Gathering evidence of the utility of bats: Training in Field Techniques for Ecological Studies of Chiroptera

C. Srinivasulu* and Sally Walker**

The Chiroptera Conservation and Information Network of South Asia (CCINSA) and the IUCN SSC Chiroptera Specialist Group joined with the College of Forestry, Kerala Agricultural University, Thrissur to conduct its second field techniques training workshop, from 28 July – 1 August 2003 sponsored by Chester Zoo and Marwell Zoo, U.K at Thrissur.

The first such workshop was conducted at Madurai Kamaraj University, School of Biological Sciences almost two years ago, ably led by Dr. Paul Bates from U.K. and author of the definitive book on bats of this region *Bats of the Indian Subcontinent*, (1997). He was assisted by Dr. M. S. Pradhan and Dr. Y. P. Sinha from the Zoological Survey of India. This workshop focused on general field techniques and taxonomy with a day spent on the IUCN Red List Criteria and Categories and the C.A.M.P. Workshop Process in order to prepare CCINSA members for the impending Chiroptera C.A.M.P. which was held last year in January.

The South Asian Chiroptera C.A.M.P. covered all 123 species of South Asian Chiroptera. After that workshop, which updated the output of the 1997 BCPP C.A.M.P. for mammals, CCINSA has continued to lobby very seriously to get fruit bats off the Vermin (Schedule V) list of the Indian Wildlife Protection Act, 1972 as ammended upto 1991. About one year ago, while pursuing that objective, we learned from Ministry officials that they required scientific evidence of the utility of fruit bats in Indial There are plenty of published studies of the ecological utility of fruit bats from other tropical countries, but such evidence from this country was required to justify the removal of these controversial and misunderstood animals from the Schedule which permits anyone to capture, harass, torment and kill them with legal impunity.

Therefore, it seemed a good time to start promoting ecological field studies, which could turn up evidence of the tremendous positive impact which both fruit bats and insectivorous bats have on the ecosystem. There are some such studies ongoing currently but many, many more studies are required, both ecological as well as population, distribution, etc.

In the C.A.M.P. workshop, 5 fruit bats and 24 insectivorous bats were assessed as threatened in India. See list above. New topics were added to this workshop. As a result of the

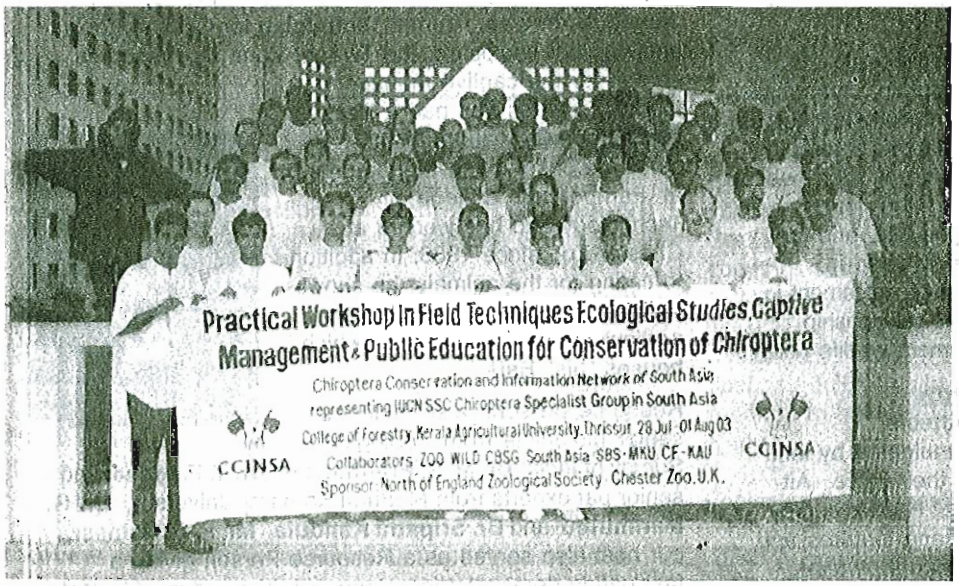
Threatened bats of India

Fruit bats (Megachiroptera) -- total 5

Latidens salimalii Thonglongya, 1972 -- EN
Pteropus faunulus Miller, 1902 -- EN
Pteropus hypomelanus Temminck, 1853 -- EN
Pteropus melanotus Blyth, 1863 -- VU
Pteropus vampyrus (Linnaeus, 1758) -- EN

Insectivorous bats (Microchiroptera) -- total 24

Hipposideros diadema (E. Geoffroy, 1813) -- VU
Hipposideros durgadasi Khajuria, 1970 -- EN
Hipposideros hypophyllus Kock & Bhat, 1994 -- EN
Ia io Thomas, 1902 -- EN
Miniopterus pusillus Dobson, 1876 -- VU
Murina grisea Peters, 1872 -- CR
Myotis annectans (Dobson, 1871) -- VU
Myotis blythii (Tomes, 1857) -- VU
Myotis daubentonli (Kuhl, 1819) -- EN
Myotis montivagus (Dobson, 1874) -- VU
Myotis mystacinus (Kuhl, 1819) -- VU
Myotis sicarius Thomas, 1915 -- EN
Nyctalus leisleri (Kuhl, 1819) -- EN
Otomops wroughtoni (Thomas, 1913) -- CR
Philetor brachypterus (Temminck, 1840) -- EN
Pipistrellus savii (Bonaparte, 1837) -- VU
Rhinolophus cognatus Andersen, 1906 -- VU
Rhinolophus ferrumequinum Schreber, 1774 -- VU
Rhinolophus hipposideros (Bechstein, 1800) -- VU
Rhinolophus mitratus Blyth, 1844 -- VU
Rhinolophus subbadius Blyth, 1844 -- VU
Rhinolophus trifoliatus Temminck, 1834 -- VU
Rhinolophus yunanensis Dobson, 1872 -- VU
Taphozous theobaldi Dobson, 1872 -- VU



Participants pose with the world's largest bat (see hovering figure, left). Photo by C. Srinivasulu.

***CSIR Research Associate, Department of Zoology, Osmania University, Hyderabad 500007, Andhra Pradesh**
****Founder/Hon. Director, Z.O.O., Coimbatore 641004**

C.A.M.P. workshop, we now have very specific information about the bats of South Asia and can begin to educate people about them. Bat researchers themselves are the most effective educators as they are passionate about their field. Therefore, in the workshop a slot for education was scheduled. Also, some information about bats can best be gathered if one observes them up close and a few researchers in CCINSA keep bats, so a module on captive management was included as well.

CCINSA now knows of many bat researchers in India but other countries in South Asia are not so rich in researchers. Therefore CCINSA is trying to build up a community of bat researchers in the surrounding countries as well. For the workshop a group of 5 budding bat researchers from Bangladesh made the very long journey by train and also a group of 3 from Sri Lanka. In the coming years, we will try to find biologists in Nepal, Bhutan, Maldives and Pakistan who would take up bat studies. Finally, although India has more bat researchers than other countries, it is not sufficient to cover this important and large group sufficiently. Bats are the largest group of mammals in India -- 114 species out of about 400 mammals. There is much more work to do on bats so that we do not lose these extremely useful animals.

Resource Persons

The workshop was privileged to have **Dr. Paul Racey, Chair of the SSC IUCN Chiroptera Specialist Group** which CCINSA represents in South Asia. Dr. Paul Racey is Regius Professor of Natural History in the Department of Zoology, Aberdeen University, Scotland. Dr. Racey Co-Chairs the SSC IUCN Chiroptera Specialist Group along with Dr. Anthony Hutson, and an active bat researcher. He is active on many animal committees, including the Council of the London Zoological Society and the Inspection team for Welfare of Laboratory Animals, etc,

Paul Racey's comment on his current activities is: "Bats are the most important contributors to Britain's mammalian biodiversity and although their roosts are protected, this is of limited value in maintaining bat populations if foraging habitats are being lost. Present knowledge of such habitats and the extent to which bat species adapt their foraging patterns to changes in land use is inadequate, and my group is addressing this throughout the UK and in mainland Europe. I am also increasing my involvement in ecological studies of tropical bats, and the relationship between ecological research and government wildlife policy".

Paul's specific major projects are below

(a) Testing the wildlife corridors hypothesis
Wildlife corridors have been widely promulgated by land managers in advance of formal proof of their value. Although the results of the first National Bat Habitat survey indicate the importance of linear landscape features and connectance between the habitats in which they feed, reports of the use of vegetation corridors by wildlife including bats, lack statistical rigour. This involves automatic recording to test the hypothesis that bats move between occupied and vacant habitats along vegetation corridors.

(b) Gleaning as a foraging strategy in *Myotis nattereri*
To test the hypothesis that Natterer's bats do not switch off echolocation when gleaning and this affects where and on which arthropods they forage.

(c) The effect of eutrophication on Daubenton's Bat, *Myotis daubentonii*
Using the natural laboratory of our study area which contains both oligotrophic and eutrophic rivers, we are testing the hypothesis that eutrophication is responsible for the increase in numbers of Daubenton's bats throughout Europe.

(d) Genetic variation in European bats particularly *Pipistrellus* and *Myotis*
In collaboration with Elizabeth Barratt (Institute of Zoology) and Gareth Jones (University of Bristol) this project has confirmed that the two phonic types of the Pipistrelle are sibling species, and has thus added a new bat species to the European list. It continues to investigate genetic substructuring and patterns of gene flow in the two Pipistrelle species, and is now accumulating data on the genetic structure of British populations of Natterer's bats.

(e) The ecology and roosting behaviour of the Noctule Bat *Nyctalus noctula*
To investigate why this species prefers to roost in tree holes rather than in the roof spaces of houses.

(f) The role of fruit bats as pollinators and seed dispersers of tropical forests
To test the hypothesis that fruit bats are keystone species in tropical forests, work is in progress in Southern Madagascar and Thailand. The work in Madagascar also involves a nationwide survey of the roosts of the three endemic Megachiroptera, supported by the Darwin Initiative.

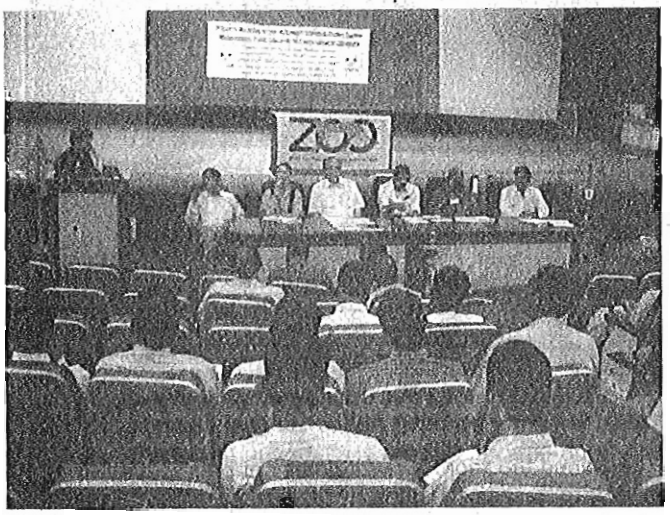
(g) The effect of different logging regimens on bat community structure and ecology -- This project is supported by The Leverhulme Trust and will begin in June 2000 in Trinidad.

James Andrewes, Animal Technician for Chester Zoo's amazing bat enclosure, the Twilight Zone was resource person for the captive management module. James has had a lifelong fascination with natural history. He studied Conservation Management at Farnborough College of Technology and has worked at Chester Zoo since 1986. In addition to caring for the animals, he shows visiting dignitaries around the zoo, particularly the Twilight Zone which houses "his" Bats.

Resource persons also included senior biologists from Zoological Survey of India, **Dr. M. S. Pradhan** and **Dr. Y. P. Sinha**; and senior bat experts from Madurai Kamaraj University, **Dr. G. Marimuthu** and **Dr. Sripathi Kandula**. **Mr. P. O. Nameer,** our host also served as a Resource Person giving a fascinating demonstration along with his student, **Mr. Roby**, of preparing dry specimens of bats. Second author **Sally Walker** was resource person for education.

Inaugural

Luckins C. Babu, Associate Dean, College of Forestry; P. O Nameer, Assistant Professor, College of Forestry and General Convenor of the workshop; O. P. Kaler, IFS, Registrar KAU; Paul Racey, Regius Professor of Zoology, Aberdeen University and Chair, IUCN SSC Chiroptera Specialist Group; G. Marimuthu, Chair, CCINSA and Sally Walker, Convenor, CCINSA. Nearly everyone on the dias stressed the importance of appropriate legal protection of bats in their inaugural remarks.



Inaugural function in the KAU auditorium.

Workshop : Day 1

Bats are the 2nd largest animal group in the world. The total number of bat species in the world has gone up from 1001 to 1,111 according to Dr. Nancy Simmons, the premier chiroptera taxonomist in the world. Her checklist is to be published in the upcoming version of Wilson and Reeder's classic. In South Asia bats make up the largest group of mammals. Bats are the only volant (flying) mammals.

The objectives of this field techniques workshop were:

-- To convey practical field techniques for use for ecological studies

-- To reinforce and improve handling, field and lab techniques for scientific studies

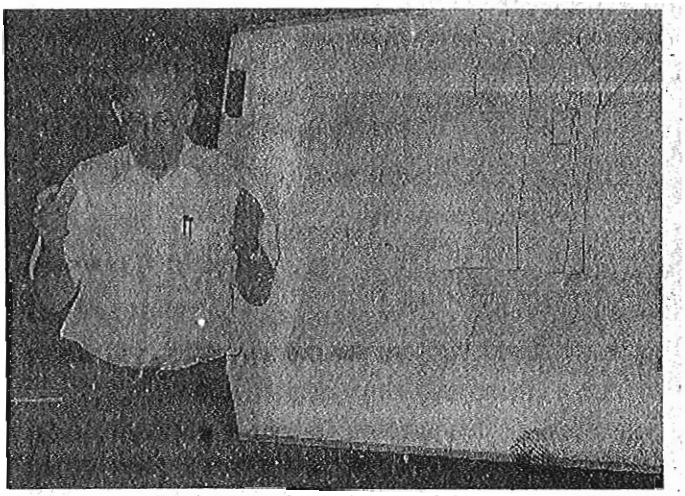
-- To teach captive management and welfare of bats as well as educational techniques for reaching the public

-- To discuss future directions and activities of the network in collaboration with the Chiroptera Specialist Group.

Every morning there was a lecture session, followed by a demonstration in the field in the afternoon, and bat watching and catching at night. Dr. Paul Racey was the primary resource person and for three days, without the use of slides or Powerpoint, he kept all participants glued to their seats during the day and on their toes at the demonstrations in the evening and at night.

DAY 1 -- Lecture

Surveys : Surveys are necessary first to determine what species of bats we have, e.g. presence / absence. Also for ecological studies, diet analysis, foraging guilds, habitat preferences need to be established by standardized survey techniques. By locating mist nets properly we can



Paul Racey lecturing participants

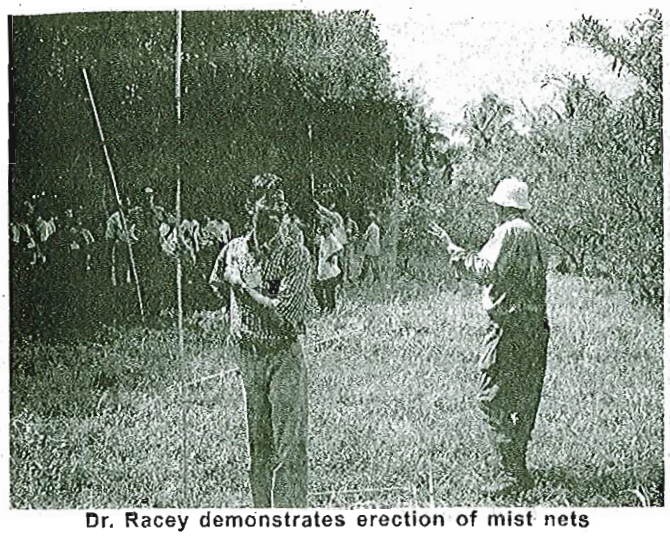
establish bats' feeding habits as to whether they are gleaners, aerial insectivores or frugivores. Surveys help determine the seasonality of reproduction. Mist netting also helps us know the habitat preferences of bats. Studies indicate that bats use woodland edges, unimproved grasslands, and water is much preferred.

Bat detectors : Species can be separated by sophisticated ultrasound bat detectors and molecular analysis. Bat detectors convert the ultrasound frequencies emitted by bats to frequencies audible to humans. The calls recorded through a recording medium can be studied by using computer software called the Bat Sound or AVISOFT. This kind of analysis provides 80% accuracy in the identification of species of bats emitting that frequency. The minimum distance required for proper detection is 30m in a clear night (sometimes it depends as it has been observed that at distances more than 100m the bat detector can detect the presence of bats pretty clearly) to 10m on a rainy or humid night.

Methods : Dr. Racey described different kinds of methods used for catching bats include ground mist nets, sub canopy nets, harp nets or -- for best results -- a combination of all the three. He demonstrated the use of ground mist nets and sub-canopy nets in the afternoon at a fruit orchard.

Bat bites : He discussed that bat bites and their implications including diseases carried by them. European Bat Lyssa Virus is a rabies-like virus occuring in European countries that causes death in a few weeks of infection. EBLV I was reported from Serotine (*Eptesicus serotinus*) while EBLV II has been found in Daubenton's Bat *Myotis daubentonii*. Cholera can be contracted from *Hipposideros speoris*. Juliet Vanitharani related that this species was reported to have caused cholera in selected areas of Tamil Nadu.

Topics related to postnatal growth, relationship between tooth wear and age, roost count techniques and problems faced in deploying mist nets in forested areas with large wildlife were discussed at length.

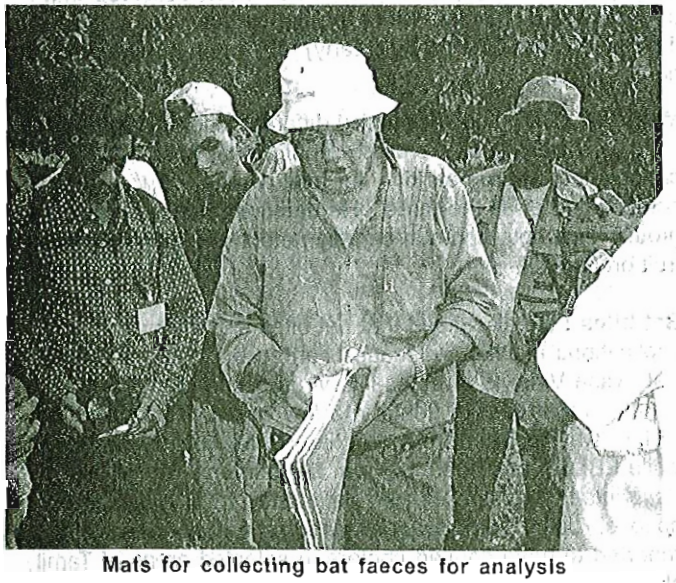


Dr. Racey demonstrates erection of mist nets

Fieldwork on Day 1

After a demonstration of mist net erection, participants erected 6 mistnets in Sapota orchards. Paul explained the use of mats for collecting bat faeces for dietary analysis. The mat can be made from indigenously available jute or any other easily available material. Faeces can be easily collected from it to monitor the diet of both insectivorous and frugivorous bats.

Later, participants collected specimens of Greater Short-Nosed Fruit Bat *Cynopterus sphinx* in the nets and learned to remove the netted bats without causing them any pain or injury. A few animals were taken back to the venue to show participants how to take morphometric measurements before releasing.



Mats for collecting bat faeces for analysis

DAY 2

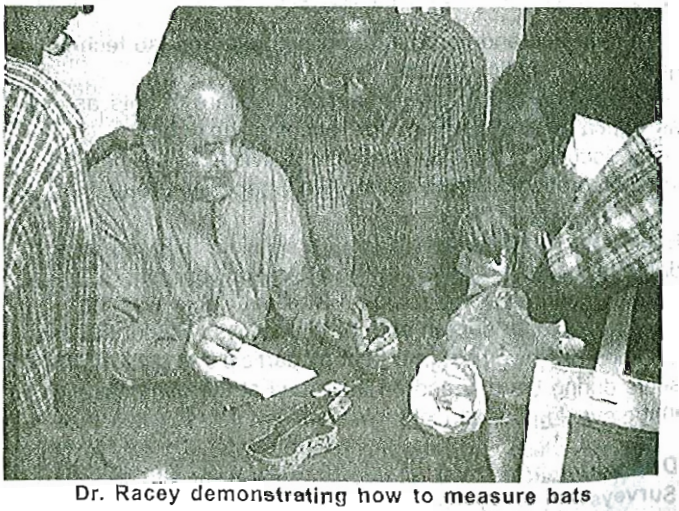
Dr. Racey discussed taxonomy of bats, emphasizing the need for a dichotomous key for easier identification of species of the region. The key in preparation was passed around and made available to participants for use and review. Dr. Racey taught the importance of DNA analysis and methods for taking biopsy punches of wing membrane of bats. Examples of cryptic species have been discussed in light of the methods used for identification of problem species or subspecies pairs. Echolocation calls of *Pipistrellus* species of United Kingdom fall in the same range but the DNA analysis showed at least 11% divergence between the species.

Releasing a bat from mist net without pain to either man or animal

He described the reproductive biology of bats in brief and methods to assess the reproductive stage among male and female bats. He related the importance of hair cuticular pattern and shape of the baculum, their efficacy and problems related with these studies.

Fieldwork on Day 2

Participants erected 5 mist nets in forest ecosystem and observed them. A specimen of Asiatic Yellow Bat *Scotophilus heathii* was collected in the mist net. After having taken the morphometrics the bat was released. A canopy net was erected and explained. The use of mats for collecting bat faeces was also explained in more detail.



Dr. Racey demonstrating how to measure bats

A demonstration led by Sally Walker on how to educate children on bats using education packets

Dr. Racey described the use of forearm rings (phalange ring), reflective tape on rings, cyalume (it produces a bright cold light) in capsules, and necklace as well as the use of radio tracking, its advantages and disadvantages. He also discussed methods of faecal analysis to know the diet of bats. He related methods for collection of faecal pellets using cloth bags and plastic sheets both from bats in roosts and those mist netted. He also elaborated on the faecal pellet analysis methodologies and basic methods for identifying dietary components of furgivorous and insectivorous bats.

Fieldwork on Day 3

The participants were taken to a cave roost of the Fulvous Fruit Bat *Rousettus leschenaultii* in Peechi-Vazhani Wildlife Sanctuary. No collections were made.

DAY 4

Dr. M.S. Pradhan, Deputy Director, Z.S.I., Pune gave an interesting talk on Chemotaxonomy and its importance for the first lecture of the day.

James Andrewes, an Animal Technician from Chester Zoo UK described aspects of captive management and husbandry of bats. He said having good knowledge of the behaviour of bats in the wild was important for effective captive management. He also discussed enclosure designs and furnishing of the enclosures. He described the importance of environmental parameters including temperature and humidity, emphasizing their effects on bat behaviour and biology in captivity. He stressed the role of good husbandry, reproductive success and well being of captive bats.

Sally Walker, Convenor of CCINSA, showed slides of the various educational programmes about bats which had been conducted by both CCINSA members as well as zoos, NGO's and school teachers. She also led a demonstration of some activities possible using the materials provided in the Bat Education Kit. She also stressed the need for disseminating information about the utility of bats for healthy ecosystems.

Fieldwork on Day 4

Dr. Racey demonstrated the use of bat detectors to know about the presence of bats in any given habitat. He reviewed ground mist netting, canopy netting and introduced catching of bats from the roost site. After capturing a specimen of *Cynopterus sphinx* and two specimens of *Hipposideros ater*, Dr. Racey related taxonomic tips for identifying these bats to participants.

DAY 5 - Q&A, Valedictory and Goodbyes

Paul Racey brought up several issues which had been raised during the workshop and spoke about them in detail, such as research prioritisation, animal welfare in research etc. Participants raised other queries regarding foraging guilds, bat detectors, radio tracking, conservation data base, bat behaviour, etc. that Prof. Racey clarified during the morning session. The Valedictory session was conducted at 12:00 noon after which the workshop participants had lunch and then set off for a visit to Guruvayur Temple and its elephant kraal before dispersing.

Babu from Bangladesh, Sampath from Srl Lanka and Mahesh from Pune setting up a mist net

Group photograph