some of the recent works have included this taxon in synonymy. Ryley in 1913 proposed *R. i. superans* based on type (housed in British Museum, Reg. No. 13.6.21.3) from Wotekolli, South Coorg. This description was based on a few number of samples from the southern

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range of *R. i. indica* were discretely and notably larger than the ordinary subspecies, *R. i. indica* from Dharwar and North Kanara. This *nomen* too is currently regarded as junior synonym of *R. i. indica* (Erxleben, 1777). Beside the nominate form, two more subspecies, namely, *Ratufa indica maxima* (Schreber, 1784) and *Ratufa indica centralis* (Ryley, 1913) are recognized (Srinivasulu and Srinivasulu, 2012).

***Ratufa bicolor* (Sparrman, 1778)**

Ratufa bicolor (Sparrman, 1778) [Black Giant Squirrel, also known as Malayan Giant Squirrel] is principally a South East Asian species with records reported from Bangladesh, Bhutan, Cambodia, China, India, Indonesia, Lao People's Democratic Republic, Malaysia, Myanmar, Nepal, Thailand and Viet Nam. In South Asia, this species has been recorded widely distributed in Bangladesh, Bhutan, India (Arunachal Pradesh, Assam, Meghalaya, Nagaland and West Bengal), and eastern Nepal (distribution poorly recorded) at elevations of 500 to 2,500 m asl (Molur et al. 2005). This species was described by Sparrmann in 1778 based on a specimen collected from Anjer, West Java as *Sciurus bicolor*. The type of *Sciurus bicolor* Sparrman, 1778 is untraceable. In South Asia, only one subspecies *Ratufa bicolor gigantea* (McClelland, 1839) is present. McClelland in 1839 described this taxon as *Sciurus giganteus* based on type (housed in British Museum, Reg. No. 79.11.21.336) from "Assam". Later, Hodgson in 1849 described *Sciurus macruroides* based on types (housed in British Museum, Reg. No. 43.1.12.76-77) from "Nepal". This later *nomen* was by some authorities treated as *nomen nudum*, but with the existence of the types (present in British Museum, collected by B.H. Hodgson in 1830 and 1840) this becomes a valid *nomen*.

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Additional site records of Indian Pangolin (*Manis crassicaudata* Gray 1827) (Pholidota; Manidae) in Guntur, Mahabubnagar and Medak districts of Andhra Pradesh, India

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Pangolins are nocturnal and are adapted to have a highly specialized diet of ants and termites (Prater 2005; Lim and Ng 2008; Pattnaik 2008). All species of Asian pangolins are rarely observed due to their secretive, solitary, and nocturnal habits, and there is not enough research on population densities or global population (Molur 2008). There are eight extant species of pangolins; among them population of four Asian pangolin species (Botha and Gaudin 2007; Lim and Ng 2008) including Indian Pangolin *Manis crassicaudata* is believed to have declined significantly in many areas due to hunting and trade (Broad et al. 1988). In India, only two species of pangolins, namely, Indian Pangolin (*Manis crassicaudata*) and Chinese Pangolin (*Manis pentadactyla*) are present (Srinivasulu and Srinivasulu 2012). Indian pangolin is widely distributed through the plains and lower slopes of hills south of the Himalaya to the southern extremity of India (Tikader 1983; Prater 2005). Very little is known about the status and activity pattern of Indian pangolin throughout its range (Burton and Pearson 1987).

In Andhra Pradesh, the Indian pangolin has been reported from a few localities in six districts (Adilabad, Hyderabad, Kurnool, Mahabubnagar, Ranga Reddy and Warangal) (Molur et al. 2005). It has been known to occur in tropical dry deciduous forests, scrublands and grasslands. Recently this species has also been reported from Kambalakonda Wildlife Sanctuary, Visakhapatnam district (Murthy and Mishra 2011). Additionally, the species has been observed by us from a few more sites including Puttakota, Edlapadu mandal, Guntur district; Nagarkurnool (16.46°N, 78.34°E), Nagarkurnool mandal, Mahabubnagar district; Kalvakol (16.18°N, 78.34°E), Kollapur mandal, Mahabubnagar district and Pocharam (18.12°N 78.21°E), Medak mandal, Medak district.

Threats and conservation

The population of Indian pangolins in the nature has been decreasing due to large scale poaching for the scales, meat and medicinal usage (Molur et al. 2005). Hunting and habitat loss, alteration of habitats due to plantation, increasing human activities at their habitats, pest control practices and forest fires have made these scaled mammals one of the most vulnerable groups. Available information suggests that Indian pangolin populations are increasingly under threat throughout their range due to domestic and international demand for live pangolin, skin, scales and meat. Pangolin scales are extracted after killing and skinning the animal. Scales from one adult animal weigh an average of 1kg. The recent record of the species from Vishakhapatnam district as reported by Murthy and Mishra (2011) based on road kill individual flags the negative impact of vehicular traffic on small mammals, especially so in areas within or adjacent to Protected Areas. All the sightings that we are reporting are based on specimens poached either for consumption locally, for sale in town markets or for medicinal values, as has been observed in Guntur district where a general belief that the meat of the Indian pangolin having curative property for AIDS is prevalent. The biology of Indian pangolin, with particularly low reproductive rates and a large distribution, make them vulnerable to over-exploitation. Considering the vulnerability, Indian pangolin is included in the Schedule I of the Wildlife (Protection) Act, 1972, and thereby totally protected throughout the country. The species has been listed as Near Threatened globally (Molur 2008) and Vulnerable in South Asia (Molur et al. 2005). Site based actions in protected areas, recovery management and detailed studies on Indian pangolin its impact on the ecosystem needs to be carried out for better conservation.

Acknowledgements

We thank the facilities provided by Head, Department of Zoology, Osmania University, Hyderabad. We are also grateful to the Andhra Pradesh Forest Department for encouraging wildlife studies in Andhra Pradesh.

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Recent Observations of Black Giant Squirrel *Ratufa bicolor* (Sparrman, 1778) in the Vicinity of Makalu-Barun National Park, Nepal

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We present some recent observations of black giant squirrel *Ratufa bicolor* from the vicinity of Makalu-Barun National Park (MBNP) in eastern Nepal.

***Ratufa bicolour* observed in eastern Nepal**

Dead skin of *R.bicolor*

Observation 1: Between Seduwa and Num

The first observation happened on January 3, 2010 on our route from Seduwa (National Park Headquarters) to Num *bazaar* through an undisturbed sub-tropical broadleaved forest. *Schima wallichi*, *Bombax ceiba* were the dominant vegetation in the area. We observed some raw seeds of *Schima wallichi* falling in the ground in front of us. We looked up towards the canopy and saw an animal with yellowish underparts. Such was its similarity with yellow throated marten (YTM) *Martes flavigula* that we were convinced that it was one. Our mind was dominantly preoccupied by YTM since we had captured more than 20 YTM pictures in our preceding camera trapping efforts in the area and we also knew that the species is sometimes arboreal. We took some pictures and in the process it started leaping from canopy to canopy. The altitude of the point is 1130 meters and the gps coordinates is N: 27° 33.668' E: 087° 16.826'.

Observation 2: Between Seduwa and Num

The second observation was not of a live animal but the skin of a dead one. The place where the pelt was recorded was not far away from the first site of observation. The animal was killed by a boy mistaking it for a masked palm civet *Paguma larvata.* It was killed in cardamom plantation which needs a fair amount of shade thus also supporting squirrels. Interestingly, the boy who killed the squirrel had kept its skin hanged in a bamboo pole in his potato field in order to avoid chickens entering the field. The coordinates of the point is N: 27° 33.590' E: 087° 16.929' and it was situated at an elevation of 1350 meters.

Observation 3: Below Num on the way to Dobhan

The third sighting was done on the eastern side of the Num *bazaar* on the way to *Dobhan* (Confluence of Arun river and Khoktak *khola* which means a small river in local language). The species was feeding on the seeds of *Schima wallichi* this time too. The sighting was done at N: 27° 33.434' E: 87° 17.801' and an elevation of around 1300 masl. The forest was dominated by *Castanopsis spp., Quercus* spp., *Schima wallichi* and *Populus ciliate.* The animal was playing on the canopy of a *S. wallichi* tree which was just on the side of the trail. It was not shy of us while we were busy taking its pictures. We observed the animal for more than ten minutes. It started leaping from branch of one tree to another after it heard the sound of bells of ponies.

Discussion

Nepal is believed to be the westernmost range for black giant squirrel (Molur *et al.* 2005). The species is listed as a near threatened by IUCN (www.iucnredlist.org). Habitat loss through much of its range is the prominent reason for its decline around the world which is estimated to be around 30% in the last 10 years (Watson *et al.* 2008). In Nepal they inhabit broadleaved and evergreen forests in the distributional range from

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500m to 2000m a.s.l. (Baral and Shah 2008, Suwal *et al*. 1995). This is also the largest squirrel species in the country and is also the most threatened one in view of its occurrence mainly outside protected areas, in fragmented locations and with a continued population decline (DNPWC 2010). They are victim of Retaliatory killing and people believe them as the pest at MBNP, Sankhuwasabha district (Dahal and Thapa 2010). Moreover the species has also been killed in the country as a result of its occurrence in the forests nearby cardamom plantations which is a beneficial cash crop in the hills of the country (personal observation). The population size of this species is crudely estimated to be approximately 500 individuals and considered to be in decline (DNPWC 2010). It has been reported from Makalu-Barun National park (MBNP), Rara national park (RNP) and Ilam district in eastern Nepal (Suwal *et al.* 1995, Ghimirey 2010) however its current distribution in the western Nepal needs to be ascertained.

Three observations of the species were done including one dead specimen during three visits though the incidences of observation is too small to advice any kind of conclusion about its indication of rarity or availability. Whatever the reason for its frequent sightings, the habitat in which it was observed makes it a little bit more susceptible to human persecution. The species was sighted in the forests with cardamom plantation on both occasions. Cardamom plantation is expanding in the area because it requires less effort and fetches good market price in the hills where hard cash is rare (*www.agripricenepal.com/newsdoc/20090716150653.pdf)*. Sankhuwasava district, where MBNP lie, is one of the five largest producers of cardamom in Nepal (ADB 2010) which will only help in increasing the problem of its conflict with humans further.

Also there is another dimension to its conflict with humans. Since it has been noticed around cardamom plantations in the study area it can be mistakenly identified as Masked palm civet *Paguma larvata* in many cases. Masked palm civet is sympatric with black giant squirrel and has been recorded in both evergreen and deciduous forest even when the habitat is disturbed a little (Duckworth *et al.* 2008). In MBNP they are found to prefer forests (sub-tropical and temperate) with cardamom plantations (Ghimirey 2010). This species of civet is considered to be a serious pest by people who cultivate cardamom and since black giant squirrel also occurs in the similar type of habitat, however not compulsorily with cardamom plantation, it is always prone to killing by people mistakenly. The boy had killed the squirrel by mistake. There was one instance where a person, during an informal discussion, showed black giant squirrel when he was asked to show *Kaala*, a local name for masked palm civet. This type of mistake further aggravates the conservation problem of the species which is already threatened by habitat loss.

Acknowledgements

We would like to thank CEPF grants in eastern Himalayas, WWF Nepal and Friends of Nature for funding the field work and logistical support. The help of different individuals during the field visits is highly appreciated.

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Observation on Nest-Site selection by Indian Giant Squirrel in Karlapat Wildlife Sanctuary, Odisha

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Abstract

Indian Giant Squirrel (*Ratufa indica*) is a top canopy dwelling species. The nesting of this squirrel was observed in Karlapat WLS in Odisha. 80 km^2 area out of 175 km^2 was covered by walking transects. The species was found to select a particular tree height for nesting. Further the personal interviews were made to understand the threats to the species in the sanctuary area.

Introduction

The ecology of squirrels from Asian countries has been scantily studied and published information is scarce. There are 3 species of Giant squirrels reported from India (Prater, 1971). Indian Giant Squirrel (*Ratufa indica*) is a diurnal and arboreal species. It is a top canopy dwelling species and rarely travels on the ground (Ramachandran, 1988; Borges.1989: Datta, 1993). Giant squirrels build nests using twigs and leaves in the higher canopy. *R.indica* builds eagle-sized nests in the branches of trees and raises the young there until they begin to emerge from the nest and gain independence (Borges, 1992; Nowak, 1999).

Several articles have appeared pertaining information on *R. indica* from India. Borges (1989) studied the resource heterogeneity and the foraging ecology of *R. indica* in Bhimashankar wildlife sanctuary of western India. Nest-site selection by the Indian Giant Squirrel in Sitanadi WLS was investigated by Kanoje, 2008, where it showed the differential use of plant species preferring plant species- *Terminelia tomentosa, Schleichera oleosa, Syzygium cumini, Shorea robusta* and *Mangifera indica*. *R. indica* is a solitary living species, constructs globular nests or dreys with leaves and twigs (Borges 1989; Thorington & Cifelli 1989; Ramachandran 1992). The giant squirrel constructs more than one drey during a season. Individual squirrels used more than four nests within a territory at given time (Rout & Swain 2006).

Fig. 2. Giant Squirrel (*Ratufa indica*) in Karlapat Wildlife Sanctuary

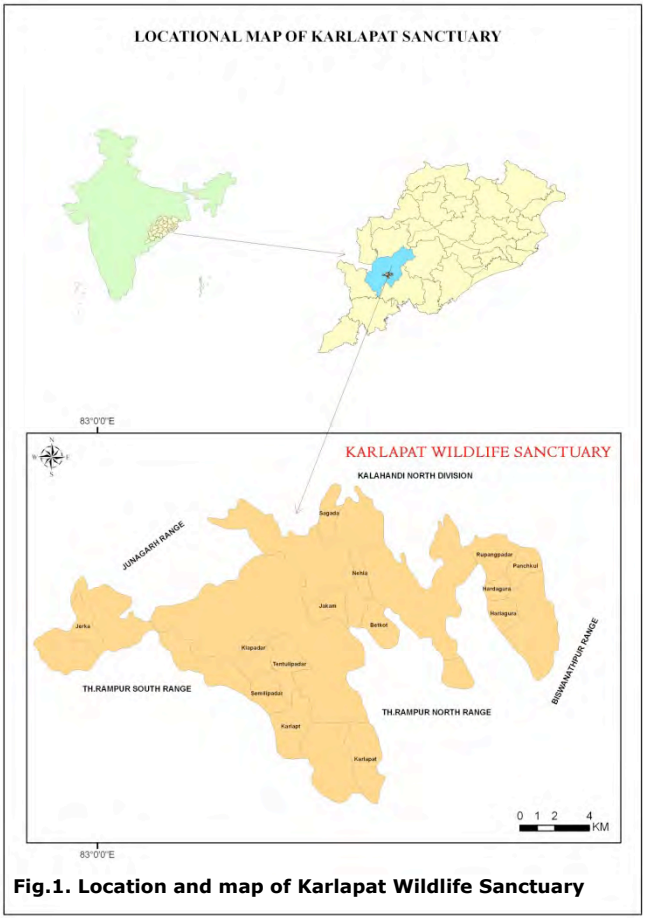

Fig.1. Location and map of Karlapat Wildlife Sanctuary

The present work was carried out in Karlapat Wildlife Sanctuary (WLS) which is centrally located in the district of Kalahandi between 82° 56′ 18′′ to 83° 19′ 35′′ East and 19° 36′ 50′′ to 19° 50′ 51′′ North in southern Odisha. Karlapat WLS comprises of an area of 175.503 Sq km of both primary and secondary forests. Altitude of the sanctuary ranges from 400 m to 996 m from mean sea-level (m-msl). The sanctuary consists of six forest blocks namely Karlapat Reserve Forests (RF) (70.77 Sq km), Nehla RF (39.56 Sq km), Jugsahipatna RF (20.84 Sq km), Jerka RF (27.54 Sq km), Sagada RF (10.69 Sq km) and Jugsahipatna Protected RF extension (6.095 Sq km). The forest types identified in the sanctuary are moist peninsular Sal, moist mixed deciduous, Boswellia forest and riparian semi evergreen forest as per the forest classification by Champion and Seth, 1968.

Material and Methods

The study was conducted for the period from Feb., 2009 to June, 2009 with the objectives of studying the status and current threat to Indian Giant Squirrel within the Karlapat WLS. A total of 80 km^2 area in all the six blocks was covered through line transacts from early morning to evening each day. Observations were taken on the direct sightings and nests of the species. Number of nests on the

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tree was recorded and the tree height, height of the nest from the ground was estimated visually. Additional information on sighting of the squirrel, preferred areas, changes in population since last 5 years and illegal hunting and poaching were collected through personal interviews in the villages falling within or on the boundary of the sanctuary.

Result and Discussions:
Altitude appears as a limiting factor for the distribution of the squirrel. In our study the squirrels were observed in the altitudinal range from 400 to 700 m-msl. Most of the sightings were within the altitudinal range of 550-650 m-msl; and after 750 m-msl no animal was sighted within the sanctuary.

In total 277 nests of Indian giant squirrels were recorded during our observation. A total of 37 tree species belonging to 21 family and 31 genera were used to build the nest by the animal within the sanctuary. The trees such as *Terminalia alata, Anogeissus latifolia, Schleichera oleosa, Desmodium oojeinensis, Shorea robusta, Mangifera indica,* and *Xylia xylocarpa* were found having a larger proportion of observed nests. However the tree-height of the selected plant and height of the nest from the ground were quite consistent. Average height of the selected trees was 11.08±0.32 m and average height of the nest from the ground was 9.64±0.29 m.

Kumara and Singh, 2006 have reported the most observations at a height of 16-20 m in the wet forests and 11-15 m in dry forests. We had 133 direct observations and the animals were observed at a height between 8-20 m which is in accordance with Kumaran and Singh for dry forests.

Interaction with the local community revealed a considerable decline of the population of Indian Giant squirrel since last 5 years (2004-2008) due to poaching. Poaching incidents have increased over the years, as there were 37 incidents in 2004, followed by 27 (2005), 9 (2006), 39 (2007) and 50 (2008). Rampant forest fire, illegal tree failing, encroachment into forest for agriculture, plantation of non-native trees, construction of roads and micro-hydro projects and mining are the current threat to the flora and fauna of the sanctuary.

Acknowledgement
This study was conducted as part of first author's M.Sc. dissertation. He is thankful to Dr. Prautush Mahapatra, Dr. Prasad Dash and Rupa Majhi for their support during the field work. The Director of Vasundhara (NGO) from Bhubaneswar is duly acknowledged for the financial support.

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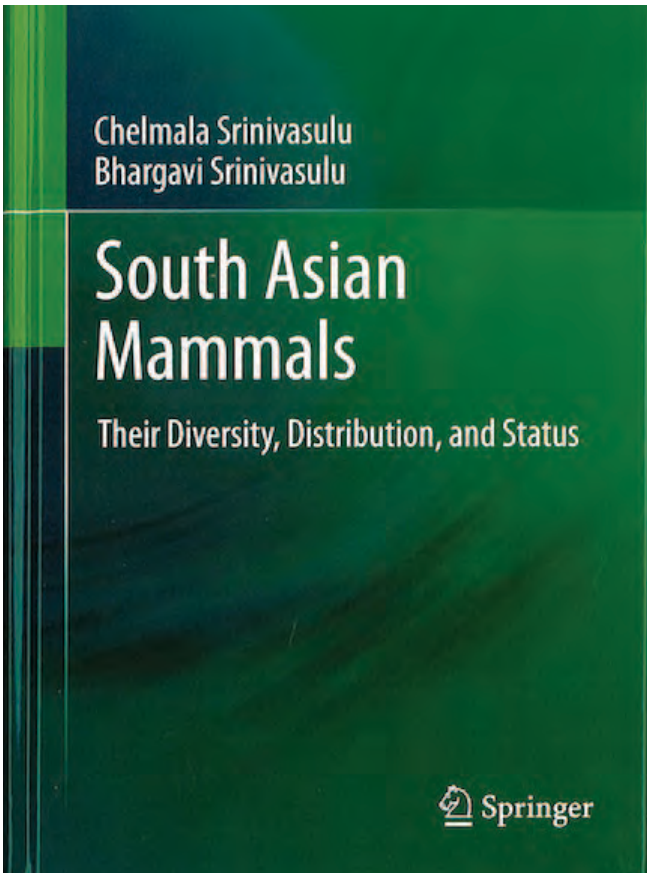
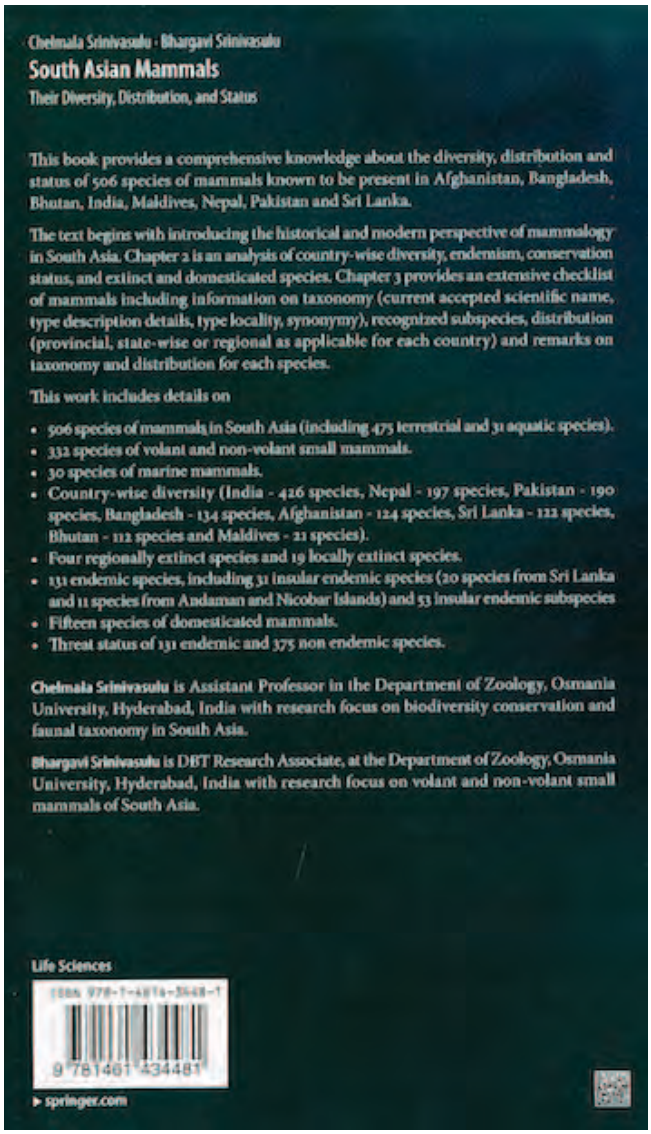
New Book on "South Asian Mammals: Their Diversity, Distribution, and Status"

Publication Date: **May 23, 2012** | ISBN-10: **1461434483** | ISBN-13: **978-1461434481** | Edition: **2012**



Until now, information on mammals in South Asia has never been brought together on a single platform providing all–inclusive knowledge on the subject. This book is the most up–to–date comprehensive resource on the mammalian diversity of South Asia. It offers information on the diversity, distribution and status of 506 species of terrestrial and aquatic mammals found in Afghanistan, Bangladesh, Bhutan, India, Maldives, Nepal, Pakistan and Sri Lanka. This work is unique being the first of its kind that deals with diversity and distribution at the subspecies level. The book is divided in to three chapters. Chapter 1 introduces the subject and takes off from the recent works on mammals at the global level, provides an historical perspective on mammal studies in South Asia and concludes with a note on recent phylogenetic changes at supraordinal levels. Chapter 2 summarizes the information on the diversity of South Asian Mammals, provides analysis by country of mammalian diversity (supported by data in tabular form) dealing with species richness, endemism and possibly occurring species, separate analysis for each country with details on endemic and threatened species, extinct mammals, domestic mammals, and finally the IUCN status of mammals with special emphasis on threatened mammals. Chapter 3 is a comprehensive checklist that provides information on each species, including its scientific name, type details, standardized English name, synonyms, subspecies, distribution and comments on taxonomic status. Country–wise listings and analysis of species richness with emphasis on subspecies distribution Most of the analysis is supported by data in tabular forms for better understanding Notes on extinct and domesticated mammals as well as their IUCN Red List Status with criteria for such status A very comprehensive bibliography that would help readers track down specific literature

From the reviews: "Chelmala Srinivasulu and Bhargavi Srinivasulu (both, Osmania Univ., India) focus on extant and recently extinct mammals from this region. The volume is dominated by the nearly 300-page checklist of 506 species … . Each species entry includes the original reference, type locality, synonyms, subspecies, distribution, and comments. … Summing Up: Recommended. … Graduate students through professionals interested in South Asian mammals." (E. J. Sargis, Choice, Vol. 50 (3), November, 2012).



On the Occurrence of the Large Brown Flying Squirrel (*Petaurista philippensis*) in Andhra Pradesh, India

Rachakonda Sreekar[1,2], C. Srinivasulu[3*], Ashwin Naidu[4] and Imran Siddiqi[5]

The Large Brown Flying Squirrel (*Petaurista philippensis*) is a globally least concern (LC) species but has been assessed as near threatened (NT) species in South Asia (Walston *et al.* 2008; Molur *et al.* 2005). The global range of this species is in China, India, Lao (People's Democratic Republic), Myanmar, Sri Lanka, Taiwan (Province of China), Thailand and Viet Nam (Fig. 1) and within India it has been reported from Andhra Pradesh, Bihar, Chhattisgarh, Gujarat, Jharkhand, Karnataka, Kerala, Madhya Pradesh, Maharashtra, Rajasthan and Tamil Nadu (Fig. 1). This species is known to inhabit the tropical and subtropical dry deciduous, tropical and subtropical moist deciduous and semi evergreen to evergreen forests (Molur *et al.* 2005).

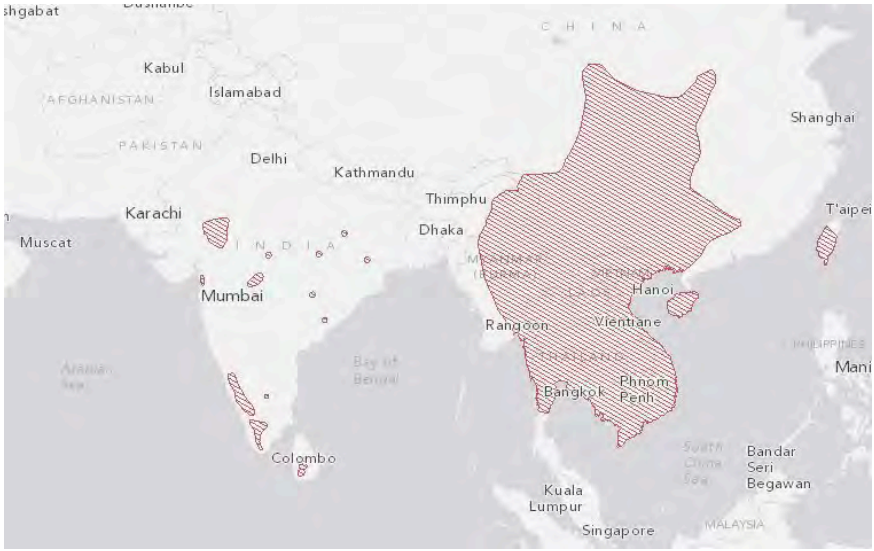


Fig 1. Global distribution of Large Brown Flying Squirrel *Petaurista philippensis* (after Walston *et al*. 2008).

In Andhra Pradesh, this species has been sighted by one of us (CS) from five locations in the forests within the Godavari river basin in Karimnagar and Warangal districts between 1997 and 2000. The locations in the Karimnagar district were highly disturbed forests and the places where the species has been sighted is highly degraded forest now (recent surveys conducted were in mid-2010 to mid-2011). The other locations in Warangal district are in the Eturnagaram Wildlife Sanctuary that has good forested tracts still remaining and the promises to hold populations of this species, however, it has not been sighted since last decade. The report of this species from Eastern Ghats in Visakhapatnam district is based on sightings in late 1980s (S. S. Saha pers. comm.) and there has been no recent reports since long. All these sightings have been included by Molur *et al.* (2005), but Walston *et al.* (2008) retained only Visakhapatnam in its range within Andhra Pradesh. Perhaps, it was deemed that the reports of this species from the Godavari river basin as improbable due to lack of any reliable evidence (like a photograph or a specimen).

Fig 2. Specimen of Large Brown Flying Squirrel *Petaurista philippensis* encountered at Kawal Wildlife Sanctuary, Andhra Pradesh (Note the head injury)

This species has been sighted on three different occasions at Kawal Wildlife Sanctuary, Adilabad district, Andhra Pradesh in 2007. The first sighting was that of a dead specimen (Fig. 2) on 5 June 2007 at 1730 hrs. at Maisamma Loddhi (Fig. 3), near Kawal village. Careful examination of the specimen revealed no bodily injuries excepting scraped skin on the head

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Fig 3. Distribution of Large Brown Flying Squirrel *Petaurista philippensis* in Andhra Pradesh; sighting records (yellow circles) and specimen-based record (red circle), 1 – Jyothimamidi, Vishakapatnam district, 2 – Tadwai, Warangal district, 3 & 4 – Sarvai & Venkatapuram, Warangal district, 5 – Azamnagar, Karimnagar district, 6 – Chintakani, Karimnagar district, and 7 – Maisamma Loddhi, Adilabad district; State borders in red, Eastern Deccan Plateau border in yellow, districts in which the species has been sighted hatched green.

(Fig. 2). We assume that the flying squirrel had died due to a heavy hit on the skull, possibly from a falling branch. Later, this species was twice sighted in late 2007 from the same vicinity.

The Large Brown Flying Squirrel is an arboreal and nocturnal and crepuscular animal. The sightings of this species has been limited, at least in the Godavari river basin of Andhra Pradesh, due to limitations of conducting night surveys due to naxalism threat and all the sightings have been opportunistic. This species' distribution in Andhra Pradesh is from the Highland Moist to Dry Deciduous forests of the Eastern Deccan Plateau region (Olston & Dinerstein 1998) and future surveys will yield more evidence of its presence here.

Acknowledgements

CS acknowledges DBT, Government of India for research grant and facilities extended by Osmania University, Hyderabad. Thanks to Aditya Srinivasulu for help with mapping.

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Daytime feeding in the diurnal roost by the Indian flying fox, *Pteropus giganteus*

Augustus Robince P., J. Dhivahar and S. Suthakar Isaac

The Indian flying fox, *Pteropus giganteus* is widely distributed in the tropics and subtropics of Asia, Australia, Indonesia, islands of East Africa, and a number of remote oceanic islands in both the Indian and Pacific Oceans (Nowak, 1999). It is a colonial species that lives in large diurnal roost which may comprise hundreds or even thousands of individuals. This species commonly roosts in trees such as *Terminalia arjuna, Bassia latifolia, Ficus bengalensis, Cassia siamea, Termarindus indica, Ficus religiosia* and *Mangifera indica* (Dhivahar and Isaac, 2012).

Generally, the foraging activity of bats under natural conditions exhibits temporal variations. Peak feeding visits occur at different times during nights for different species of bats (Elangovan et al., 1999). In sourthern part of Tamilnadu, it is reported that *Rousettus leschenaulti* and *Cynopterus sphinx* exhibited two peaks of foraging activity, immediately following nightly emergence (18.30- 20.00h) and before individuals returned to their day-roost (4.00- 6.00h). But *P. giganteus* exhibited a unimodel foraging pattern that peaked between 19.00 and 21.00h (Stephenraj et al., 2010).

In the present study, a small colony of *ca*. 20 individuals were roosting in *Ficus religiosa* tree in Ambalamukku temple campus, at pattoor near Thiruvanathapuram. We had a serendipitous observation on a group of bats feeding on the fruits of *Ficus religiosa* of the day roost site during the day time. About 7 bats were found feeding on the fruits at 3.00 pm on 23rd October 2012. The climatic condition was cool, cloudy and drizzling. We didn't continue the observation for more than 30 minutes and so we don't know the total duration of feeding in the day roost.

Generally, fruit bats show two bouts in their foraging activity, dusk and dawn. *P. giganteus* shows greater duration of foraging bouts and but lesser number of feeding visits compared to that of *C. sphinx* and *R. leschenaulti* (Augustus, 2011). The significantly greater duration of feeding bouts of *P. giganteus* facilitate to conserve its energy that is needed to exhibit commuting flights, since flight cost increases with increase in body mass. As large flying foxes usually commute to longer distances in search of food, to fulfil the energy requirement, they were observed to have large intake of food (Nelson, 1965).

Bats feeding during daytime may not be common as they are nocturnal animals. The day feeding activity observed even though in a small group of bats for a brief period may have some physiological implications. Suggested reason may be need for energy before they emerge for foraging as the bats might not have enough food due to scarcity or due to disturbed feeding bouts owing to the rain in the previous nights. The bats also got an opportunity to feed in the day as the fruits happened to be available in the same day roost. Further studies are needed on energetics of this larger fruit bat and pattern of foraging flight during disturbed foraging periods such as rainy and windy nights including drought fruit seasons.

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New Encounters during Expedition with Bat Detectors in KMTR

Juliet Vanitharani, S. Selva Ponmalar and C. Mercy

Bats being a bio-indicator really help to learn more about the habitat requirement. Recent proposal regarding opening of tourism in Kalakad Mundanthurai Tiger Reserve made a curiosity to assess the bat activity at Mundanthurai range. Wide range of stress that influence bats have the same effect on many other taxa. Bats' graded responses to habitat degradation correlated with responses of other taxa too. During our survey on bat's incredible diversity, monitoring of bat populations (thro' acoustic monitoring-Pettersson D240x), bat species richness (thro' Anabat SD2 detectors), we have encountered two new bat species among the activity of 17 bat species at Mundanthurai. Through this article we report the presence and distribution of *Rhinolophus acuminatus*, and *Hipposideros einnaythu* for the first time from Mundanthurai, KMTR, Tirunelveli district, Tamil Nadu. S. India.

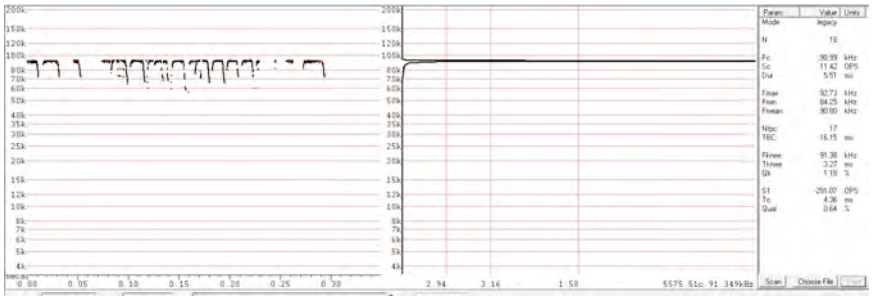
Report about the new encounter *Rhinolophus acuminatus*
Order: Chiroptera
Family: Rhinolophidae
Common Name: Acuminate horseshoe bat
The Family Rhinolophidae consists of horseshoe bats distributed in the temperate and tropical regions of southern Europe, Africa, and Asia south to northern and eastern Australia (Simmons 2005; Hutcheon and Kirsch 2006). During the acoustics diversity investigation at various sites of KMTR, during the month of April 2012, we encountered a roosting colony of *Rhinolophus acuminatu* (Fig 1) at Kuravan kuzhi, a cave over streams inhabited by thick forest vegetation at Mundanthurai (N 08° 37 546, E 077° 17 532) with an altitude of 1648 ft. The dull brown or reddish brown *R. acuminatus* have leaf-like, horseshoe-shaped protuberances on their noses. Their wings are broad, making their flight particularly agile.

The collected morphological measurements (in mm) from 2 species of *R. acuminatus* are given in the Table.

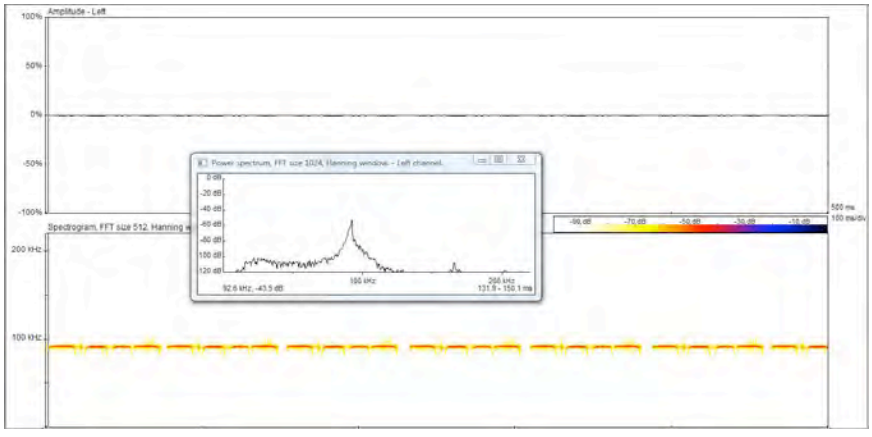
Fig.1: *Rhinolophus acuminatus*

Body Weight (W)	Forearm (FA)	Ear (E)	Tail (T)	Hind foot (HF)	Head-Body Length (HB)	Tibia (T)	Nose Leaf (NL)
13	52.7	16.2	26.5	8.1	52.6	23.2	6
14	49.1	17	23.4	9.7	50.8	20.6	5.9

Table 1: Morphological measurements (in mm) from 2 species of *R. acuminatus*



Recorded *R. acuminatus echocalls by Anabat SD2*



Recorded *R. acuminatus echocalls* by Pettersson D240x
Fig. 2: Frequeny and shape of Echo call of R. acuminatus

Esselstyn *et al* (2004) has reported these acuminate horseshoe bats roost as colonies in diverse habitat of Palawan island of Philippines, they prefer caves, hollow trees, and some time these species sleep in the open, among the branches of trees near caves over streams, and in bamboo thickets. In peninsular Malaysia, they have been found roosting singly and in

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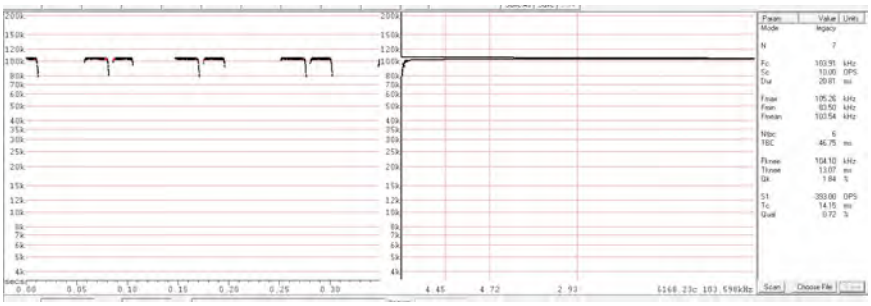
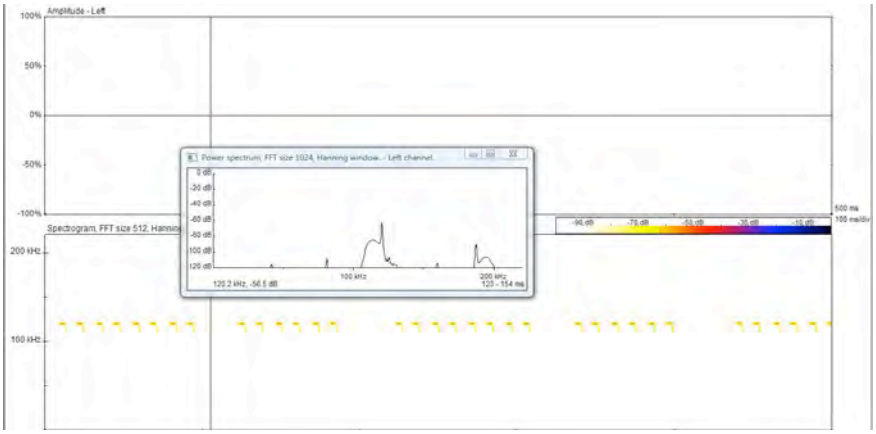
Fig.3 *Hipposiderous einnaythu*



Recorded *H. einnaythu echocalls* by Anabat SD2



Recorded *H. einnaythu echocalls* by Pettersson D240x
Fig.4:Frequeny and shape of Echo call of H. einnaythu

W	FA	E	T	HF	HB	Tib	NL
10.5	40.7	19.9	28.4	6.3	44.9	18.1	4.6

Table 2: Morphological measurements (in mm) of *H.einnaythu*

pairs under palm leaves (Kingston *et al*. 2006).

These insect eating bats forage by producing sound waves and detect the prey through echolocation (Pierce and Griffin 1938; Schnitzler *et al*. 2003). Echo calls were recorded at the roosting colony. Their calls were then analysed through software to find out the frequency, shape and activity pattern of the species (Fig 2).

Bat species differ by modifying the structure and emission pattern of their calls. The frequency range and duration of calls vary within species depending on behavioural mode and between species depending on foraging strategy. The frequency of *R. acuminatus* ranges from 90-97 kHz. The collected morphological measurements (in mm) from 2 species of *R. acuminatus* are given in the table 1.

Report about the new encounter
Hipposideros einnaythu
Order: Chiroptera
Family: Hipposideridae
Common Name: House-dwelling leaf-nosed bat
The Family Hipposideridae consists of Leaf-nosed bats. These members are the widespread old world family with a range that extends from Africa and Madagascar to Arabia, India, South-east Asia and Australia (Koopman 1993). During our acoustics diversity investigation in various sites of KMTR, we have captured (through mist netting), a single *Hipposiderous einnaythu* species from the foraging area near a dam site tunnel at Mundanthurai (N 08° 41 427, E 077° 18 394) with an altitude of 1074 Ft (Fig 3) .

The bat was grayish brown in colour and consists of a horizontal horseshoe like nose leaf with accessory folioles, an intermediate leaf and a posterior leaf. The ears are pointed and separate. Most of the Hipposideridae species are very gregarious and live in large colonies; others are solitary and roost in small groups or alone. They commonly prefers roost in old deserted manmade structures, tunnels and in caves (Hill and Smith 1984). Hipposiderids feed on insects and forage by producing sound waves to detect the prey through echolocation (Pierce and Griffin 1938; Schnitzler *et al*. 2003). Echo calls were recorded and then analysed through softwares to find out the frequency, shape and activity pattern of the species.The frequency of *H. einnaythu* ranges from 120-130 kHz (Fig 2).

The collected morphological measurements (in mm) from *H. einnaythu* are given in the table 2.

Acknowledgement
We acknowledge Harrison Institute UK for species identification and Tamil Nadu Forest Department for granting permission and field assistance in KMTR forest area, Western Ghats Tamil Nadu, India.

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Light-coloured Squirrel

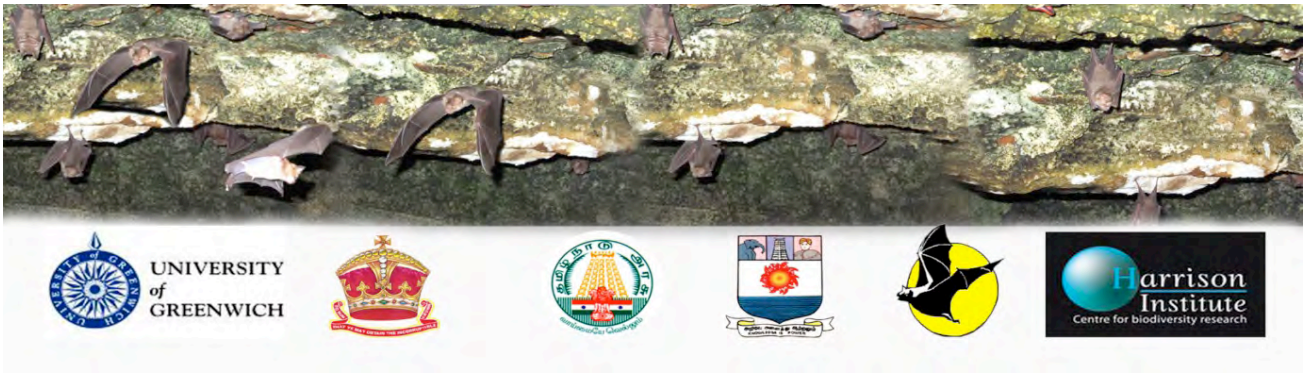
The accompanying photograph shows an unusually light coloured three palm squirrel that I saw at the Children's Park zoo, Guindy, in March 2011. A few months later, a friend, Mr. Ramanan, photographed another similarly coloured squirrel in the city.

I am interested in knowing if Small Mammal Mail readers have come across such squirrels. If yes, could they please send in the details.

Kumaran Sathasivam
k_sathasivam@hotmail.com

Bat calls from India - International bat Acoustics workshop 2012

Tanja Straka*



Conveners
Dr. Juliet Vanitharani, Prof. & Head, Zoology Dept. & Research Centre (Bat Research Laboratory), Sarah Tucker College, (Autonomous),Tirunelveli-627 007,Tamil Nadu
Dr. H. Malleshappa IFS, CCF & Field Director-KMTR, Executive Director KMTCF, Kalakad Mundanthuari Tiger Reserve, Southern Western Ghats, Tamil Nadu.
Dr. Nikky Thomas, Scientific Officer, Harrison Institute, United Kingdom, www.harrison-institute.org
Dr. Bebbie Bartlett, Conservationist, Greenwich University, United Kingdom.

KMTR Tiger Reserve, Tamil Nadu (left) and opening of the workshop (from left to right: Tanja, Hayden Torr, Richard Crompton, Dr. Debbie Bartlett, Dr. Nikky Thomas and Dr. Juliet Vanitharani with three of her colleagues.

India is a hotspot for biodiversity, particularly in relation to bats, with 114 currently known bat species (13 megabats, 101 microbats) which represents 20% of the subcontinent's mammal species. This large proportion shows the need to foster acoustic monitoring techniques and establish regional databases to enable the inventory of bat species in regions of high biodiversity, which are found all over the Indian subcontinent. To address this demand, a microbat acoustic workshop was held to enhance the understanding and practical application of acoustics in the study of bat diversity in India, and to build a network of academic researchers from South and South-East Asia as well as from Europe and Australia. In the long term, this project aims to gather bat calls from several regions in India and their neighbours such as Nepal and Sri Lanka into a central call library which will enable local scientists to use and share them for their monitoring projects. The workshop took place 22-25 April 2012 at the Kalakadu-Mundantharai Tiger Reserve (KMTR) in Tamil Nadu, South India. The reserve is considered to be one of the world's biodiversity hotspots. The long rainy periods (about eight months) give this rich forest reserve with 14 rivers and streams not only abundant habitat for tigers, leopards, crocodiles and macaques, but also large numbers of endemic plant and animal species. It is also a perfect place to find a high diversity of bat species! How excited I was to be able to take part in this workshop in such a stunning reserve! Twenty-two researchers and students from several states in India (Kerala, Andhra Pradesh, Rajasthan, Maharashtra, Karnataka and Assam) were invited to attend this ultrasonic training workshop. In addition, 14 international delegates from Lao PDR, Nepal, Sri Lanka, Thailand, Germany/ Australia and United Kingdom took part.

The workshop was organized by Dr. Juliet Vanitharani (Department of Zoology and Research Centre of Sarah Tucker College) and Dr. Nikky Thomas (The Harrison Institute, United Kingdom), and sponsored by the Harrison Institute, the University of Greenwich and Tamil Nadu Forest Department. Following the workshop, Pettersson Elektronik and Titley Scientific donated ultrasonic equipment and software to delegates from several states of India to use and gather reference calls.

What did we learn and experience from the workshop?
First of all, it was of course a great meeting of bat students and researchers, who shared ideas and knowledge and were very keen to learn more about acoustic monitoring. Richard Crompton, the UK Titley representative, gave a demonstration of the Anabat detector, the software and smart functions to use for the analyses. Dr. Nikky Thomas from the Harrison Institute gave an overview of Pettersson detectors; the differences between full spectrum and zero crossing recordings and of course tips on how to use the software. During the sessions and while participants worked on their first analyses, the PhD students Boun from Lao PDR, Pipat from Thailand and myself were engaged as demonstrators. *The evening sessions* The evenings of the workshop were dedicated to the actual recordings, including active and passive monitoring of bat activity as well as gathering initial reference calls from captured bats. In small groups we went to rivers and paths of the forest to set up harp traps and mist nets and to undertake recordings. Kumar, Juliet´s field assistant, was very innovative in building a small "Anabat hut" for the stationary monitoring. With just a few sticks, strings and some covering material he created this protection for the Anabat over night.

What bats did we catch?
We caught around 10 different bat species during the workshop and gathered their reference calls. Some of the captured bats were *Myotis*

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Fig. 2. KMTR Tiger Reserve.

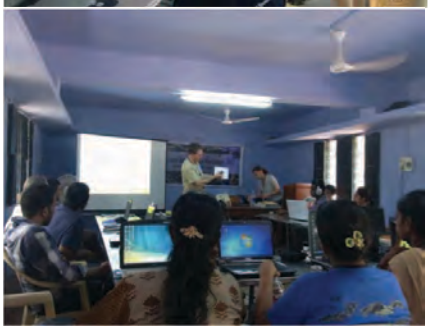

Fig. 3 & 4. Introduction to ultrasonic detection. Richard Crompton introducing Anabat and Dr. Nikky Thomas the Pettersson.

Fig. 5, 6. Students and Dr. Juliet Vanitharani recording with Pettersson and Anabat detectors.

Fig. 7. Kumar making the "Anabat hut".

Fig. 8. Harp trapping. Figs. 9 and 10. Two of the captured species: Myotis horsefieldii and Megaderma spasma.

Fig. 11 & 12. Other fauna encountered including a macaque and a peacock.

Fig. 13 and 14. One of the rivers in the reserve and tea break in the mountains from left Boun, Abi, Pipat and Tanja.

horsfieldii, Pipistrellus tenuis, Hipposideros cf einnaythu, Hipposideros fulvus, Hipposideros speoris and *Rhinolophus acuminatus.*

Any other animals other than bats?
But of course, in such a stunning forest like this we also had the chance to experience more wildlife other than our immediate focus. Such as the macaques! During lunch we had to be very cautious of these smart animals as they just waited for a moment when we were inattentive so that they could pinch some snacks. And of course also the graceful peacocks, the national bird of India, were curious about us while we were sitting outside eating delicious Indian food.

After four days of working and learning together, sharing ideas and knowledge, and building new friendships, most of the participants had to return to their states and countries. Everybody seemed to be excited now about being able to set up their own local monitoring projects and to gather their own reference calls of their regions. Some lucky ones, myself included, stayed for a few more days with Dr. Juliet Vanitharani to explore some of the bat caves in the mountains of the tiger reserve. After climbing up the mountains, we were rewarded with caves inhabited by bats such as *Hipposideros* spp. and *Rhinolophus* spp. I am really grateful that I was able to take part in this workshop. And after this experience I can just repeat myself that bat people are just great individuals wherever you meet them across the globe.

What has happened since the workshop and where next?
The collection of reference calls in India continues and since April 2012, there have been collected in Tamil Nadu alone enough reference calls from 17 different bat species (both with Anabat and Pettersson detectors) for the bat call library. If you would like to support this project with spare equipment such as mist nets or harp raps, feel free to get in touch with Tanja and I will make sure that it will go into the right hands in India. Thank you, Tanja.

Status Survey and Conservation Education Campaign: A Community participation approach to protect bats in Rajasthan parts of the Thar desert

K.R. Senacha

Editor's Note: This article is the report of the project on bat conservation awareness programme funded by Rufford Small Grants (Ref. 11950-B). The study area has recorded depletion in populations and species diversity of bats over last two decades. Misconceptions and dearth of awareness among locals about the importance of bats and its conservation are the major reasons for their decline. The project reports about various awareness programmes conducted in Thar desert and its impact. The entire project was executed with the support of Indian Bat Conservation Foundation, Mumbai, India Ecology and Rural Development Society, Jodhpur, India Adarsh Mahavidhyalaya, Jodhpur, India.

Bats play vital role in an ecosystem as pollinators, seed dispersers and insect eaters. The Thar, an important ecosystem of western India have seen remarkable depletion in populations and species diversity of bats over the last two decades. Apparent among cited reasons for deterioration in diversity of bats in the Thar are prevailing myths about nature of bats and lack of awareness among locals about their ecological role and importance. Districts of Jodhpur, Jaisalmer and Bikaner represent more than 80% of the core desert area in Rajasthan part of the Thar. However Jodhpur was recently been thoroughly surveyed to explore diversity of bats and addressed to create bat conservation awareness among locals through the years 2007-2009 in RSG 1st Project, Bikaner and Jaisalmer remained unstudied. In RSG 2nd Project we intended to review the impact of RSG 1st bat conservation initiatives in Jodhpur and undertake a comprehensive survey to assess current status of bats and launch a similar bat conservation and awareness campaign in Jaisalmer and Bikaner districts.

The RSG 2nd Project was executed through the period of August 2010 to December 2011. A total of 245 roosts belonging to 11 species of bats (3 megachiropteran and 8 microchiropteran) were studied during this phase of project, of which 96 belongs to Jodhpur, 82 from Jaisalmer and 67 from Bikaner districts (Tables 1 - 6).

All, 96 bat roosts reported till the completion of RSG 1st from Jodhpur district, along with 11 and 9 explored previously from districts of Jaisalmer and Bikaner of the Thar Desert respectively were revisited and studied from species composition, population status and threats point of view. Moreover, 71 bat roosts in Jaisalmer and 58 in Bikaner districts were newly discovered, studied and being reported for the first time. Geoffroy's Trident bat, *Asellia tridens* reported here during survey in Jaisalmer district is not only a new species of bat for the Great Indian Desert but also first record from India.

Beside this, collectively 172 settlements (town/villages/ *dhani*s) were visited from Jaisalmer and Bikaner districts for bat conservation education campaign. Lectures themed of ecological significance, nature and diversity of bats in the Thar Desert were delivered in 4 colleges, 116 schools (112 co-ed. and 4 girl's school), 35 village *Panchayat Bhavans* and about 70 small gathering at different destinations. A sum of 10,000 pieces of informative educational material on scientific facts about bats of this region (500 big size, 1500 medium size posters/ 5000 postcards/ 3000 pamphlets) were prepared and distributed among target groups during this campaign in attempt to create conservation awareness and to educate locals about ecological significance of bats dwelling in their locality.

Geoffroy's Trident bat, *Asellia tridens* reported from Gajroop Sagar tunnel roost in Jaisalmer district of the Thar Desert.

Volunteers and Area Coordinator Mr. Vigil Wilson and Mr. Gajendra Singh while trying to catch a bat for identification purpose at Gajroop Sagar Tunnel roost at Jaisalmer district of the Thar Desert.

Co-ordinators of the Bat Clubs, initiated in selected schools of Jodhpur district while implementation of RSG 1st Project, were approached, interacted to have updates on their annual activities and suggestions of improvement for better achievement were received. Enthusiastic teachers and students at selected schools in districts of Jaisalmer and Bikaner were encouraged to start similar Bat Clubs, such that their participating members be educated and trained to play vital role in protection of bat roosts and disseminating the scientific information about bats and their environmental importance to locals and their upcoming generations. 18 schools and 2 colleges were

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Principal Investigator and Scientist In-charge of the project Dr. K. R. Senacha while interacting with locals of village Jhinjhiyali in Jaisalmer district of the Thar Desert and inquiring about the possible roosts of bats in their locality.

Public well at isolated location near village Nokhada in Bikaner district inhabits a colony of Greater Mouse-tailed bat, *Rhinopoma microphyllum* and Lesser Mouse-tailed bat, *Rhinopoma hardwickii*.

Principal Investigator and Scientist In-charge of the project Dr. K.R. Senacha while delivering lecture on species diversity, nature and ecological significance of bats of the Thar Desert to students of a private school located at RD 682 of IGNP in Bikaner district of the Thar Desert.

shortlisted near prominent bat roosts in the study area and motivated to formulate bat clubs (Table 7).

Response of locals and students participated in Bat Conservation and Awareness Campaign commenced at districts of Jaisalmer and Bikaner too was quite remarkable and comparative, if not more, to that received in Jodhpur district while implementation of this campaign in RSG 1st Project. Alike Jodhpur more than 98% of targeted audiences were unaware of ecological significance of bats and 70-80% of them had strong belief in popular myths like bats attack furiously on human nose and consider them as sign of sin. They explained that because of inadequate knowledge about nature and ecological significance, as well in influence of prevailing myths people here in the study area had never ever admired the presence of bats in their surroundings, which in turn pose serious threat of intentional damage to the existing bat roosts.

But, because of our sincere efforts of disseminating the concrete scientific information about nature and ecological significance of bats, through launching and execution of the bat conservation and awareness campaign under this project, people in the study area have updated their knowledge and realized that bats are indeed quite useful creatures and play imperative role to insure good health of an ecosystem. Upon learning the importance and natural facts about bats they appeared quite excited and confident of discarding their fear of bats attacking human nose and got rid of prevailing myths of considering bats as sign of sin.

Moreover, they started believing that bats are environmental friendly creatures and deeply appreciated the objective of bat conservation and awareness campaign in this project. They were also quite impressed upon learning the fact that such useful project is launched and financially supported by a foreign organization based in U.K. and truly admired the novel effort of the Rufford Small Grants Foundation to fund this project.

OBSERVATIONS AND RESULTS

(A)Survey and assessment of bat roosts:

Altogether eleven species of bats, 8 microchiropterans and 3 megachiropterans (Table 1, Photo gallery I and II) were reported from the study area i.e. Jodhpur, Jaisalmer and Bikaner districts of the Thar Desert, during this investigation from their 228 active roosts of the total 245 reported so far (Table 2 to 6).

All the seven microchiropterans, *Rhinopoma microphyllum, Rhinopoma hardwickii, Taphozous nudiventris, Taphozous perforatus, Scotophilus heathii, Rhinolophus lepidus* and *Pipistrellus tenuis* reported from Jodhpur district, during the investigation of RSG 1st Project through the years 2007 – 2009, were found dwelling there during this investigation. However, *Cynopterus sphinx* among the only two megachiropterans (*Pteropus giganteus* and *Cynopterus sphinx*) reported during investigation of RSG 1st Project was found missing from its only reported site of this species from Jodhpur district, i.e. Badi Haveli at Tinwari village in Osia Tehsil. Of the total 96 bat roosts reported so far from Jodhpur 11 were found deserted completely while 7 of the remaining 85 are found partially deserted, from species composition point of view, than what was observed during the investigation of RSG 1st Project (Table 2).

Survey of RSG 2nd Project in Jaisalmer district revealed that five species of microchiropterans are thriving here currently of which three, *Rhinopoma microphyllum, Rhinopoma hardwickii* and *Taphozous nudiventris* have already been reported from this region in recent past

Table 1: Taxonomic status of the chiropteran species reported from Jodhpur, Jaisalmer and Bikaner districts of the Thar Desert during this study

Name of the species	Common name	Family	Superfamily
Sub-order: Megachiroptera			
Pteropus giganteus (Brunnich, 1782)	Indian flying fox	Pteropodidae	-
Cynopterus sphinx (Vahl, 1797)	Shot-nosed fruit bat	Pteropodidae	-
Rousettus leschenaulti (Desmarest, 1820)	Fulvous fruit bat	Pteropodidae	-
Sub-order: Microchiroptera			
Rhinopoma microphyllum (Brunnich, 1782)	Greater mouse-tailed bat	Rhinopomatidae	Emballonuriodea
Rhinopoma hardwickii (Gray, 1831)	Lesser mouse-tailed bat	Rhinopomatidae	Emballonuriodea
Taphozous perforatus (E. Geoffroy, 1818)	Egyptian tomb bat	Emballonuridae	Emballonuriodea
Taphozous (Liponycteris) nudiventris (Cretzschmar, 1830-31)	Naked-rumped tomb bat	Emballonuridae	Emballonuriodea
Scotophilus heathii (Horsfield, 1831)	Asiatic greater yellow house bat	Vespertilionidae	Vespertilionoidea
*Pipistrellus tenuis (*Temminck, 1840)	Indian pygmy bat	Vespertilionidae	Vespertilionoidea
Rhinolophus lepidus (Blyth, 1844)	Blyth's horseshoe bat	Rhinolophidae	Rhinolophoidea
Asellia tridens (Geoffroy, E., 1813)	Trident bat	Hipposideridae	Rhinolophoidea

Table 2: Distribution of chiropterans reported earlier in and around Jodhpur of the Thar Desert and their current status

Roosting sites	Profile of bat species			
	Reported earlier (1961 to 2009)	Reported during the RSG 2nd study (2010-2011)	Missing	Addition
Megachiropterans status				
Balsamand Garden, Jodhpur (26.33361°N, 73.02361°E)	*Pteropus giganteus*	*Pteropus giganteus*	Nil	Nil
Rail Sadan, Jodhpur (26.27111°N, 73.01611°E)	*Pteropus giganteus*	*Pteropus giganteus*	Nil	Nil
Jeevati Samadhi, Keru (26.33960°N, 72.87443°E)	*Pteropus giganteus*	Nil	*Pteropus giganteus*	Nil
Khinyaniya well, Ramdwara, Balesar Satta (26.34848°N, 72.82760°E)	*Pteropus giganteus*	*Pteropus giganteus*	Nil	Nil
Chowk in Meghwal colony, Balesar Durgawata (26.35302°N, 72.83818°E)	*Pteropus giganteus*	Nil	*Pteropus giganteus*	Nil
Badi Haveli, Tinwari, Osia (26.46195°N, 72.92123°E)	*Cynopterus sphinx*	Nil	*Cynopterus sphinx*	Nil
Microchiropterans status				
Meharangarh fort, Jodhpur (26.29333°N, 73.02028°E)	*Rhinopoma microphyllum* *Rhinopoma hardwickii* *Megaderma lyra*	*Rhinopoma microphyllum* *Rhinopoma hardwickii*	*Megaderma lyra*	Nil
Mandore tunnel, Jodhpur (26.35250°N, 73.03306°E)	*Rhinopoma microphyllum* *Taphozous perforatus* *Hipposideros fulvus* *Megaderma lyra* *Rhinopoma hardwickii* *Rhinolophus lepidus*	*Rhinopoma microphyllum* *Rhinopoma hardwickii* *Taphozous perforatus*	*Hipposideros fulvus* *Megaderma lyra* *Rhinolophus lepidus*	Nil
Bheembhadak, Jodhpur (26.29611°N, 72.95750°E)	*Rhinopoma microphyllum* *Rhinopoma hardwickii* *Taphozous nudiventris*	*Rhinopoma microphyllum* *Rhinopoma hardwickii*	*Taphozous nudiventris*	
Lal Sagar, Jodhpur (26.32129°N, 73.05534°E)	*Rhinopoma microphyllum* *Taphozous perforatus*	Nil	*Rhinopoma microphyllum* *Taphozous perforatus*	Nil
Kaga, Jodhpur (26.29531°N, 73.05713°E)	*Rhinopoma microphyllum* *Rhinopoma hardwickii* *Taphozous perforatus*	Nil	*Rhinopoma microphyllum* *Rhinopoma hardwickii* *Taphozous perforatus*	
Balsamand garden, Jodhpur (26.333946°N, 73.024156°E)	*Rhinopoma hardwickii*	Nil	*Rhinopoma hardwickii*	Nil
Udai Mandir, Jodhpur (26.29462°N, 73.03655°E)	*Rhinopoma microphyllum* *Rhinopoma hardwickii* *Taphozous perforatus*	Nil	*Rhinopoma microphyllum* *Rhinopoma hardwickii* *Taphozous perforatus*	Nil
Shrinathji kee haveli, Mahamandir, Jodhpur (26.30667°N, 73.04361°E)	*Rhinopoma microphyllum* *Rhinopoma hardwickii* *Taphozous perforatus*	Nil	*Rhinopoma microphyllum* *Rhinopoma hardwickii* *Taphozous perforatus*	Nil
Open Convocation Center, JNV University New Campus, Jodhpur (26.24639°N, 73.02417°E)	*Rhinopoma microphyllum* *Rhinopoma hardwickii*	*Rhinopoma microphyllum* *Rhinopoma hardwickii*	Nil	Nil
Mehalado, Soor Sagar, Jodhpur (26.32972°N, 72.98806°E)	*Rhinopoma microphyllum*	Nil	*Rhinopoma microphyllum*	Nil

Roosting sites	Profile of bat species			
	Reported earlier (1961 to 2009)	Reported during the RSG 2nd study (2010-2011)	Missing	Addition
Krishna Nagar, Jodhpur (26.22861°N, 73.02806°E)	*Rhinopoma microphyllum*	Nil	*Rhinopoma microphyllum*	Nil
Sagee kee Bhakari, Jhalamand (26.21361°N, 73.11972°E)	*Rhinopoma microphyllum Rhinopoma hardwickiiTaphozous nudiventris*	*Rhinopoma microphyllum Rhinopoma hardwickii*	*Taphozous nudiventris*	Nil
Daijar Mata Mandir, Jodhpur (26.39694°N, 73.05278°E)	*Rhinopoma hardwickii Rhinolophus lepidus*	*Rhinopoma hardwickii Rhinolophus lepidus*	Nil	Nil
Palm tree plantation of Mandore garden, Jodhpur (26.35222°N, 73.02806°E)	*Scotophilus heathii*	*Scotophilus heathii*	Nil	Nil
Deval of Maharaja Shri Ajit Singh, Mandore Garden, Jodhpur (26.35222°N, 73.03583°E)	*Taphozous nudiventris Taphozous perforatus*	*Taphozous perforatus*	*Taphozous nudiventris*	Nil
Deval of Maharaja Shri Gaj Singh, Mandore Garden Jodhpur (26.35250°N, 73.03583°E)	*Taphozous nudiventris*	*Taphozous nudiventris*	Nil	Nil
Badi Haveli, Tinwari, Osia (26.46195°N, 72.92123°E)	*Rhinopoma microphyllum Rhinopoma hardwickii Taphozous nudiventris Taphozous perforatus*	*Rhinopoma microphyllum Rhinopoma hardwickii Taphozous nudiventris Taphozous perforatus*	Nil	Nil
Ram Ka Kua, Doli (26.17812°N, 72.88430°E)	*Rhinopoma microphyllum*	*Rhinopoma microphyllum*	Nil	Nil
House of Mr. Jagmal Ram Anjana, Doli (26.17375°N, 72.88617°E)	*Pipistrellus tenuis*	*Pipistrellus tenuis*	Nil	Nil
Farm Well Kago ki Dhani, Doli (26.20189°N, 72.90572°E)	*Rhinopoma microphyllum*	*Rhinopoma microphyllum*	Nil	Nil
Jain Bhavan (Gram Panchayat Bhavan), Dhava (26.05989°N, 72.74289°E)	*Rhinolophus lepidus*	Nil	*Rhinolophus lepidus*	Nil
House of Sh. Ganga Singh Ji, Aagolai (26.53922°N, 72.38058°E)	*Rhinopoma microphyllum Rhinopoma hardwickii*	Nil	*Rhinopoma microphyllum Rhinopoma hardwickii*	Nil
Public Well (Deserted), Alidas Nagar, near Shetarana (26.59675°N, 72.34292°E)	*Rhinopoma microphyllum*	*Rhinopoma microphyllum*	Nil	Nil
Farm Well at Saro ki Dhani, Madasar – Deda (26.59589°N, 72.34473°E)	*Rhinopoma microphyllum*	*Rhinopoma microphyllum*	Nil	Nil
Fort premise, Setarawa (26.59594°N, 72.34469°E)	*Rhinopoma hardwickii*	*Rhinopoma hardwickii*	Nil	Nil
Public Well (Pisaca), Solankia Tala (26.53650°N, 72.26992°E)	*Rhinopoma microphyllum*	*Rhinopoma microphyllum*	Nil	Nil
Public Well (Pisaca), Bhungra (26.43903°N, 72.28225°E)	*Rhinopoma microphyllum*	*Rhinopoma microphyllum*	Nil	Nil
Goga Dev Temple, Bhungra (26.43597°N, 72.28350°E)	*Rhinopoma hardwickii*	*Rhinopoma hardwickii*	Nil	Nil
Door Singh ka Kua, Gada (26.49128°N, 72.36672°E)	*Rhinopoma hardwickiiRhinopoma microphyllum*	*Rhinopoma hardwickii Rhinopoma microphyllum*	Nil	Nil
Public well (Pisaca), Ketu (26.52461°N, 72.45486°E)	*Rhinopoma hardwickii*	*Rhinopoma hardwickii*	Nil	Nil
Public Well (Pisaca) – Kharia Bera, Bhalu Kalla (26.55569°N, 72.50319°E)	*Rhinopoma microphyllum Rhinopoma hardwickii*	*Rhinopoma microphyllum Rhinopoma hardwickii*	Nil	Nil
Public Well (Pisaca) – Naya Bera, Bhalu Kalla (26.55621°N, 72.50311°E)	*Rhinopoma microphyllum Rhinopoma hardwickii*	*Rhinopoma microphyllum Rhinopoma hardwickii Taphozous perforatus*	Nil	Nil
Public Well (Pisaca) – Kharia Bera, Bhalu Ratangarh (26.58036°N, 72.51781°E)	*Rhinopoma microphyllum Rhinopoma hardwickii*	*Rhinopoma microphyllum Rhinopoma hardwickii*	Nil	Nil
Public Well (Pisaca) - Naya Bera, Bhalu Ratangarh (26.58345°N, 72.51721°E)	*Rhinopoma microphyllum Rhinopoma hardwickii*	*Rhinopoma microphyllum Rhinopoma hardwickii*	Nil	Nil
Public Well (Pisaca), Chamu (26.65550°N, 72.57789°E)	*Rhinopoma hardwickii*	*Rhinopoma hardwickii*	Nil	Nil
House of Mr. Dhana Ram Paliwal, Barnau (26.73476°N, 72.47704°E)	*Rhinopoma microphyllum Rhinopoma hardwickii Taphozous nudiventris*	*Rhinopoma microphyllum Rhinopoma hardwickii Taphozous nudiventris*	Nil	Nil
Public Well (Pisaca), Dechu (26.77328°N, 72.32633°E)	*Rhinopoma hardwickii*	*Rhinopoma hardwickii*	Nil	Nil
Public Well (Pisaca), Dhadhu (26.92078°N, 72.13650°E)	*Rhinopoma hardwickii*	*Rhinopoma hardwickii*	Nil	Nil
Public Well (Pisaca), Khara (27.02286°N, 72.12550°E)	*Rhinopoma hardwickii*	*Rhinopoma hardwickii*	Nil	Nil

Roosting sites	Profile of bat species			
	Reported earlier (1961 to 2009)	Reported during the RSG 2nd study (2010-2011)	Missing	Addition
Public Well (Pisaca), Sihara (27.19047°N, 72.05647°E)	*Rhinopoma microphyllum* *Rhinopoma hardwickii*	*Rhinopoma microphyllum* *Rhinopoma hardwickii*	Nil	Nil
Ground Water Tank, Sihara (27.19050°N, 72.05650°E)	*Taphozous nudiventris*	*Taphozous nudiventris*	Nil	Nil
Public Well (Pisaca), Tepu (27.27392°N, 72.02082°E)	*Rhinopoma hardwickii* *Taphozous nudiventris*	*Rhinopoma hardwickii* *Taphozous nudiventris*	Nil	Nil
Public Well (Pisaca), Kanasar (27.44772°N, 72.11086°E)	*Rhinopoma microphyllum* *Rhinopoma hardwickii*	*Rhinopoma microphyllum* *Rhinopoma hardwickii*	Nil	Nil
Public well (Pisaca), Nava (27.48548°N, 72.11346°E)	*Rhinopoma microphyllum*	*Rhinopoma microphyllum*	Nil	Nil
Public Well (Pisaca), Bhadala (27.48114°N, 72.13132°E)	*Rhinopoma microphyllum*	*Rhinopoma microphyllum*	Nil	Nil
Dilapidated mud building, near Main Market, Bap (27.37350°N, 72.35517°E)	*Rhinopoma hardwickii*	*Rhinopoma hardwickii*	Nil	Nil
Dilapidated building (deserted) near village pond, Bap (27.37339°N, 72.35508°E)	*Rhinopoma hardwickii*	*Rhinopoma hardwickii*	Nil	Nil
Salt Pan well of Mr. Pachu Lal Sanda, Bap (27.33796°N, 72.38717°E)	*Rhinopoma microphyllum* *Rhinopoma hardwickii*	*Rhinopoma microphyllum* *Rhinopoma hardwickii*	Nil	Nil
Dilapidated Mud House (Deserted), Jambu (27.31083°N, 72.51636°E)	*Rhinopoma hardwickii*	*Rhinopoma hardwickii*	Nil	Nil
Public Well (Pisaca), Bhinyasar (27.22983°N, 72.77325°E)	*Rhinopoma hardwickii*	*Rhinopoma hardwickii*	Nil	Nil
Public Well (Pisaca), Bhojasar (27.22983°N, 72.80217°E)	*Rhinopoma hardwickii*	*Rhinopoma hardwickii*	Nil	Nil
Public Well (Pisaca), Aau (27.20075°N, 72.26564°E)	*Rhinopoma hardwickii*	*Rhinopoma hardwickii*	Nil	Nil
Public Well (Pisaca), Sewap (27.09203°N, 72.88236°E)	*Rhinopoma microphyllum* *Rhinopoma hardwickii*	*Rhinopoma microphyllum* *Rhinopoma hardwickii*	Nil	Nil
Thakurji Temple, Esharu (27.08361°N, 72.95292°E)	*Rhinopoma hardwickii*	*Rhinopoma hardwickii*	Nil	Nil
Public Well (Pisaca), Matoda (26.96231°N, 72.87756°E)	*Rhinopoma microphyllum* *Rhinopoma hardwickii*	*Rhinopoma microphyllum* *Rhinopoma hardwickii*	Nil	Nil
Public Well (Pisaca), Padsala (26.88436°N, 72.88939°E)	*Rhinopoma microphyllum* *Rhinopoma hardwickii*	*Rhinopoma microphyllum* *Rhinopoma hardwickii*	Nil	Nil
Village Fort, Danwara (26.71269°N, 73.09492°E)	*Rhinopoma microphyllum* *Rhinopoma hardwickii*	*Rhinopoma microphyllum* *Rhinopoma hardwickii*	Nil	Nil
Public Well (Pisaca), Chandrak (26.80350°N, 73.13497°E)	*Rhinopoma microphyllum*	*Rhinopoma microphyllum*	Nil	Nil
New Public Well (Pisaca), Hania (26.82680°N, 73.17284°E)	*Rhinopoma microphyllum*	*Rhinopoma microphyllum*	Nil	Nil
Jagdamba Temple, Bhari Nagar (26.80600°N, 73.27694°E)	*Rhinopoma hardwickii*	*Rhinopoma hardwickii*	Nil	Nil
Thakurji Temple, Paladi (26.76478°N, 73.42125°E)	*Rhinopoma microphyllum* *Rhinopoma hardwickii*	*Rhinopoma microphyllum* *Rhinopoma hardwickii*	Nil	Nil
Baba Raghuram Temple, Surpura Khurd (26.70839°N, 73.47614°E)	*Scotophilus heathii* *Pipistrellus tenuis*	*Scotophilus heathii* *Pipistrellus tenuis*	Nil	Nil
Fort , Surpura Khurd (26.70132°N, 73.47112°E)	*Rhinopoma microphyllum*	*Rhinopoma microphyllum*	Nil	Nil
Fort, Bhopalgarh (26.65489°N, 73.49178°E)	*Rhinopoma microphyllum* *Rhinopoma hardwickii*	*Rhinopoma microphyllum* *Rhinopoma hardwickii*	Nil	Nil
Shimbhasheva Ashram, Bhopalgarh (26.65423°N, 73.49214°E)	*Rhinopoma microphyllum* *Rhinopoma hardwickii*	*Rhinopoma microphyllum* *Rhinopoma hardwickii*	Nil	Nil
Temple Bavadi (Step Well), Bagoria (26.59822°N, 73.49769°E)	*Rhinopoma microphyllum*	*Rhinopoma microphyllum*	Nil	Nil
Tukon ka Bhakar (Near Sujannath Temple), Sopado (26.60531°N, 73.44600°E)	*Rhinopoma microphyllum*	*Rhinopoma microphyllum*	Nil	Nil
Shyam Manohar Prabhu Temple, Choupasani (26.26962°N, 72.94765°E)	*Rhinopoma microphyllum* *Rhinopoma hardwickii*	*Rhinopoma microphyllum* *Rhinopoma hardwickii*	Nil	Nil
Old building near Arana Jharna Bath Kund, Arana Jharna (26.30156°N, 72.93604°E)	*Rhinopoma microphyllum* *Rhinopoma hardwickii*	*Rhinopoma microphyllum* *Rhinopoma hardwickii*	Nil	Nil
Dilapidated building in Maheshawari Mohalla, Keru (26.34497°N, 72.87322°E)	*Rhinopoma microphyllum* *Rhinopoma hardwickii* *Rhinolophus lepidus*	*Rhinopoma microphyllum* *Rhinopoma hardwickii* *Rhinolophus lepidus*	Nil	Nil
A building of Mr. Meethalal Jain, Aagolai (26.53910°N, 72.38154°E)	*Rhinopoma microphyllum* *Rhinopoma hardwickii*	*Rhinopoma microphyllum* *Rhinopoma hardwickii*	Nil	Nil
A building Ramdwara, Balesar Satta (26.34845°N, 72.82785°E)	*Rhinopoma microphyllum* *Rhinopoma hardwickii*	*Rhinopoma microphyllum* *Rhinopoma hardwickii*	Nil	Nil
House of Mr. Nema Ram in Meghwal colony, Balesar Durgawata (26.35383°N, 72.83785°E)	*Rhinolophus lepidus*	*Rhinolophus lepidus*	Nil	Nil
Ban Mata temple, Bhavad (26.46174°N, 73.10627°E)	*Rhinopoma microphyllum* *Rhinopoma hardwickii* *Rhinolophus lepidus* *Taphozous nudiventris*	*Rhinopoma microphyllum* *Rhinopoma hardwickii* *Rhinolophus lepidus* *Taphozous nudiventris*	Nil	Nil

Roosting sites	Profile of bat species			
	Reported earlier (1961 to 2009)	Reported during the RSG 2nd study (2010-2011)	Missing	Addition
An unattended house in Brahmapuri Mohalla, Bavadi (26.61976°N, 73.17754°E)	*Rhinopoma microphyllum* *Rhinopoma hardwickii*	*Rhinopoma microphyllum* *Rhinopoma hardwickii*	Nil	Nil
Meethia Bera public well (Pisaca), Bada Kelava (26.62954°N, 73.13572°E)	*Rhinopoma microphyllum*	*Rhinopoma microphyllum*	Nil	Nil
Jeevati Samadhi premise, Mevasa (26.64421°N, 73.13695°E)	*Rhinopoma microphyllum* *Rhinopoma hardwickii*	*Rhinopoma microphyllum* *Rhinopoma hardwickii*	Nil	Nil
Public Well (Pisaca), Santoda Khurd (26.64705°N, 73.15146°E)	*Rhinopoma microphyllum*	*Rhinopoma microphyllum*	Nil	Nil
Public Well (Pisaca), Basani Bhatian (26.65322°N, 73.17062°E)	*Rhinopoma microphyllum* *Rhinopoma hardwickii*	*Rhinopoma microphyllum* *Rhinopoma hardwickii*	Nil	Nil
Kot of Maharaja Ummed Singh, Ummed Nagar (26.66512°N, 73.19035°E)	*Rhinopoma microphyllum*	*Rhinopoma microphyllum*	Nil	Nil
Unattended haveli of Kotecha Thakur, Bada Kotecha (26.69202°N, 73.22457°E)	*Rhinopoma microphyllum*	*Rhinopoma microphyllum*	Nil	Nil
Aasop Fort, Aasop (26.79310°N, 73.58240°E)	*Rhinopoma microphyllum* *Rhinopoma hardwickii*	*Rhinopoma microphyllum* *Rhinopoma hardwickii*	Nil	Nil
Haveli of Mr. Vijaya Raj Tailor, Aasop (26.79588°N, 73.58105°E)	*Rhinopoma microphyllum* *Rhinopoma hardwickii*	*Rhinopoma microphyllum* *Rhinopoma hardwickii*	Nil	Nil
Gadi ka Bera Public Well (Pisaca), Aasop (26.79153°N, 73.58008°E)	*Rhinopoma microphyllum* *Rhinopoma hardwickii*	*Rhinopoma microphyllum* *Rhinopoma hardwickii*	Nil	Nil
Unoccupied rooms in premise of Aai Mata Temple, Bilara (26.18093°N, 73.70536°E)	*Rhinopoma microphyllum* *Rhinopoma hardwickii*	*Rhinopoma microphyllum* *Rhinopoma hardwickii*	Nil	Nil
Deserted mud house, Bhavi (26.21443°N, 73.61541°E)	*Rhinopoma microphyllum*	*Rhinopoma microphyllum*	Nil	Nil
House of Shri Ratan Bishnoi, Banar (26.33421°N, 73.14269°E)	*Pipistrellus tenuis*	*Pipistrellus tenuis*	Nil	Nil
Public Well, Dangiyawas (26.26252°N, 73.28660°E)	*Rhinopoma microphyllum* *Rhinopoma hardwickii*	*Rhinopoma microphyllum* *Rhinopoma hardwickii*	Nil	Nil
Unoccupied house of Shri Khem Chand Jain, Pipar (26.37850°N, 73.54428°E)	*Rhinopoma microphyllum*	Nil	*Rhinopoma microphyllum*	Nil
Public Well, Kakani (26.06669°N, 73.07265°E)	*Rhinopoma microphyllum* *Rhinopoma hardwickii*	*Rhinopoma microphyllum* *Rhinopoma hardwickii*	Nil	Nil
Unoccupied house of Shri Nena Ram Bishnoi, Luni (26.03350°N, 73.07770°E)	*Rhinopoma microphyllum*	*Rhinopoma microphyllum*	Nil	Nil

Table 3: Distribution of chiropterans reported earlier in and around Jaisalmer of the Thar Desert and their current status

Roosting sites	Profile of bat species			
	Reported earlier (1961 to 2009)	Reported during the RSG 2nd study (2010-2011)	Missing	Addition
Megachiropterans status – No reports till the year 2009				
Fort, Lathi (27.03661°N, 71.51699°E)	*Cynopterus sphinx*	Nil	*Cynopterus sphinx*	Nil
Gajroop Sagar Tunnel, Gajroop Sagar (26.94722°N, 70.92889°E)	Nil	*Rousettus leschenaulti*	Nil	*Rousettus leschenaulti*
Microchiropterans status				
Annapurana Bhandar, Sonar Fort, Jaisalmer (26.91250°N, 70.91611°E)	*Rhinopoma hardwickii* *Taphozous nudiventris*	*Rhinopoma hardwickii* *Taphozous nudiventris*	Nil	Nil
Raj Mahal, Sonar Fort, Jaisalmer (26.91417°N, 70.91333°E)	*Rhinopoma microphyllum* *Rhinopoma hardwickii* *Taphozous nudiventris*	*Rhinopoma microphyllum* *Rhinopoma hardwickii*	*Taphozous nudiventris*	Nil
Rani Mahal, Sonar Fort, Jaisalmer (26.91167°N, 70.91389°E)	*Rhinopoma microphyllum* *Rhinopoma hardwickii*	*Rhinopoma microphyllum* *Rhinopoma hardwickii*	Nil	Nil
Patawa Haveli, Jaisalmer (26.91611°N, 70.91500°E)	*Rhinopoma hardwickii*	*Rhinopoma hardwickii*	Nil	Nil
Amar Sagar Garden, Amar Sagar (26.93194°N, 70.87139°E)	*Taphozous nudiventris*	Nil	*Taphozous nudiventris*	Nil
Shri Adinath Jain temple (26.92917°N, 70.87167°E)	*Rhinopoma hardwickii* *Taphozous nudiventris*	*Rhinopoma hardwickii*	*Taphozous nudiventris*	Nil
Gajroop Sagar Tunnel, Gajroop Sagar (26.94722°N, 70.92889°E)	*Rhinopoma microphyllum* *Rhinopoma hardwickii*	*Rhinopoma microphyllum* *Rhinopoma hardwickii* *Rhinolophus Lepidus* *Asellia tridens*	Nil	*Rhinolophus Lepidus Asellia tridens*
Public Well, Gajroop Sagar (26.94722°N, 70.92889°E)	*Rhinopoma microphyllum* *Rhinopoma hardwickii*	*Rhinopoma microphyllum* *Rhinopoma hardwickii*	Nil	
Fort, Lathi (27.03661°N, 71.51699°E)	*Rhinopoma microphyllum* *Rhinopoma hardwickii* *Taphozous perforates* *Taphozous nudiventris*	*Rhinopoma microphyllum* *Rhinopoma hardwickii* *Taphozous perforates* *Taphozous nudiventris*	Nil	Nil

(Prakash, 1963; Senacha, 2003) and Blyth's horseshoe bat, *Rhinolophus lepidus* has been reported for the first time from this district, while Geoffroy's Trident bat, *Asellia tridens* found here from Gajroop Sagar tunnel bat roost is significantly the first record of this species not only from the Great Indian Desert (The Thar) but from India (Table 3 & 4). However, alike the findings of Senacha (2003) we have not seen any roost of Egyptian Tomb bat, *Taphozous perforatus* which has been reported here in early 1960's by Prakash (1963).

However *Cynopterus sphinx*, the only reported species of megachiropterans from district of Jaisalmer (Senacha *et al.,* 2006) has been found missing during this investigation at its reported roost of Fort of Lathi village, an another megachiropteran species Fulvous Fruit bat, *Rousettus leschenaulti* has been reported for the first time here and found co-inhabiting with microchiropterans at Gajroop Sagar roost.

Analysis revealed that of the total eleven chiropteran roosts reported earlier from Jaisalmer district one has been deserted completely while species composition found altered at another four of these roosts (addition of species at one and depletion at three roosts); beside this change, 71 new chiropteran roosts have been explored and reported here during this investigation

Species composition at microchiropterans roosts varied significantly from prevailing congregation of Greater Mouse-tailed bat, *Rhinopoma microphyllum* and Lesser Mouse-tailed bat, *Rhinopoma hardwickii* to solitary roosts of each species except Geoffroy's Trident bat, *Asellia tridens* and Fulvous Fruit bat, *Rousettus leschenaulti*. We have observed the co-existence of *Rhinopoma microphyllum, Rhinopoma hardwickii*, *Taphozous perforators* and *Rhinolophus lepidus* at some of the roosts. However, at one roost in Jaisalmer four microchiropteran species, *Rhinopoma microphyllum*, *Rhinopoma hardwickii*, *Rhinolophus lepidus, Asellia tridens* and a megachiropteran species, *Rousettus leschenaulti* were found to roost altogether (Table 2 & 6).

Occupancy estimates revealed that *Rhinopoma microphyllum* is the most common among microchiropterans in Jodhpur where as *Rhinopoma hardwickii* dominates in Jaisalmer and Bikaner districts, whereas *Pteropus giganteus* dominates all over the study area among megachiropterans.

Based on regular monitoring of some selected sites, temporal fluctuations in population size were observed in six of the eight microchiropterans but none of the three megachiropterans. Population of *Rhinopoma microphyllum* declined significantly in late summer whereas *Rhinopoma hardwickii* population showed a spike during the same time. *Rhinolophus lepidus* and *Taphozous perforatus* populations declined gradually from winter to summer and remained stable thereafter, but no significant fluctuations were observed in *Taphozous nudiventris* and *Scotophilus heathii* populations. It shows that some of the microchiropteran species performs local migration either to overcome the effect of seasonal changes in microclimatic parameters of their roosts or to accommodate with food abundance, while others do not. Due to difficulty in accessibility and field logistics we could not study trend on population fluctuation in *Pipistrellus tenuis* and *Asellia tridens*.

As far as breeding of bats in the study area is concern, mating in *Pteropus giganteus* was observed in months of

Project volunteer Ms. Suman Senacha while discussing the nature and ecological importance of bats of the Thar Desert with women of village Mathania in Jodhpur district.

Project team while interacting with locals at roadside hotel near Kolayat of Bikaner district in the Thar Desert to enquire about probable bat roosts in their locality

October and November, whereas parturition was observed in March and April. They found to deliver one pup and just after parturition the newborn hold position in mother's ventral body part by gripping her in head to head direction. Mating in *Rhinopoma microphyllum* and *Rhinopoma hardwickii* occurs in March and April, whereas parturition takes place in July and August. These too deliver single pup and remain attached to the ventral body parts of mother in head to tail direction. Parturition in was *Taphozous perforatus* observed in May and June, but we could not conclude their mating time. Most delivered females of this species were seen with single pups but few others were sighted to carry two pups, possibly the twins. The direction of attachment of pups to their mother was head to head. Mating in *Taphozous nudiventris* was usually observed in March and April, but some pairs seen to be mounting in July and August. Parturition in this species was observed in July and August and pups found attached to mother in head to head direction. Parturition in *Scotophilus heathii* was observed in June and July, but their mating time could not be studied. Most delivered females seen with single pups, but remaining carried twins attached to mother's ventral body parts in head to head direction. However, parturition in *Rhinolophus lepidus* was observed in May and June, period of mating could not be

Table 4: Species profile of the newly reported chiropteran roosts from Jaisalmer district of the Thar Desert during this study through the years 2010 – 2011

Name of the roost site	Type of Roost	Geographical Position	Name of the city/ village/ settlement	Species Composition
Public Well	Inside peripheral wall of the well	26.6068°N, 72.0736°E	Jhalara	*Rhinopoma microphyllum* *Rhinopoma hardwickii*
Rawasoniya Bera	Inside peripheral wall of the well	26.6300°N, 72.0172°E	Jhalara	*-- same as above --*
Dilapidated Gram Panchayat Water Tank	Inside peripheral wall of the Tank	26.6384°N, 71.9562°E	Doongara Ki Dhani	*Rhinopoma hardwickii*
Pond water over flow tunnel, Karani Mata Temple	At peripheral walls and ceiling of the tunnel	26.6272°N, 71.8655°E	Bhaniyana	*Rhinopoma microphyllum* *Rhinopoma hardwickii*
Public Well	Inside peripheral wall of the well	26.6232°N, 71.8656°E	Bhaniyana	*-- same as above --*
Public Well	Inside peripheral wall of the well	26.4876°N, 71.8172°E	Bhikhodai	*-- same as above --*
Public Well	Inside peripheral wall of the well	26.5180°N, 71.7468°E	Rajmathai	*-- same as above --*
Public Well	Inside peripheral wall of the well	26.5675°N, 71.5629°E	Minaj Pura	*-- same as above --*
Public Well	Inside peripheral wall of the well	26.6130°N, 71.4881°E	Bhensada	*-- same as above --*
Public Well	Inside peripheral wall of the well	26.4904°N, 71.2072°E	Fatehgarh	*-- same as above --*
Fort premises	Ceilings and forewalls of dilapidated rooms	26.6943°N, 71.2015°E	Devikot	*-- same as above --*
Public Well	Inside peripheral wall of the well	26.6943°N, 71.2015°E	Devikot	*-- same as above --*
Public Well	Inside peripheral wall of the well	26.8130°N, 70.9070°E	Polaji Ki Dairy	*-- same as above --*
House of shri Mana Ram	Wall crevices near main door	26.7693°N, 70.9485°E	Bhu Gaon	*Pipistrellus tenuis*
Public Well	Inside peripheral wall of the well	26.7350°N, 70.9413°E	Pitholai	*-- same as above --*
Public Well	Inside peripheral wall of the well	26.7041°N, 70.9237°E	Bhopa	*-- same as above --*
Public Well	Inside peripheral wall of the well	26.5122°N, 70.9245°E	Chelak	*-- same as above --*
Public Well	Inside peripheral wall of the well	26.3622°N, 70.9224°E	Devada	*-- same as above --*
Public Well	Inside peripheral wall of the well	26.2702°N, 70.9176°E	Jogidas ka Gaon	*-- same as above --*
Public Well	Inside peripheral wall of the well	26.2076°N, 70.6471°E	Jhinjhiyali	*-- same as above --*
Public Well	Inside peripheral wall of the well	26.2251°N, 70.3904°E	Myazlar	*-- same as above --*
Dilapidated house structure	Ceilings and forewalls of this house	26.3667°N, 70.4780°E	DNP Chowki Phulia	*-- same as above --*
Public Well	Inside peripheral wall of the well	26.4263°N, 70.4441°E	Dau	*-- same as above --*
Public Well	Inside peripheral wall of the well	26.5180°N, 70.4923°E	Hattar	*-- same as above --*
Public Well	Inside peripheral wall of the well	26.5679°N, 70.5183°E	Chohani	*-- same as above --*
Public Well	Inside peripheral wall of the well	26.5730°N, 70.4823°E	Koriya	*-- same as above --*
Public Well	Inside peripheral wall of the well	26.6210°N, 70.4855°E	Faledi	*-- same as above --*
Public Well	Inside peripheral wall of the well	26.7419°N, 70.5585°E	Bida	*-- same as above --*
Public Well	Inside peripheral wall of the well	26.7758°N, 70.5418°E	Sudasari	*-- same as above --*
Public Well	Inside peripheral wall of the well	26.8667°N, 70.4990°E	Sum	*-- same as above --*
Ruined unattended house structure	Ceilings and forewalls	26.8385°N, 70.5023°E	Luno ki Basti	*-- same as above --*
Public Well	Inside peripheral wall of the well	26.9922°N, 70.4620°E	Mangliawas	*-- same as above --*
Public Well	Inside peripheral wall of the well	27.0471°N, 70.4318°E	Siyambar	*-- same as above --*
Public Well	Inside peripheral wall of the well	27.1435°N, 70.4116°E	Khuiwala	*-- same as above --*
Public Well	Inside peripheral wall of the well	27.1814°N, 70.3526°E	Banda	*-- same as above --*
Public Well	Inside peripheral wall of the well	27.2472°N, 70.4890°E	Murdai Dhani	*-- same as above --*
Public Well	Inside peripheral wall of the well	27.2983°N, 70.4941°E	Ekaipura	*-- same as above --*
Public Well	Inside peripheral wall of the well	27.3317°N, 70.5498°E	Ramgarh	*-- same as above --*
Public Well	Inside peripheral wall of the well	27.2463°N, 70.6524°E	Sonu	*-- same as above --*
Public Well	Inside peripheral wall of the well	27.1326°N, 70.7645°E	Mokal	*-- same as above --*
Public Well	Inside peripheral wall of the well	27.2731°N, 70.8689°E	Khinwsar	*-- same as above --*
Public Well	Inside peripheral wall of the well	27.3335°N, 70.9084°E	Mada	*-- same as above --*
Public Well	Inside peripheral wall of the well	27.3515°N, 70.9785°E	Nehdai	*-- same as above --*
Fort Premises	Unattended rooms at periphery of the fort permises	27.2836°N, 71.2380°E	Mohangarh	*Rhinopoma microphyllum* *Rhinopoma hardwickii* *Taphozous nudiventris*
Public Well	Inside peripheral wall of the well	27.2836°N, 71.2371°E	Mohangarh	*Rhinopoma microphyllum* *Rhinopoma hardwickii*
Public Well	Inside peripheral wall of the well	27.4424°N, 71.6934°E	Nachana	*-- same as above --*
Public Well	Inside peripheral wall of the well	27.3304°N, 71.7037°E	Didhu	*-- same as above --*
Public Well	Inside peripheral wall of the well	27.0058°N, 71.9058°E	Ramdevara	*-- same as above --*
Rajgharana Samadhi tombs	Basement rooms and underside of tombs	26.9357°N, 71.9125°E	Pokharan	*Rhinopoma hardwickii* *Taphozous nudiventris*
Public Well	Inside peripheral wall of the well	26.3951°N, 71.9232°E	Phalsund	*Rhinopoma microphyllum* *Rhinopoma hardwickii*
Public Well	Inside peripheral wall of the well	26.4674°N, 71.5441°E	Arang	*-- same as above --*
Public Well	Inside peripheral wall of the well	26.6830°N, 71.5808°E	Luna	*-- same as above --*
Public Well	Inside peripheral wall of the well	26.7324°N, 71.5848°E	Sankra	*-- same as above --*
Public Well	Inside peripheral wall of the well	26.9665°N, 71.7193°E	Odhania	*-- same as above --*
Public Well	Inside peripheral wall of the well	27.0198°N, 71.7156°E	Khavolai	*-- same as above --*
Public Well	Inside peripheral wall of the well	27.2604°N, 71.7052°E	Ajasar	*-- same as above --*
Public Well	Inside peripheral wall of the well	27.3311°N, 71.7091°E	Didhu	*-- same as above --*
Public Well	Inside peripheral wall of the well	26.9985°N, 71.0763°E	Hamira	*-- same as above --*
Public Well	Inside peripheral wall of the well	27.0732°N, 70.5612°E	Kutchchari	*-- same as above --*
Public Well	Inside peripheral wall of the well	27.3167°N, 70.0498°E	Ghotaru	*-- same as above --*
Public Well	Inside peripheral wall of the well	27.6630°N, 70.8043°E	Bhuttewala	*-- same as above --*
Public Well	Inside peripheral wall of the well	27.7964°N, 70.3540°E	Tanot	*-- same as above --*
Public Well	Inside peripheral wall of the well	27.6538°N, 70.4592°E	Ranao	*-- same as above --*

Name of the roost site	Type of Roost	Geographical Position	Name of the city/ village/ settlement	Species Composition
Fort Premises	Cielings and forewalls of unattended ruined rooms in the premises	27.8707°N, 70.5635°E	Kishangarh	-- *same as above* --
Public Well	Inside peripheral wall of the well	27.4832°N, 70.6928°E	Sadhan	-- *same as above* --
Public Well	Inside peripheral wall of the well	26.9437°N, 70.1425°E	Monnar	-- *same as above* --
Public Well	Inside peripheral wall of the well	26.7764°N, 70.3720°E	Chhilaro	-- *same as above* --
Public Well	Inside peripheral wall of the well	26.6122°N, 70.7161°E	Khoordi	-- *same as above* --
Public Well	Inside peripheral wall of the well	26.4644°N, 70.7839°E	Satanagar	-- *same as above* --
Public Well	Inside peripheral wall of the well	26.4685°N, 70.8951°E	Nagraj	-- *same as above* --
Public Well	Inside peripheral wall of the well	26.5520°N, 71.0416°E	Rama	-- *same as above* --

Table 5: Distribution of chiropterans reported earlier in and around Bikaner of the Thar Desert and their current status

Roosting sites	Profile of bat species			
	Reported earlier (1961 to 2009)	**Reported during the RSG 2nd study (2010-2011)**	**Missing**	**Addition**
Megachiropterans status – No reports till the year 2009				
Microchiropterans status				
Junagarh fort, Bikaner (28.02278°N, 73.32028°E)	*Rhinopoma microphyllum* *Rhinopoma hardwickii*	*Rhinopoma microphyllum* *Rhinopoma hardwickii* *Pipistrellus tenuis*	Nil	Nil
Jalmahal, Sagar village (28.02056°N, 73.39306°E)	*Rhinopoma microphyllum* *Rhinopoma hardwickii* *Rhinolophus lepidus*	*Rhinopoma microphyllum* *Rhinopoma hardwickii* *Rhinolophus lepidus*	Nil	Nil
Overflow tunnel, Devikund Sagar, Sagar village (28.01972°N, 73.39278°E)	*Rhinopoma hardwickii*	*Rhinopoma hardwickii*	Nil	Nil
Public Well, Sagar village (28.01944°N, 73.39306°E)	*Rhinopoma microphyllum* *Rhinopoma hardwickii*	*Rhinopoma microphyllum* *Rhinopoma hardwickii*	Nil	Nil
Laleshwar Mahadev Mandir, Shiv Badi, Bikaner (28.00028°N, 73.35361°E)	*Pipistrellus tenuis*	Nil	*Pipistrellus tenuis*	Nil
Annapurana Mata Mandir, Pawan Puri, Bikaner (27.99250°N, 73.33861°E)	*Rhinopoma hardwickii*	Nil	*Rhinopoma hardwickii*	Nil
Dauji Ka Mandir, Court Gate, Bikaner (28.01556°N, 73.30583°E)	*Rhinopoma microphyllum* *Rhinopoma hardwickii*	Nil	*Rhinopoma microphyllum* *Rhinopoma hardwickii*	Nil
Girdhari Lal Ji Ka Bada, Court Gate, Bikaner (28.07722°N, 73.32250°E)	*Rhinopoma hardwickii*	Nil	*Rhinopoma hardwickii*	Nil
Session Court Building, Bikaner (28.00500°N, 73.32250°E)	*Rhinopoma hardwickii*	Nil	*Rhinopoma hardwickii*	Nil

Table 6: Species profile of the newly reported chiropteran roosts from Bikaner district of the Thar Desert during this study through the years 2010 – 2011

Name of the roost site	Type of Roost	Geographical Position	Name of the city/village/ settlement	Species Composition
IGNP Guest House Campus	Mango and Neem trees	27.7936°N, 72.5175°E	Bajju	*Pteropus giganteus*
Public Well	Inside peripheral wall of the well	27.4591°N, 72.9402°E	Bhelu	*Rhinopoma microphyllum* *Rhinopoma hardwickii*
Thakurji Temple	Temple ceiling and walls	27.4598°N, 72.9511°E	Bhelu	-- *same as above* --
Public Well	Inside peripheral wall of the well	27.4904°N, 72.9320°E	Khajola	-- *same as above* --
Public Well	Inside peripheral wall of the well	27.5526°N, 72.9287°E	Khindasar	-- *same as above* --
Public Well	Inside peripheral wall of the well	27.5917°N, 72.9383°E	Lamana Bhatiyan	-- *same as above* --
Public Well	Inside peripheral wall of the well	27.6424°N, 72.8724°E	Hadda	-- *same as above* --
Public Well	Inside peripheral wall of the well	27.6368°N, 72.8028°E	Khariya Malinath	-- *same as above* --
Public Well	Inside peripheral wall of the well	27.5627°N, 72.7183°E	Udat	-- *same as above* --
Public Well	Inside peripheral wall of the well	27.6316°N, 72.6499°E	Nokhada	-- *same as above* --
Public Well	Inside peripheral wall of the well	27.7561°N, 72.6986°E	Mandal Charanan	-- *same as above* --
Old unattended Hostel Building	Ceiling and walls	27.7579°N, 72.5893°E	Gadiyala	-- *same as above* --
Public Well	Inside peripheral wall of the well	27.7935°N, 72.5180°E	Girandhi	-- *same as above* --
Door Crevices at Government Upper Primary School Building, IGNP Campus	Inside peripheral wall of the well	27.7823°N, 72.5178°E	Bajju	*Pipistrellus tenuis*
Public Well	Inside peripheral wall of the well	28.2841°N, 72.8309°E	Amarpura	*Rhinopoma microphyllum* *Rhinopoma hardwickii*
Public Well	Inside peripheral wall of the well	28.4357°N, 72.9319°E	IGNP RD 682	-- *same as above* --
Public Well	Inside peripheral wall of the well	28.5923°N, 73.0791°E	Sattasar Phanta	-- *same as above* --
Public Well	Inside peripheral wall of the well	28.4512°N, 73.1122°E	Motigarh	-- *same as above* --
Public Well	Inside peripheral wall of the well	28.3864°N, 73.1834°E	Kela Phanta	-- *same as above* --

Public Well	Inside peripheral wall of the well	28.3337°N, 73.1929°E	Lakhasar	-- *same as above* --
Public Well	Inside peripheral wall of the well	28.1804°N, 73.1900°E	Badarasar	-- *same as above* --
Public Well, Shobhasar Limestone Factories	Inside peripheral wall of the well	28.1556°N, 73.2010°E	Shobhasar	*Rhinopoma microphyllum* *Rhinopoma hardwickii*
Public Well	Inside peripheral wall of the well	28.1253°N, 73.2259°E	Shobhasar	-- *same as above* --
Public Well	Inside peripheral wall of the well	28.2002°N, 73.3848°E	Khara	-- *same as above* --
Public Well	Inside peripheral wall of the well	28.2501°N, 73.4031°E	Jamsar	-- *same as above* --
Public Well	Inside peripheral wall of the well	28.4093°N, 73.5954°E	Dheerera	-- *same as above* --
Public Well	Inside peripheral wall of the well	28.4255°N, 73.6180°E	Dularo Gaon	-- *same as above* --
Public Well	Inside peripheral wall of the well	28.4411°N, 73.6441°E	Hansera	-- *same as above* --
Public Well	Inside peripheral wall of the well	28.4872°N, 73.7326°E	Lunkaransar	-- *same as above* --
Public Well	Inside peripheral wall of the well	28.3866°N, 73.8886°E	Kalu	-- *same as above* --
Public Well	Inside peripheral wall of the well	28.3454°N, 73.7608°E	Shejarasar	-- *same as above* --
Public Well	Inside peripheral wall of the well	28.3464°N, 73.6413°E	Khari	-- *same as above* --
Public Well	Inside peripheral wall of the well	28.3603°N, 73.5941°E	Dheerera	-- *same as above* --
Public Well	Inside peripheral wall of the well	28.3532°N, 73.5978°E	Uttamdesar	-- *same as above* --
Public Well	Inside peripheral wall of the well	28.2768°N, 73.5879°E	Bandha	-- *same as above* --
Public Well	Inside peripheral wall of the well	28.2768°N, 73.5879°E	Karanisar Beeka	-- *same as above* --
Public Well	Inside peripheral wall of the well	28.2604°N, 73.5717°E	Molania	-- *same as above* --
Public Well	Inside peripheral wall of the well	28.2319°N, 73.5073°E	Malasar	-- *same as above* --
Public Well	Inside peripheral wall of the well	28.2354°N, 73.4706°E	Dandusar	-- *same as above* --
Public Well	Inside peripheral wall of the well	27.6681°N, 73.3680°E	Bhamathsar	-- *same as above* --
Public Well	Inside peripheral wall of the well	27.5880°N, 73.3416°E	Nokha Gaon	-- *same as above* --
Public Well	Inside peripheral wall of the well	27.5717°N, 73.4581°E	Bikasar	-- *same as above* --
Public Well	Inside peripheral wall of the well	28.1247 °N, 73.0346°E	Jaimalsar village	-- *same as above* --
Public Well	Inside peripheral wall of the well	27.9838°N, 72.4843°E	Panwarwala	-- *same as above* --
Public Well	Inside peripheral wall of the well	27.7279°N, 72.5335°E	Girajsar	-- *same as above* --
Public Well	Inside peripheral wall of the well	27.5609°N, 72.2510°E	Naukh	-- *same as above* --
Public Well	Inside peripheral wall of the well	27.9968°N, 72.2706°E	Goda	-- *same as above* --
Public Well	Inside peripheral wall of the well	28.1854°N, 72.2436°E	Barsalpur	-- *same as above* --
Public Well	Inside peripheral wall of the well	28.5910°N, 72.3271°E	Chulam Aliwala	-- *same as above* --
Public Well	Inside peripheral wall of the well	28.6690°N, 73.1205°E	Chhatar Garh	-- *same as above* --
Public Well	Inside peripheral wall of the well	28.5151°N, 72.8135°E	Pugal	-- *same as above* --
Public Well	Inside peripheral wall of the well	28.8642°N, 73.2970°E	Raner	-- *same as above* --
Public Well	Inside peripheral wall of the well	28.9422°N, 73.5731°E	Hathusar	-- *same as above* --
Public Well	Inside peripheral wall of the well	28.7211°N, 73.5978°E	Kumana	-- *same as above* --
Public Well	Inside peripheral wall of the well	28.7688°N, 73.8566°E	Mahalan	-- *same as above* --
Public Well	Inside peripheral wall of the well	27.8406°N, 72.9581°E	Kolayat	-- *same as above* --
Public Well	Inside peripheral wall of the well	27.4893°N, 73.2272°E	Panchur	-- *same as above* --

Table 7: List of institutes selected and promoted to form Bat Clubs in the study area

Name of the Institute	Name of the city/village/ settlement	District
Schools		
Government Senior Secondary School, Jhinjihinyali	Jhinjhiyali	Jaisalmer
Government Primary School, Doongara Ki Dhani	Doongara Ki Dhani	Jaisalmer
Government Senior Scondary School, Jaisalmer	Jaisalmer	Jaisalmer
Government Secondary School, Pitholai	Pitholai	Jaisalmer
Government Senior Secondary School, Sonu	Sonu	Jaisalmer
Government Senior Secondary School, Myazlar	Myazlar	Jaisalmer
Jawahar Navodaya Vidhyalaya, Mohangarh	Mohangarh	Jaisalmer
Government Senior Secondary School, Ramgarh	Ramgarh	Jaisalmer
Government Primary School, Kohriya	Kohriya	Jaisalmer
Adarsh Vidhya Mandir, Mohangarh	Mohangarh	Jaisalmer
Government Primary School, Chohani	Chohani	Jaisalmer
Government Upper Primary School, Hasuva	Hasuva	Jaisalmer
Government Upper Primary School, Khinwsar	Khinwsar	Jaisalmer
Saraswati Vidhya Mandir Senior Secondary School, RD 931 of IGNP	Bajju	Bikaner
Government Upper Primary School, IGNP Colony	Bajju	Bikaner
Government Upper Primary School, Bhelu	Bhelu	Bikaner
Government Senior Secondary School, Kolayat	Kolayat	Bikaner
Government Upper Primary School, Khindasar	Khindasar	Bikaner
Colleges		
Government College, Jaisalmer	Jaisalmer	Jaisalmer
Government Veterinary College, Bikaner	Bikaner	Bikaner

defined. Delivered females were found to carry single pup attached to their ventral body part in head to tail direction. We could not observe breeding activities in species of *Cynopterus sphinx, Rousettus leschenaulti, Asellia tridens,* and *Pipistrellus tenuis*.

Megachiropteran species, *Pteropus giganteus* found roosted on the seven species of trees *viz., Ficus bengalensis* (Banyan), *Ficus religiosa* (Peepal), *Azadirachta indica* (Neem), *Syzygium cumini* (Jamun), *Albizia lebeck* (Sares), *Saraca asoca* (Ashoka) and *Pithecellobium dulce* (Vilaiti Imaly), but *Cynopterus sphinx* and *Rousettus leschenaulti* were found roosted in deserted historical buildings like fort, haveilies and manmade tunnels. The microchiropteran species *viz, Rhinopoma microphyllum*, *Rhinopoma hardwickii*, *Taphozous perforatus*, *Taphozous nudiventris, Asellia tridens* and *Rhinolophus Lepidus* are found roosted in the segregated locations of deserted public wells (Pisaca's), stepwells (Bhavadi's), unattended ruined building structures, under roofs of mud houses, manmade tunnels, temples and natural caves, whereas *Pipistrellus tenuis* was found roosted in deep dark crevices in concrete and mud walls of building's or rocks. In contrast to all these, the *Scotophilus heathii* found to roosts in the hollow spaces under dry foliage of palm trees.

Comparative analysis of data from investigation through RSG Projects (RSG 1st and RSG 2nd) to that with data from studies conducted historically from 1960 to 2007 revealed that seventeen bat roosts reported earlier from districts of Jodhpur, Bikaner and Jaisalmer have been either deserted or destroyed completely in due course of time, while ten have been deserted partially with significant depletion in species composition observed there earlier (Table 2 to 6).

During this investigation, as observed earlier by Purohit *et al.* (2002) and Senacha (2003, 2009), we observed dead and decayed individuals of *Rhinopoma microphyllum* which got entangled in thorns of the trees of *Prosopis juliflora*, grown wildly at openings of certain microchiropteran roosts in the study area (Fig. 47). Scientifically, individuals of *Rhinopoma microphyllum* posses good power of echolocation and rely on it for navigation while performing their flying and foraging activities. They therefore are expected to detect the presence of every obstacle coming up in their way while flying and should not become the victims of such type of causality. The occurrence such unpredicted trapping of only *Rhinopoma microphyllum* individuals in thorns of *Prosopis juliflora* at entrance of multispecies roosts of microchiropteran has raised a questions mark on potential of echolocation ability of at least victimised individuals of this species, if not all. It further reveals, either echolocation power become weak in some unhealthy or old individuals or it temporarily deteriorate drastically even in healthy individuals under the influence of certain physiological or atmospheric conditions, which leads to such unique causalities. To unearth the exact fact behind this phenomenon detailed investigation is required on echolocation capabilities of individuals of this species.

Electrocution in individuals of megachiropteran species, *Pteropus giganteus*, as reported earlier by Purohit and Senacha (2003) and Senacha (2003, 2009) is common phenomenon and similar incidents were observed here during this investigation (Fig.48). Thirty five individuals of this species were found dead due to electrocution at various feeding locations in this study area. Analysis of data revealed that majority of these incidents took place over and due to existence of un-insulated three phase electricity wires installed alongside the roads but specifically near the occurrence of *Ficus religiosa*, a resource tree for feeding activities of this species.

Bat roosts located in premises of ancient Forts and Havelies are prone to face threat of renovation. Most of these buildings are quite old and ruined therefore their authorities have started renovation activities at many of these sites and are in process to initiate it at others. We therefore approached the concern authorities and tried to convince them to not to disturb roosts of bats. However some of them were quite positive other seemed bit reluctant in lieu of losing the benefits out of renovation.

Majority of bats dwelling in countryside of the study area roosts in traditional public wells (Pisaca) which were potentially used to source ground water by villagers recently till village authorities have provided them required purified drinking water through modern supply system. Ground water level receded significantly and most of these wells are running out of drinkable water and are not in use nowadays. These wells, therefore, are facing threats of either sealing them completely or refilling them with soil to avoid possibilities of animals and children falling into them accidentally. We therefore have approached concerned authorities and requested them to not to refill them with soil, but seal partially in such a way that a comfortable opening be left for bats to make in and out moment while performing foraging activities.

As described in final report of RSG 1st Project (Senacha, 2009) establishment of wind energy farms, comprising of large number of wind mills, at various locations in study area could potentially be fatal to the life of bats foraging in their vicinity. Around 1000 plus wind mills have already been installed in different locations of the study area and many more are underway of installation (Fig.46). Worldwide, wind mills have proven hazardous and deadly to many species of bat flying in their close proximity (Arnett, 2005). A zone of low atmospheric pressure is created around the working wind energy farms. When, bats enter this low pressure zone, while foraging, their blood pressure falls significantly and leads to the failure of blood circulatory system resulting in death. It is therefore required that a scientific study be carried here and intensity of probable damage caused of wind energy farms to the diversity of bats be investigated; and proper damage control measures be suggested to the concern authorities.

(B) Bat conservation education campaign:
As mentioned earlier people in this area have been misunderstanding bats over last many generations and consider them as evil and sign of sin. They also believe in myth of bat attacking human nose. While campaigning we have delivered lectures and demonstrations about nature and ecological significance of bats to children, students, youths and elders living in many of the urban and rural settlements of the study area (Figs. in Photo Gallery II) This exercise of bat campaign has helped many locals to sweep out existing myths on bats from their minds and turned them a lifelong admirer of bats. It is hence believed that these people will play key role in imparting right message to remaining public about nature and prevailing benefits of species of bats thriving in this area. Bat Clubs initiated during implementation of both the RSG projects will be the key source to teach the future generations about nature and ecological importance of bats. By this way existing myths about bats would sweep out completely from public mind over the period of time and with their changed attitude people will start appreciating existence of bats in this area. I, therefore, strongly believe

that initiative of launching Bat Conservation and Awareness Campaign through both of the RSG projects will propagate adequately and would be considered as a milestone achievement in the field of wildlife conservation in this area.

RECOMMENDATIONS

Based upon the observations and analysis of data obtained through the study under RSG 1st and 2nd Projects I formulate following recommendations to conserve the roosts and species diversity of bats in Jodhpur, Jaisalmer and Bikaner districts of the Thar Desert.

1. As mentioned earlier, myths about nature of bats are deep rooted among locals in this study area of Rajasthan parts of the Thar Desert. However, execution of two consecutive Bat Conservation and Awareness Campaigns under RSG first and RSG second projects have played significant role to deracinate existing bat myths and update their knowledge about significance of bats among locals, constant efforts are further required to ensure that this message persuade thoroughly to maximum number of people inhabiting in this area and their future generations. So as to achieve it, one has to make sure that article themed of types, nature and ecological significance of bats be published in local newspapers and advertised through local television channels over the period of reasonable time span; relevant lectures are delivered at least yearly, if not more, in schools, colleges and gatherings at settlements (towns/villages/dhanies) in due course of time.

2. Majority of bats dwelling in rural areas of Jodhpur, Jaisalmer and Bikaner districts of the Thar Desert roosts in traditional public wells (Pisaca) which were potentially used to source ground water by villagers recently till village authorities (Gram Panchayat's) provided them required purified drinking water through modern supply system. Ground water level receded significantly and most of these wells are running out of drinkable water and are not in use nowadays. These wells, therefore, are facing threats of either sealing them completely or refilling them with soil to avoid possibilities of animals and children falling into them accidentally. It is therefore of vital importance that concern authorities of these wells be approached and convinced to not to refill them with soil, but be allowed to seal partially in such a way that a comfortable opening be left for bats to make in and out moment while performing foraging activities.

3. Chiropteran roosts located in ancient monuments like Forts and Havelies are prone to face threat 2nd of renovation. However, during the implementation of RSG Project we approached authorities of potential monuments, conveyed them about significance of bats, discussed probability of damage to existing bat roosts by renovation activities and requested them to avoid renovation of sites of bat roosts located in their premises, constant monitoring and efforts of communication with such authorities are required ahead to assure safety these bat roosts. If comfortable, at selected sites authorities of these monuments can be further better educated about ecological importance and species diversity of bats inhabited in roosts located in their premises, and be encouraged to declare it as wildlife spot and earn from visiting tourists, but, in consultation and prior permission from competitive wildlife authorities.

4. We approached and arranged meetings with local wildlife department to discuss status of bats in the study area. Although they are reasonably aware of ecological importance and diversity of bats in their jurisdiction we need to chase them in due course of time, convince and pressurise to include bats in their conservation priorities, as currently bats are least concerned from conservation point of view.

5. Study area should regularly be reinvestigated in due course of time to assess diversity status of bats and to evaluate the impact of conservation measures initiated in this study.

6. Similar approach of studying bats and efforts to create bat conservation awareness is well required in other parts of the Thar Desert, such that a wider objective of conservation of bats in this unique ecosystem be achieved.

7. We need to monitor the activities of Bat Clubs instituted during implementation of both the RSG projects and help them out with providing required raw material, guidance and technical support in due course of time such that they work well and achieve the objectives of educating the targeted groups about nature and ecological significance of bats, and conservation of diversity of bats in their area.

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Male-Male Interaction in Indian Flying Fox *Pteropus giganteus*

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Behavioural attributes of bats are always a fascinating phenomenon. As a matter of survival strategy bats exhibit various behavioural adaptations to favour the changing environmental conditions (Kunz, 1982). The Indian flying fox *Pteropus giganteus*, which roost in open foliages, involved in homosexual behaviour during pre-breeding period.

To observe the behavioural pattern in Indian flying fox *Pteropus giganteus*, a study was made from September 2010 to September 2011 at Srivaikundam, Tamilnadu, South India in a colony of 16,000 bats (in the month of September – Breeding season) roosting in foliages of 28 trees of *Terminalia arjuna*. The colony is located on the bank of perennial Thamirabarani River and Srivaikundam dam. Binocular (Super Zenith 12 x 50) was used to observe the behavioural pattern at the roost. Hand made mist nets (Mesh size 6 x 6 inches; Net size: 100 x 100 sq. meshes) were used to capture bats for observation of reproductive status. The dimensions of the testes were measured using high sensitive electronic balance and dial calipers, and the volume of the testes was also recorded (testes volume = 0.523 x L x w^2: 0.523=constant, L = length of the testes, W = width of the testes (Abott and Hearns, 1978). The observations were made on external morphology and no animals were sacrificed.

Pteropus gianteus was found to form two distinct type of roost, a breeding and a non-breeding roost. Breeding roost is found to be the roost where mating occurs and in non-breeding roost parturition was found to occur. A seasonal fluctuation in the population size was found to occur in the colony. During non-copulation periods (Table 1), both the male and female bats maintain an inter-individual distance of >1 foot and a roosting hierarchy were also observed with regarding to sex and age in the roosting tree as in other *Pteropus* sp. (Nelson, 1965). Colony size was found to fluctuate at a greater rate, depending on breeding and non-breeding seasons. During the month of mid August to early September, when the colony size was around 1500 individuals and 95.5% of them were males. Adult male bats were found to involve in an uncharacteristic homosexual activity, which was not observed in other months. A total of 61 male-male interactions were observed, to a maximum of 18 in a single day. Male bats engaged in homosexual activity were found to have a different morphological size; one male bat was smaller in size than the other. The smaller male bat was found to be either a sub adult or an adult, which enters in to an adult stage from sub adult stage (colour of the mane). As a process of this behaviour, the adult bat which was larger in size move towards the ventral side of the smaller sized bat and it sniffs at the lower abdominal region and then towards the reproductive organ and then it moves towards its dorsal side by holding the bat with its claws. Licking of the reproductive organ was also observed. By moving towards the dorsal side of the smaller sized bat, the larger sized adult male holds the smaller sized bat with wings and clawed fingers, and showed mounting behaviour as observed during mating. Copulation between male and female bats occurs through venter to venter position (Koilraj *et al*., 2001), whereas the homosexual interaction are usually through dorsum to venter position.

Bats, which involved in such behaviour grips the other bat by biting robustly and in some other cases the smaller bat escapes and was found to alter its roosting branch. The complete process of homosexual behaviour exists for a period of 30 seconds to 3 minutes, it was observed to be very common in near by roosts around the study area during the above months. This behaviour mostly occurs during 1000h to 1100h at a greater rate than other hours of the day and also in the dim lighted and densely leaf-clustered areas of the tree. The number of such behaviour originates more when the temperature was around 29ºC to 31ºC. A male bat, which was reared in the captivity, shows such a type of behaviour during the month September with a sub adult male bat.

To study the breeding pattern in male bats, size, weight and volume of the testes was noted for the bats collected in the field. It shows a significant difference in the size, weight and volume during different collections and a statistical significant variation was also observed ($F= 0.67$; $P>0.001$). The testes weight and volume of the bats collected during pre breeding (late-August and mid-September) and copulatory season (late-September and early-October) was found to be higher than the other seasons (Table 1). This clearly indicates that the testicular activity starts during pre breeding season and the adult male bats were found to wield in such a sexual behaviour. The changes in the testicular activity were well studied in several species of Indian bats (Gopalakrishna, 1969) but no report was there to say that the bats might engage in such a type of behaviour. Nelson (1965) reported the social contacts between same sex and homosexual behaviour in *Pteropus poliocephalus* in their summer colonies. Several species of rodents also exhibit homosexual behaviour (Elid-Eibesfeldt, 1958). During the breeding season the female bats moves towards the male and they form a harem like group (three to seven females along with a male bat could be commonly found hanging in the foliages as a group) and copulation occurs as in other *Pteropus* species (Nelson, 1965).

Table: 1 Mean mass and volume of testis of *Pteropus giganteus* in different seasons

SEASON	TESTES MASS (g)	TESTES VOLUME (cc)
Non breeding (Jan - Jul)	3.26	1.47
Pre-breeding (Aug)	4.12	2.73
Copulation (Sep - Oct)	5.17	3.9
Post breeding (Nov - Dec)	3.47	1.66

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Acknowledgement: The work was supported by a UGC-Major Project fund to MRS.

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Roosting Ecology of Indian Flying fox (*Pteropus giganteus*) colonies in the western part of Assam with special reference to their conservation

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The role of megachiropterans or Old World fruit bats is well recognized in the regeneration of the forest as these bats are well known for seed dispersal and pollination. In India, three fruit bat species are very common and among these, Indian flying fox (*Pteropus giganteus)* is ubiquitous but very little information exists on its ecology and biology from northeast India. The present study was therefore aimed to collect information on the roosting ecology and conservation of the species in western Assam.

The study was carried out in the Dhubri district (westernmost part of Assam) of lower reach of the Brahmaputra Valley. The general climatic condition of the study area was muggy with moderate temperature and high humidity. All total 9 roosting sites could be identified in the district during the present survey. Those were Kacharighat, Asharikandi (Ghageralga), Ranjeet nagar (Bilasipara), Salkocha, Nagpatti (Chapor), Sotogoladighi, Simlakandi near Pholbari, Nayahat, and Hatipota (Rabhapara). Out of those, five roosting sites namely Dhubri Kacharighat, Asharikandi, Ranjeet Nagar-Bilasipara, Nagpatti-Chapar and Hatipota (Rabhapara) were selected for ecological study.

Indian flying fox (*Pteropus giganteus*) is the largest fruit bat species of Assam of the Order-Chiroptera, Suborder Megachiroptera and Family Pteropodidae. In Assamese, it is locally known as 'Pholkhowa borbaduli' (meaning Frugivorous Big Bat). Roosting sites are found to be distributed throughout the district. All the 9 roosting sites investigated in the present study from the Dhubri district of lower reach of the Brahmaputra Valley were found in the thickly populated human habitats in their planted or naturally generated trees near road side or inside the man made buildings. Some of the roosting sites were found nearby perennial water sources. Indian Flying Fox (*Pteropus giganteus*) has been emerged as an exclusively plant dependent bat species. All total 21 different roosting tree species have been recorded in the studied roosting sites. Out of those 21, 23.81% plant species were of the Assam valley semi evergreen forest type. Plant species were *Ficus religiosa, Anthocephalus cadamba, Eugenia jambolana* and *Terminalia arjuna* and *Aegle marmelos* (Bel / wood apple). 42.86% roosting plant species such as *Caesalpania inermis, Eucalyptus globossus, Bombax ceiba, Tamarindus indica, Ficus glomerata, Shorea robusta, Trewia nudiflora, Artocarpus heterophyllus* and *Psidium guajava* were fallen under the forest category East Himalayan moist mixed deciduous forest. Remaining 33.33 % plant species such as *Caryota urens*, *Areca catechu, Mangifera indica, Bambusa* sp*, Ficus bengalensis, Alstonia scholaris* and *Polyalthiya longifolia* were Ever-green trees although there were no Ever-green forest patches in true sense in the study areas. Generally Indian flying foxes (*Pteropus giganteus*) preferred to roost in trees of 31 to 50 feet height range. Plant species having girth at breast height (GBH) of 201-300 cm were mostly seen selected for roosting purposes in the study sites.

Some Roosting Trees of the Dhubri district of Assam

Photo 1: *Eucalyptus globossus*

Photo 2: *Anthocephalus cadamba*

A total of 2526 individuals of Indian flying foxes were recorded in the study sites. Looking at the total area surveyed (700 sq.km) to locate the 9 roosting sites for the population study, the approximate population of *P. giganteus* in Assam was estimated at 2, 83,049 bats with the population density of 3.61 bats in per square

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Photo 3: ***Caesalpinia inermis***

Photo 4: ***Bombax ceiba***

Photo 5: ***Aegle marmelos***

Photo 6: ***Caryota urens***

Photo 7: ***Shorea robusta***

km area. Overall mean population of the sites were calculated at 505.2.

Habitat loss due to anthropogenic deforestation, hunting for medicinal use of bat flesh and for food; electrocution; natural calamities like occasional hailstorm, cyclones; and predation were identified as the threats of *P. giganteus* populations in their habitats in the Brahmaputra Valley of Assam. Higher human population pressure and developmental denudation of trees forced the *P. giganteus* population to a vulnerable state with the reduction of their number in most of the sites of the lower reach of the Brahmaputra Valley of Assam. Now this bat species seems to be a "conservation dependent" one so it is time to launch serious long term conservation-management programme and to plan for multidimensional scientific research works in the college, universities as well as in field to save the existing roosting sites and the existing population from further declines in the State of Assam.

Short Summary of the final report on UGC sponsored Minor Research Project. [Reference No. F.5-316/2009-10(MRP/ NERO)/5888, Dated 14th December, 2009.]

Bat Conservation International - Global Grassroots Conservation Program

Nurul Islam

Grantee Name: Nurul Islam
Grantee Affiliation: Chittagong Veterinary & Animal Sciences University, Bangladesh
Project Title: Strengthening the community approach towards conservation of Bats through myths elimination and conservation education in Bangladesh
Reference No: GG12001
Period Covered by report: August 11, 2011 to August, 2012

Executive Summary: Bat Conservation International is committed to support the grassroots conservation effort around the world. Bangladesh is a land of 33 bat species, which are facing multifarious threats due to man-made and natural causes. We used the Global Grassroots Conservation Fund to conduct the first bat conservation education programme in Bangladesh.

During the project period, a questionnaire survey was conducted to assess the knowledge and myths about bats in Nipah outbreak and non-outbreak areas of Bangladesh. We developed outreach material in *Bangla* (native language) based on the survey results and conducted outreach and educational campaign in different areas of Bangladesh. The programs includes 20 school education campaign, 5 villagers education, 2 zoo education, 2 seminar, and a workshop. During Nipah encephalitis outbreak, three awareness campaigns were also conducted in Noagoan and Faridpur districts of Bangladesh. Three abstracts, 2 news paper articles and journal articles were published during the project period and 2 manuscripts are now under processing to submit in scientific journal.

We are receiving a lot of positive response from the community people especially young volunteers regarding the educational programmes. We are able to reach 2000 people within a year which includes students, farmers, teachers, journalists, orchard owners and different community people. Due to budget constrain our program was limited within the study site. But the education program needs to reach out in other area of the country with a research entity via sustainable source of funding.

Project Background: Bats provide important ecological services such as insect control, pollination and seed dispersal. Fruigivorus bats as flying foxes are dependent on juice and pollen of tree flowers; they play a crucial role in the pollination of tree species and pollinate at least 500 neotropical plant species of 96 genera. Insectivore's bats have competent role in human economy by controlling root warms, insect pests. Additionally Bat droppings (guano) in caves support whole ecosystem of unique organisms. Roosting sites of bats have great ecological significance in conservation of biodiversity.

About 33 species of bats are recorded in Bangladesh. In recent decades, the bat population in Bangladesh are facing extensive threats due to habitat loss, hunting for food and medicine, deforestation and climate change and cutting down tall tree for urbanization. But unfortunately bat conservation till now is a neglected issue in Bangladesh. Most of the people in Bangladesh hate the bats and treat them as dirty animal and only as pest.

We have selected Chittagong, Comilla, Faridpur, Tangail, Sylet & Chapai Nawabgong district where several bat roosts were identified by Eco health alliance team as part of Understanding the ecology of Nipah virus in Bangladesh. We conduct our educational program within the 10 km radius of a bat roost in the study site. The school, marketplace and zoo or safari park was included in the focused area of education campaign

Concurrent Nipah encephalitis outbreak, a fatal disease of human associated with flying fox contaminating the date palm sap causes death of human from 2001 to until now. This outbreak issue along with some age old misconception plays synergistic effect on negative attitude of the community people in Bangladesh.

Public awareness is also crucial component that must be taken into consideration for holistic conservation management plans for Bangladesh. Thus it was an urgent need to conduct a sustainable education program in Bangladesh on the importance of bats in pollination, seed dispersal, pest control and the benefits of their excrement (as natural organic manures) may create better understanding to preserve their roosting habitats.

There was no bat conservation education program in Bangladesh until the arrival of this project with the support of BCI. The project was implemented with an aim to raise awareness and to involve the community people to protect

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the fascinating flying mammals in Bangladesh.

The key of objectives of the project was as follows:

- *Assessing the myths and misconception among the community through structured questionnaire survey.*
- *Developing outreach and educational material in native language (*Bangla*) and distribute free of charge.*
- *Elimination of misconception and informing the role of bat via educational campaign.*
- *Educating the school children about the bats, biology and its role in the nature.*
- *Training and capacity development among the volunteer to take action in their own community.*

Study site of the project:

Development of outreach and educational materials: We developed some outreach and educational materials in native language to conduct our activity. The materials were prepared with a focus on the role of bats, threats and what can we do to protect the bat population. The materials were disseminated to the participants for free of cost during the educational program. Limited (n=100) package of the materials were sent to interested person via Post on request. Rally caps were distributed among the school children to enhance their interest and satisfaction in the program. Posters and banners were given to different important educational institute at important bat locations. The calendar and stationeries (pencil, scale and pen) were use to raised funds (wherever possible). Details of education materials developed are given below:

Name of the materials	Amount prepared (number)
General Brochure (8”×11”), 2 ply	3000
Species Card (3”×2”), both side	10000
Rally cap (8”×6”), rounded with rubber band	1000
Poster: Year of Bat (4’×3’) in PVC sheet	100
Table Calendar (8”×11”)	2000
PVC Banner (12’×8’)	20

School children education: The children are the future leaders of the nation. We conducted 15 education programs in different high schools and primary schools within our study area. Schools located with in 10 km radius of a bat roost (Indian flying fox) were identified and selected. Among 15 schools, 10 are in the urban area and five in the town. The program mainly focused on drawing competition, easy writing, quiz competition and Bat math solution. A short speech was given in every school prior to the program. Power point presentations were also given in some schools whereever electricity was available. The outreach materials were distributed among the school children free of cost. Overall, the program duration was 2-3 hours in each school. Light refreshment was served to the children at the end of the program. A questionnaire also deploy at least do evaluate the program, level of knowledge and comments from the school children and teachers.

Community education: Involving community people is the prerequisites to protect a species in its natural habitat. We conducted community outreach and educational program in different villages of the study area. We targeted the farmers, orchard owners and hunters as our primary focused people for education. We convinced the orchard owner not to use destructive netting method in their land. The farmers were suggested to use harmless pesticides or organic pesticides in their crops. It was difficult to accumulate the Bats hunter due to their security of illegal activity. So far, we could reach 13 hunters educating them about the role of the bats in the environment. But they did not agree to stop their practice for economical purposes. They asked for alternative source of income from the government for their living.

Zoo and Safari park education: We conducted two educational programs in the Chittagong Zoo and BSM Safari Park. An information booth was setup in front of the zoo to attract the visitors. A Power Point display of “Myths and its reality” was played in the projector screen. The general brochure was distributed free of cost to the visitors and calendar was used to raise fund. The volunteers were answering to the questions of the visitors about Bat Conservation and their myths. Suggestions and comments were collected in the formatted pad regarding the activity of the Bat conservation.

Bat-stall in Agricultural fair: For the first time in Bangladesh, we presented a bat stall in the agricultural fair in Chittagong. The Agricultural fair was arranged by the Department of livestock, People’s Republic of Bangladesh. We spread the message of Bat conservation among the visitors and farmers. We got the 2nd prize for presenting the important issue among the visitors. We were able to reach diverse participants from different agricultural sector from greater Chittagong. The educational materials and outreach materials were distributed free of cost.

Celebration of the Year of the Bat: Year of the Bat is an international initiative to reach among the large range of bats lovers in the world. We celebrated the Year of Bat in Chittagong Veterinary and Animal Sciences University. A short presentation, rally and seminar were held on the occasion. The teachers, students, journalist and nonprofit professionals were invited for the program. The overall program is précised by Professor Dr. A S Mahfujul Bari, Vice Chancellor of CVASU. We also printed some specific outreach material for the program obtain from Year of Bat webpage (www.yearofbat.org)

Training and field trips: A field trip and a day long workshop was organised for University students from our study area. The workshop and field trip was arranged with an aim of capacity building and enhance their interest about bats and conservation. We deployed mist net overnight in an orchard to capture the bat. We captured two *Cynopterus* spp. and one *Pteropus* spp during our field survey. We release them after taking the morphometric data by the participants. Mango-Juice was fed to the bat prior to release. The participants were selected on the basis of their merits and statement of interest by the Jury from CVASU. The field gear and other cost were fully covered by the GCRB.

Celebration of Batty World Animal Day: World Animal Day is an initiative of Nature Trust to celebrate the role of animal and their contribution in human society. As an ambassador of world animal day we celebrated the day

with proper recognition and programs. The program was held in Sylhet Agricultural University. The Animal welfare group name PRADHIKAR helped to organize the program.

Networking and collaboration: We created a face-book fan page to reach large scale of people in Bangladesh and abroad. We regularly updated the page status and shared different amazing story of Bats. We also follow the other updates from related page. The page can be found at www.facebook.com/gcrb.org.bd.
SEABCRU is one of the leading bat conservation organizations in south East Asia. We maintain a good collaborative relation with SEABRCU from the beginning of the project. For covering a large scale of people and easy access the outreach materials we upload the digital copy of outreach materials on SEABRCU WEBSITE. The materials can be found at http://www.seabcru.org/index.php/component/content/article?id=122. As I am a member of CCNISA of Zoo Outreach organization, we often provide updates to the organization about our activity. We also maintain the good collaborative relation with different organization within the country. The Green Explorers Society (GES), PRADHIKAR is most frequent helping partner of our program.

Further Recommendation:
Continuation of the education program: During our project period we were able to reach more than 2000 people in the study area. Due to fund constrain we are unable to expand our program in different district where it is an urgent need. As we develop some outreach material in the project, we can use them to fundraise. But Bangladesh is a developing country and it is too difficult to continue the program without further support from Bat Conservation International. We wish to get further help from BCI to protect the fascinating mammals in Bangladesh.

Bats and Nipah Booklet: The authority and the local media of Bangladesh only focused on that bat play role in spreading the disease without focusing their role to the environment. During winter season the Nipah outbreak often occur in Bangladesh. So developing a Bats and Nipah Booklet is conservation aspect like Bats and Rabies is necessary to conduct our further educational program in Bangladesh.

Developing a non destructive method to control the fruits bat: Through personal contact and media report shows that in the recent time death of Bat after entangling with destructive netting in the backyard and commercial orchard is the major threats to bat conservation in Bangladesh. Due to rapid habitat destruction and deforestation the bats after often forage in the commercial cropland. To protect the cash crop farmer often use destructive netting method. According to the newspaper report, more than 500 flying fox is dead in a single night in 2-3 hector of Brinjal crop land.

Assessing the threats due to netting method is necessary in Bangladesh. Developing of non destructive netting method for controlling the fruits bat in backyard and commercial farm is necessary to protect the thousand of fruits bat in one month. During our conservation education program farmers are often asking us to provide them non destructive method of controlling fruits bat in their crops. So it is an urgent need to develop a non destructive method and determination of success rate of these methods.

Training and scientific skill development of volunteer: We have a group of young enthusiastic volunteer group of student who are ready to act as bat protector and conduct any scientific research in Bangladesh. But we need to train and capacity development of the volunteer. Unfortunately, there is no Bat biologist in Bangladesh, so we need help from Bat Conservation International. It will also help us to conduct different conservation related research in Bangladesh. It will be most effective to arrange a regional workshop in Bangladesh after collaborating with other SA organization.

Protection of the Bat roosts site: We have identified some bat roosts in Bangladesh. It is an urgent need to conduct bat population survey specially the flying foxes to protect their roosting site. After identification different placard and bill board insertion in the roosting site may be effective for protect the site. Larger roosting site can also be declared as protected area with proper authority.

Threat assessment and monitoring of the bat population: The Indian flying fox is the hardest heating species in Bangladesh but they are declining rapidly. So we need to initiate a monitoring program of bat population in Bangladesh. Bat Conservation action Plan also needs to develop with collaboration of IUCN Bangladesh, GCRB and BCI.

Developing a web-resource: To enrich the conservation educational bank of Bangladesh and reach maximum people we need to develop a web-resource for our group. The website will be a potential source of species data and publication and news related to bat in Bangladesh and around the world. The outreach materials also uploaded to the website. Through the website we will able to reach many international bats lovers and able to raise funds for sustainable program. We will also prepare the monthly newsletter and send it to the interested subscriber after building the website.

Report of Albino *Rhinopoma microphyllum* kinneri sighted in Thar Desert

Dau Lal Bohra and Chandan Kumar Bahura

The Thar Desert occupies nearly 9% of India's total geographical area and covers more than 804,000 sq. km., which extends into the Pakistan. Nearly 62% of Thar Desert spreads over twelve districts of Western-Rajasthan and parts of Kutch (Rahmani, 1997). It lies between 25° to 30° N latitude and 69° to 76° E longitudes. A major portion of the Thar Desert is occupied either by dry open lands or small patches of grasslands interspersed with trees and thorny bushes (Gupta, 1975). Thar Desert have dry deciduous forests, scrub land, sandy/salty desert, and semi-arid patches of vegetation and irrigated/non irrigated agricultural fields that house wild fauna (Senacha, 2009).

One of the smallest desert of the world, the Thar is home to eleven microbats, namely, *Rhinopoma microphyllum*, *Rhinopoma hardwickii*, *Taphozous perforatus*, *Taphozous nudiventris*, *Rhinolophus lepidus*, *Scotophilus heathii*, *Pipistrellus tenuis*, *Megaderma lyra*, *Hipposideros fulvus*, *Tadarida aegyptiaca* and *Pipistrellus dormeri*, and three mega-chiropteran species namely, *Pteropus giganteus*, *Cynopterus sphinx* and *Rousettus leschenaulti* in its recent past (Chakravarthy & Girish 2003, Prakash 1963, Sinha 1979, Gaur 1981). In 2010, survey conducted in Bikaner reported the presence of four species of Microchiropterans *Rhinopoma microphyllum*, *Rhinopoma hardwickii*, *Pipistrellus tenuis* and *Rhinolophus lepidus* and one Megachiropteran *Pteropus giganteus* (Bohra, 2010)

Due to urbanization bats have lost countless traditional roosts such as caves, rock carvings, old buildings and old tree hollows. Mines are being recognized as key to the life history of bats and are critical for many purposes such as rearing young hibernation, social activities (courtship and mating), and roosting. The complexity and associated airflow of these mines provides a range of internal temperatures suitable for bats. (Altenbach, 1995).

Our study site, near residential area (27°59'33"N 73°20'19"E) is located in southern part of Bikaner, Rajasthan along the border of Pakistan. Earlier this site was used for the production of small stone as a building material and now there are nonfunctional.

Fig. 1. Albino *Rhinopoma microphyllum* kinneri inside Naganachi temple cave, Bikaner, Rajasthan

Fig. 2. Albino *Rhinopoma microphyllum* with mix population of bats

In historical point these cave were old temple of shree Hanuman and these were protected due to religious reasons. About 500-550 individuals of bats have been observed in this location. In observation period mix population of microchiropteran roost solitary in roof of cave prevailing congregation of *Rhinopoma hardwickii* (Lesser Mouse-tailed bat) and *Rhinopoma microphyllum kinneari* (Greater Mousetailed bat).

On 9th October 2011 at 17:45 hr. an albino bat was sighted in Naganachi cave temple (Fig. 1 and Fig. 2) clinging to the roof of the cave among a colony of *R. microphyllum*. Several photographs of albino bat were taken and the specimen was captured with the help of hoop net. Necessary morphometric measurements were taken using a vernier caliper, after which the specimen was released back into the cave and care was also taken to minimize stress. Morphometric measurements such as fore arm length, tail length, ear, body weight, sex (male/female) were recorded at the location and compared with standard identification key (Srinivasulu *et al*, 2010) and the

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Table 1. Morphological characters of *Rhinopoma microphyllum*

Species	Rhinopoma microphyllum* (Brünnich, 1782)	Albino Rhinopoma microphyllum Kinneri (Male)
External characters		
Forearm length	59.5-74.6	65.1
Head Body length	60.0-84.0	63.3
Tail length	50.0-77.0	49.8
Hind Foot length	14.0-18.0	15.6
Ear length	18.0-22.0	16.9
Dermal ridge	Poorly developed	Less developed
Tail length in relation to forearm length	Shorter	Short
Sex/ Body weight	-	33.1gm
Cranial characters		
Condylocanine length	17.2-22.7	17.4
Maxillary toothrow (CM3)	7.0-8.0	7.1
Mandibular tooth row (CM3)	7.6-8.6	ND
Zygomatic breadth	11.4-13.4	ND
Mandible length	13.7-15.8	ND
Nasal inflations	Small	Small

*Source – Srinivasulu *et al*, 2010
ND- Not done

species was confirmed as *Rhinopoma microphyllum* Kinneri by condylocanine length and maxillary toothrow using plastic strip. (Table 1).

Previous reports suggest that most of the albino bat species recorded so far have been sighted inside sheltered roosts such as caves, mines, galleries or buildings.(Kunz, 1982) Such roosts may be essential for the survival of albino bats to protect them against sunlight, water loss and predation by predators. Albinism is rare in bats and has been reported in only six species from the Indian subcontinent, namely *Rousettus leschenaulti*, *Rhinopoma microphyllum*, *Rhinopoma hardwickii*, *Hipposideros sp*., *Hipposideros lankadiva* and *Hipposideros diadema nicobarensis*. Though *R. microphyllum* Kinneri is a commonly occurring species in western India, there is only one report on sighting of an albino specimen from Jodhpur, Rajasthan (Bhati, 1988) and Gujarat (Devkar *et al*., 2011). In this regard, our observation of *R. microphyllum* kinneri is reported first from Bikaner.

Reports on microchiropterans, their migratory trends, traditional roosts, habitat and food preferences in western India are scanty. A study conducted in the Thar desert, Rajasthan, remains one of the most important piece of work done in western India for conservation of micro-chiropteran bats and their habitats (Senacha, 2009). A series of activities were conducted in Bikaner District of North-West part of Rajasthan state to conserve roosting sites of some of the bat species (Bohra, 2011).

Acknowledgements
We thank Head, Dept. of Zoology, Dungar College, Bikaner and Forest Department, Bikaner for key inputs and suggestions.

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Observations on nesting behaviour of five stripped squirrel, *Funambulus pennanti*, Wroughton in Indian Thar Desert of Rajasthan

Sanjay Paunikar[1] and S.S. Talmale[2]

The Thar Desert located in northwestern India, is a part of the predominantly sandy hot desert, which extends to middle-eastern and Shaharan counters in the west. Rajasthan is situated in the northwestern part of the Indian union (23^0 30′ and $30^0$11′ N latitude and $69^0$29′ and $78^0$17 E longitude). The ecosystem is hyper-thermic and characterized by low and erratic rainfall, poor soil health, low humidity and frequent drought. The faunal and floral diversity of this region is very rich due to its fascinating geography and some of them endemic to this region. Several animals found in the region from tiny insect, amphibians, reptiles, birds to larger mammals (Camel). The unique features of the animals of the Thar desert are its ability to adopt to live adverse climatic conditions of the region. The small mammals like rats live by making burrows in moist area and squirrels by making nesting places near water sources in the desert. Some interesting nesting behaviour of five stripped squirrel, *Fanambulus pennanti* Wroughton was observed by the first author in residential quarter and forest nursery of Arid Forest Research Institute, (AFRI), Jodhpur, Rajasthan during the month of April-June 2005-06.

The five stripped squirrel *Fanambulus pennanti* is a common and widespread commensal, found in homes, gardens, forest nurseries and roadside trees. It is a chirpy completely diurnal and generally arboreal in habitat. In arid parts of its range, thick foliage and the moist microclimate of trees, particularly in orchards, provide shelter from excessive climatic conditions (Ghosh, 1975). The squirrels are highly mobile, agile climbers. It was found to be uncommon in the desert biome of north-west India where it was found most frequently in rocky and ruderal areas (Prakash 1975). The *Fanambulus pennanti* is also a well recognized rodent pests of forest nurseries, kitchen garden and pomegranate fruits (Paunikar and Ahmed, 2002). The population structures of the squirrel have been studies in detail in Rajasthan (Prakash and Kametkar, 1969).

1. Squirrel move in and around air cooler

2. Nesting place of Squirrel

3. Fragments of nest of squirrel

A nest not only provides a place to give birth of young ones but also protect from predators and varied climatic conditions. Nesting behaviour of the squirrel is an instinctive behaviour. During the month of April-June in the arid region, the temperature ranges between 45^0 to 48^0 C. During this season desert coolers are fitted in houses. While fitting coolers in the window, some gap fall in between the wall and cooler. In this observation, a few days after fitting coolers, it was observed that the squirrel constructed a nest in between wall and cooler by using cotton, cloths, dry twigs and human hairs (Image 1, 2 & 3). The size of

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the nest large and possessed one main opening, one or two emergency openings and 2-3 nesting chambers within.

The squirrel and their young ones (2-3) lived in the nest. They moved in and around the cooler for water. Some times they entered in the house in search of food with their young ones. They remained in the nest throughout day due to hot weather but in the morning and evening they go outside with their young ones for feeding and playing. One day the next was removed but by evening it was found that the squirrel constructed their nest using same materials and occupied. The nest was removed about six times but they found and constructed their nest same place again. Because of extreme hot summer they preferred to construct their nest nearby cool places to avoid direct sunlight or extreme high temperature and high wind velocity of the Thar Desert of Rajasthan.

Nesting behaviour observations were also made in the forest nursery of AFRI, Jodhpur. It was observed that the squirrel constructed their nests above the ground on different forest tree species and holes of mist chambers, fencing wall, undisturbed windows and shading places. The percentage of nesting materials utilized, however, varied from nest to nest and even in different habitats as per their availability. The size of the nest seemed to be correlated with the number of individuals occupying it (Chopra and Rana, 1999). It was found that the squirrel preferred to construct their nests near water sources and tree shades. Watering to the nursery seedling is a routine practices in the forest nurseries to avoid dried the seedlings. Forest nursery is an ideal place for the squirrel not only provided the food, shelter and water but also nesting places. The forest nurseries provide feeding ground for the squirrel. They mostly feed on the sowing and germinated seeds of the important forest tree species in the nursery, which is growing for the future afforestation programmes. The five stripped squirrels eat seeds throughout the year, leaves and soft fruits during autumn, and insects, particularly locusts, during summer and do not cache food.

It is observed, that due to harsh condition of the Thar Desert during the summer season, they always wanted to remain in shaded areas or near water sources. The desert animals cannot survive without water or for long periods in the scorching sun. The small mammals like squirrels are adapted to live with adverse condition of the Indian Thar Desert of Rajasthan by their nesting behaviour during the summer season.

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Golden Guests ...*

Have you ever been there?
Where music of inverted hanging lives
Rules the milieu
The stream flows nearby
Blending its music to those echoes

Dark invites them for a delicious dinner
Fruits keep waiting for their golden guests
Lonely jungle waits the whole season
For those lovely brats
Lovely **Golden BATS**

***poem by **Dr. Sanjeev Kumari Paul**
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SMALL MAMMAL NETWORKS

Chiroptera Conservation and Information Network of South Asia (CCINSA)

CCINSA is a network of South Asian Chiroptera specialists, educators and enthusiasts. The network aims to enhance communication, cooperation and collaboration among chiroptera specialists of this region and thereby create a chiroptera conservation "community" for better biodiversity conservation.

Chair: Sripathi Kandula
Convenor and Administrator: Sally Walker
Red List and Technical Advisor: Sanjay Molur

Rodentia, Insectivora, and Scandentia Conservation & Information Network of South Asia (RISCINSA)

RISCINSA network of South Asia was suggested by interested biodiversity conservation specialists and the purpose of this network, then is to link together rodent field researchers and their field knowledge throughout South Asia (Afghanistan, Bangladesh, Bhutan, India, Nepal, Maldives, Pakistan and Sri Lanka) so the pooling of information can lead to conservation action.

Scientific Chair: Sujit Chakraborty
Convenor and Administrator: Sally Walker
Red List and Technical Advisor: Sanjay Molur

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Bat Conservation International BCI is one of the most active, innovative and respected bat conservation organisations in the world. See BCI's wonderful website: **www.batcon.org**

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IUCN SSC Bat Specialist Group
CCINSA represents the IUCN SSC Bat Specialist Group in South Asia. BSG utilises the CCINSA Network to locate specialists in different subject areas, to organise training as well as conservation assessment workshops and other activities to assist the CSG in their mission. Contact : Chair Paul Racey: **p.racey@abdn.ac.uk**
See Website:
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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, & Scandens Conservation and Information Networks of South Asia.

Editor: Sally Walker; Technical Advisors: Sanjay Molur, B.A. Daniel, R. Marimuthu; and Publication Assistants: Latha Ravikumar, Ravichandran, R. Pravin Kumar.

CCINSA and RISCINSA are an activity of Zoo Outreach Organization (ZOO) and Wildlife Information Liaison Development (WILD) in association with CBSG, South Asia and RSG, South Asia.

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