

# ANNUAL REPORT 2008-2009



Sálim Ali Centre for Ornithology & Natural History

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## BACKGROUND

**Sálim Ali Centre for Ornithology and Natural History (SACON)**, registered under the Societies Registration Act, 1860, was established in 1990 with financial support of the Ministry of Environment and Forests (MoEF) Government of India. The SACON Society has 29 members and its President is the Honorable Minister for Environment and Forests, Govt. of India. The management of SACON is vested in a Governing Council comprising 16 members and its Chairman is the Secretary to the Government of India, Ministry of Environment and Forests.

SACON came into being at a time when the issues of sustainable use and conservation of natural resources figured in the global agenda. Realizing the indispensability of holistic approach in avian studies and conservation, the major objectives of SACON have been envisaged covering the entire natural history with Ornithology at the centre stage.

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### SACON'S MISSION

*“To help conserve India's biodiversity and its sustainable use through research, education and people's participation, with birds at the centre stage”*

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### OBJECTIVES

The Objectives of SACON are

- Design and conduct research in Ornithology covering all aspects of Biodiversity and Natural History
- Develop and conduct regular courses in Ornithology and Natural History for M.Sc., M.Phil., and Ph.D. and also short-term orientation courses in related subjects
- Create data bank on Indian Ornithology and Natural History, and disseminate knowledge relating to Ornithology and Natural History for the benefit of the community.

## Executive Summary

During 2008-09, SACON has undertaken 19 projects including both projects and consultancy projects. These projects were taken up by the thematic divisions; Conservation Ecology, Eco-toxicology, Landscape Ecology, Environmental Impact Assessment and Nature Education. All these projects were funded by various agencies including the Ministry of Environment and Forests, Government of India, Tamil Nadu Forest Department, and Sir Dorabji Tata Trust. We have completed a study, '**Inventories of the biodiversity of Attappady with GIS aid**' in collaboration with the Attappady Hills Area Development Agency, which documented the distribution of major components of biodiversity, especially butterflies (133 species) and birds (152 species) of the study area to help developing strategies for management and development of the area. The single species study on '**Ecology and Conservation of the Spot-billed Pelican in Andhra Pradesh**' generates valuable information on the Spot-billed Pelican *Pelecanus philippensis*, a globally threatened species. SACON has continued the *in-situ* and *ex-situ* conservation programs for the **Edible-nest Swiftlet *Collocalia fuciphaga*** in the A & N Islands and have obtained very encouraging results. A positive trend in the population of the species is visible. In the A & N Islands, further to our earlier study on the impact of the 2004 Tsunami, we have initiated a project to monitor the **post-tsunami coastal ecosystem recovery** to develop site-specific restoration measures.

The **Mumbai Trans Harbour Link (MTHL)** is a major infrastructure project executed by Mumbai State Road Development Corporation (MSRDC). This (21 km) road link passes over the sea and over important bird areas. As a consultancy program SACON completed a

study on the project focusing on flamingos and migratory birds. Our study identified various threats to birds in the project area and came up with conservation oriented recommendations to manage the bird habitats.

One of the major objectives of SACON is to develop community participation in conservation actions. Our program in **Nagaland** is meant to impart technical support on biodiversity conservation and livelihood options to local Communities. The first phase of the programme covering about 375 villages is in progress in collaboration with a local organization, NEPED.

Study of other species associated in important bird habitats is also crucial for identifying required conservation measures. Our study on ecology of the **Endangered Indian Rock Python** in Keoladeo National Park, a world famous bird sanctuary and a world heritage site, focuses on the population structure, ranging pattern, food and breeding habits and cohabiting animals with python. Such information will be very handy to fine tune overall conservation actions in the Park. Another such study looks at the Herpetofaunal communities of the **Upper Vaigai Plateau (Western Ghats)** documenting the ecology and distribution of 34 species of amphibians and 72 species of reptiles in the area.

SACON has continued the ENVIS Center on '**Wetlands of India**'. As part of this work we have been involved in creating a website on Wetland Ecosystem with regional language interface. The website contains monthly compilation of news items on wetlands and information on data gaps in the specified subject areas. Another GIS based project undertaken during the last year was '**Inventorisation of wetlands**' in North Kerala

which aims at wetland mapping and inventory of North Kerala, identification of important wetlands for conservation and preparation of district wise wetland atlas.

Information on pollination and seed dispersal is very valuable to develop cost-effective afforestation programs and habitat conservation. We have completed a study in this line in the **dry deciduous forests in southern Eastern Ghats** during the year upon the requirement by the Tamil Nadu Forest department. The study documents about 80 species of insects and 32 species of birds visiting the flowers in the dry deciduous forests. List of tree species that sustain insect, bird pollinators and avian seed dispersers has been provided to the Forest Department. A similar study in **dry evergreen and shola forest ecosystems** of Tamil Nadu records 17 species of insect pollinators in the dry evergreen forests and 13 species in the Shola forests. Six nectarivorous bird species were recorded as major pollinators. The study on **Ecology of Indian Grey Hornbill, *Ocyrceros birostris*** highlights the critical role played by the species in seed dispersal in southern Eastern Ghats. Several economically important tree species including sandal are benefited by the role of the Indian Grey Hornbill in seed dispersal.

As part of ecotoxicological investigations, a study on Impact of agricultural pesticides on the population status and breeding success of **certain fish-eating birds** in Tamil Nadu was taken up. Of the 41 traditional breeding sites in the state, three sites, namely Vedanthangal, Vettangudipatti and Koonthankulam Bird Sanctuaries were selected for intensive investigations. Residue analysis of the bird tissues shows the presence of pesticide residues but it was only sub-lethal. Nevertheless the presence of residues is viewed as a matter of concern as these contaminants are capable of creating several abnormalities in birds.

SACON has continued its project works related to Environmental Impact Assessment. A study on the **conservation of Kottuli Wetlands** (Kerala) was undertaken in view of the proposed ecotourism project there. The wetland considered as one of the wetlands of national importance, harbours 69 species of birds, 240 species of plants including 5 mangrove species and 29 mangrove associates. We have highlighted likely environmental impacts of the developmental project and the need for active conservation measures. One of our studies, **causes of decline of House sparrow, *Passer domesticus*** in Coimbatore is in progress. A similar study on the **adaptation and tolerance of birds to urbanization** is also in progress. This study is an attempt to explore the life strategy of urban birds, in the context of various hypotheses put forth to explain the dominance of certain species in urban setup.

SACON's Nature Education activities have reached thousands of students and public during the current year. The routine Nature Education programmes such as guest lectures, one-day nature camps and wetland day ,forestry day celebrations were organized. Twenty two one-day nature camps, Salim Ali Trophy Nature Competitions 2008-09, Nature camp for mentally challenged children, Environmental Awareness for College students, and Vatavaran Film Festival were some of the major events. The Salim Ali Nature Forum continued its regular nature awareness meetings and activities. SACON has also become a partner in **DBT's Natural Awareness Clubs for Andamans**.

In terms of human resource development SACON has been in right earnest training youngsters in conservation and biodiversity studies. During 2008-09, six Ph.D.s and 4 M.Phil.s were awarded. Three Ph.D. theses are submitted, awaiting results and 18 Ph.D. works are in progress. During 2008-09, we have also

supported several M.Sc., projects and summer training programs for PG students of various colleges and universities. SACON has conducted workshops on *Wildlife and environmental film making*, *Climate Change* and symposium on *conservation and the livelihood security*.

The 58th meeting of the Governing Council of SACON was held on 21st October 2008 at the MoEF, New Delhi. The 18th Annual General Meeting (AGM) followed by an Extraordinary General Meeting (EGM) of the SACON Society was also held on the same day at the MoEF, wherein it was resolved that SACON should be converted to an autonomous centre under the Ministry of Environment and Forests, an important decision as far as the status of SACON is considered.

The Annual Research Seminar at SACON was held on 11<sup>th</sup> November 2008 followed by the 19<sup>th</sup>

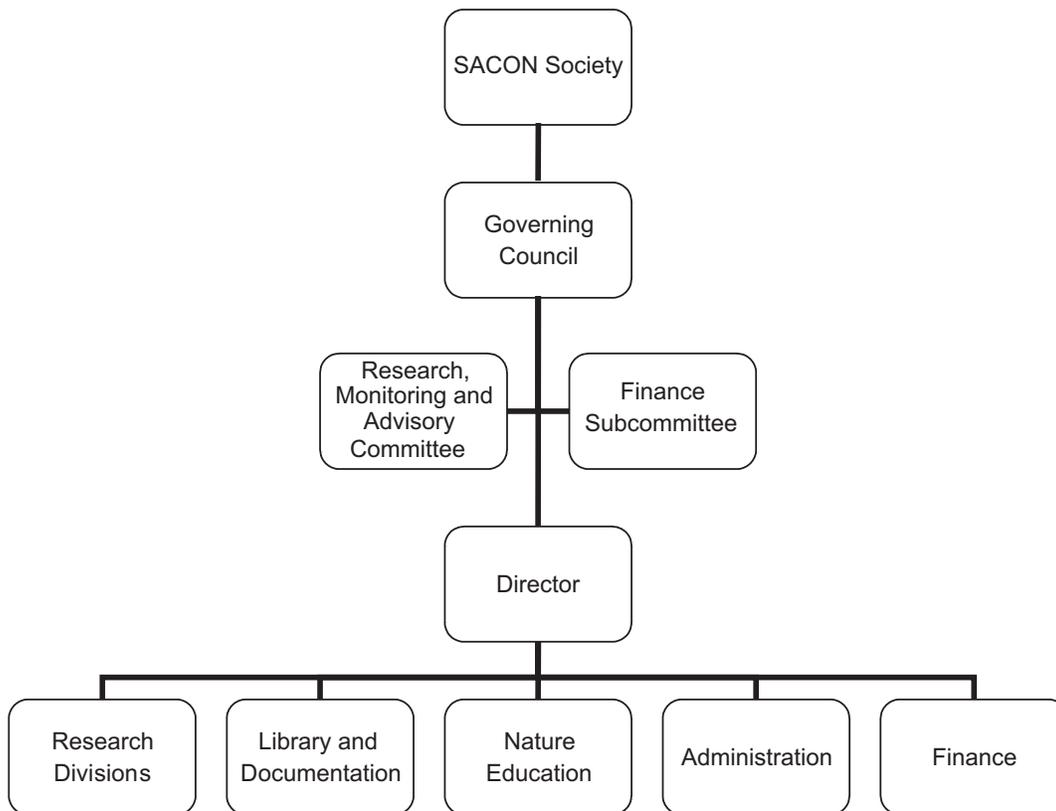
meeting of the Research, Monitoring and Advisory Committee of SACON on 12<sup>th</sup> November 2008.

We have been very active during this year in terms of publications, participation in seminars / symposia and workshops. The research team have contributed 28 publications in national journals, 17 in international journals, 11 chapters in books, 8 technical reports, 21 papers in conferences/ seminars/ proceedings/ edited volumes and 5 popular / newsletter articles.

It was very unfortunate that SACON lost its Director, Dr Ravi Sankaran on the 17<sup>th</sup> January 2009. Dr Ravi Sankaran's sudden demise is a severe loss to the fraternity of wildlife conservation in India. SACON salute the efforts of Dr Ravi Sankaran in the field of biodiversity conservation and pledge to carry forward his works.



### Organization Structure of SACON



#### Field Stations

- Mayabunder (A & N Is)
- Campbell Bay-Great Nicobar
- Bharatpur (Rajasthan)
- Hyderabad (Andhra Pradesh)
- Upper Bhavani (The Nilgiris, TN)
- Silent Valley National Park (Kerala)
- Tuensang, (Nagaland)
- Vaigai, (Tamil Nadu)
- Attapadi (Kerala)
- Sathyamangalam (Tamil Nadu)
- Mumbai (Maharashtra)
- Uppalapadu, Guntur (A.P)



## ORGANIZATION

### **SACON Society**

The SACON Society comprises the President, all members of the Governing Council and experts in the field of ornithology, wildlife sciences and management. The Honorable Minister for Environment and Forests (MEF) or nominee, Minister of State for Environment and Forests (MoS), is the President of the SACON Society and the Director/ Director In charge of SACON is the Member Secretary. The total membership of the SACON Society is 29 of which three slots are currently vacant. The list of the Society members is given in the Annexure.

### **Governing Council (GC)**

Administration of SACON is vested in the Governing Council, the Chairman of which is the Secretary to the Government of India, Ministry of Environment and Forests. The GC has 16 members; Financial Advisor, MoEF, Joint Secretary (CS) or nominee, MoEF; four ex-officio members, eight nominees of the Governing Council and the Director, SACON (member Secretary). The GC is advised by Finance Sub-Committee, Research, Monitoring and Advisory Committee. It is also advised by a Rules Sub-Committee, constituted to revise the rules of SACON, and a Building Sub-committee to oversee and advice on the construction activities at SACON.

### **Present Members of the Governing Council**

1. Mr Vijai Sharma, IAS, Secretary to the Government of India, Ministry of Environment and Forests, New Delhi (Chairperson)
2. Mr E K Bharat Bhushan, IAS, Joint Secretary and Financial Advisor, Govt. of India, Ministry of Environment and Forests, New Delhi
3. Mr A K Goyal, IAS, Joint Secretary, Government of India, Ministry of Environment and Forests, New Delhi
4. Dr AR Rahmani, Director, Bombay Natural History Society, Mumbai
5. Dr R Sukumar, Chairman, Centre for Ecological Sciences, Indian Institute of Science, Bangalore
6. Dr G Thiruvassagam, Vice Chancellor, Bharathiar University, Coimbatore
7. Mr P R Sinha, IAS, Director, Wildlife Institute of India, Dehra Dun
8. Prof H S A Yahya, Department of Wildlife Sciences, Aligarh Muslim University, Aligarh
9. Prof P C Bhattacharjee, Department of Zoology, Guwahati University, Assam
10. Mr R G Soni, IAS (Retd), Principal Chief Conservator of Forests, Rajasthan
11. Dr P Pushpangadan, Honorary Director General, Amity Institute for Herbal and Biotech Products Developments, Thiruvananthapuram
12. Dr C K Varshney, Professor (Retd), Jawaharlal Nehru University, New Delhi
13. Dr S K Dutta, Professor, PG Department of Zoology, North Orissa University
14. Dr Krishna Kumar, Director, Indian Institute of Management, Kozhikode
15. Public Sector/ Enterprise/ Banks..... *vacant*
16. Dr Ravi Sankaran, Director / Dr. PAAzeez, Director In charge, SACON (Member Secretary)

In SACON, research activities have been organized under four research divisions, namely Conservation Ecology, Landscape Ecology, Ecotoxicology and Environmental Impact Assessment. SACON also has a Division for Nature Education established to develop environmental awareness among school and college students and general public by organizing nature clubs, camps, seminars, field trips, trekking, exhibitions and competitions for school children on conservation issues and themes. The core scientific staff strength of the year was eight with three Senior Principal Scientists, four Senior Scientists, and one Nature Education Officer.

Dr Ravi Sankaran, Senior Scientist was appointed as Director of SACON by the MoEF in June 2008 and took over the charge from Dr P A Azeez, Sr. Principal Scientist, who was officiating as Director Incharge from August 2006. Subsequent to the sad demise of Dr Ravi Sankaran during January 2009, the MoEF again appointed Dr P A Azeez as Director Incharge of SACON.

The administrative section of SACON has Finance Officer, Junior Administrative Manager, Personal Assistant to Director, Accountant, Administrative Assistant, Office Assistant, Stenographer, Receptionist, two Drivers and two Office Attendants.

### **Staff of SACON**

#### **Scientific**

Director	:	Dr Ravi Sankaran (June 2008 – January 2009)
Director In charge	:	Dr P A Azeez (since February 2009)
Conservation Ecology	:	Dr Lalitha Vijayan, Sr. Principal Scientist Dr S Bhupathy, Sr. Scientist
Landscape Ecology	:	Dr S N Prasad, Sr. Principal Scientist Dr P Balasubramanian, Sr. Scientist
Ecotoxicology	:	Dr S Muralidharan, Sr. Scientist
Environmental Impact Assessment	:	Dr P A Azeez, Sr. Principal Scientist
Nature Education	:	Dr P Pramod, Nature Education Officer

#### **Technical**

Library and Documentation	:	Mr M Manoharan, Library Assistant
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#### **Administration and Finance**

Senior Finance Officer	:	Mrs Jayashree Muralidharan (on EOL, since 1.1.2007)
Finance Officer	:	Mr P Karuppiyah (on contract, since 1.1.2007)
Jr. Administrative Manager	:	Mr R Jayakumar
PA to Director	:	Mr V Vaidiyanathan
Administrative Assistant	:	Ms T Rajapaba
Accountant	:	Mr K Ramesh Kumar (on contract, since July 2008)
Office Assistant	:	Mrs R Rajalakshmi
Stenographer	:	Mr M Eanamuthu
Receptionist/LDC	:	Mrs M Jayageetha



Site Engineer	:	Lt Col. (Retd) N Sundararaj (on contract, since April 2007)
Computer Assistant	:	Mr A Srinivasan (on contract, since April 2007)
Drivers	:	Mr R Ravi and Mr P Subramanian
Office Attendants	:	Mr A Devaraj and Mrs V Santhalakshmi

### **Research, Monitoring and Advisory Committee (RMAC)**

The Research, Monitoring and Advisory Committee is an advisory body constituted by the MoEF, Government of India, to advise the Governing Council on the research programmes of SACON with the following terms of reference:

- 1) Identification of priority areas for research,
- 2) Selection of new projects in the light of the processes laid down by the Governing Council, and
- 3) Monitoring and review of ongoing research projects.

The members of the RMAC are as given below;

1. Dr Robert B Grubh, Director, Institute for Restoration of Natural Environment, Nagercoil, Tamil Nadu (Chairman)
2. Dr B M Parasharya, AINP on Agricultural Ornithology Biological Control Research Lab, Anand Agricultural University, Anand, Gujarat
3. Dr V C Soni, Professor, Department of Biosciences, Saurashtra University, Rajkot
4. Dr N V Joshi, Centre for Ecological Sciences, Indian Institute of Science, Bangalore
5. Dr J S Samant, Professor (Retd), Kolhapur University
6. Dr P S Roy, Dy. Director, National Remote Sensing Agency, Hyderabad
7. Dr Parikshit Gautam, Director, Freshwater Wetlands Programme, WWF-India, New Delhi
8. The Chief Wildlife Warden, Tamil Nadu
9. The Chief Wildlife Warden, Kerala
10. The Chief Wildlife Warden, Karnataka
11. Dr Ramakrishna, Additional Director, Zoological Survey of India, Kolkatta
12. Director (I/c Wetlands), MoEF, New Delhi
13. Dr T Sundaramoorthy, Senior Educational Officer, CPR Foundation, Chennai
14. Senior Principal Scientist, SACON, Coimbatore nominated by the Governing Council
15. Senior Principal Scientist, SACON, Coimbatore nominated by the Governing Council
16. Director/Director In charge, SACON, Coimbatore (Member Secretary)

The RMAC met on 12<sup>th</sup> October 2008 in SACON, Coimbatore under the chairmanship of Dr Robert B Grubh, and reviewed the ongoing research projects and evaluated the new projects submitted by the faculty.

## RESEARCH HIGHLIGHTS

### A. CONSERVATION ECOLOGY

#### 1. Inventory of the biodiversity of Attappady with GIS aid

Principal Investigator	: Lalitha Vijayan
Co-Investigators	: S N Prasad & P Radhakrishnan (AHADS)
Senior Research Fellow	: S Somasundaram
Duration	: July 2006 – November 2008
Start Date	: July 2006
Funding agency	: Attappady Hills Area Development Society (AHADS)
Total Sanctioned Amount	: Rs. 3/- lakhs
Funds Available for the reporting Period	: Rs. 1.3/- lakhs
Status	: Completed

#### Background

Attappady lying in the foothills of Nilgiris falling under the Mannarkad Forest Division in Kerala in the Western Ghats has been largely cleared with several human settlements and extensive cultivations. This region forms part of the restoration zone in the Nilgiri Biosphere Reserve that requires habitat improvement. The Attappady Hills Area Development Society (AHADS) has been working in this region for the improvement and restoration of the habitats and for the uplift of the living conditions of the tribals.

#### Objectives

- 2 Inventory the major components of biodiversity of the area, especially butterflies and birds, which can be used for monitoring changes in the area and
- 2 to use the data for immediate use in deciding strategies for management and development of the area.

#### Methods

Data were collected on the birds and butterflies from different habitats and localities in Attappady following line transect method. In total 40 localities were surveyed during September 2006 to March 2008.

The satellite imageries provided by AHADS were analyzed following standard methods; other data provided by them and also collected by us on birds and butterflies were overlaid on the map with GIS layers using Open Source Software to get the distribution map of areas of richness and for particular species of interest. Other data provided by AHADS on the settlements and disturbances were also used to identify priority areas for conservation and eco-development.



#### Results and discussion

**Birds and Butterflies:** Totally 4607 individuals of 152 species of birds were recorded during the study. This included 15 endemic species of the Western Ghats out of the total 24. Most of these species were mainly confined to shola and evergreen forests. Of the 133 species of butterflies recorded included eight species endemic to the region, of which four species are endemic to south India, one to Peninsular India and three to the Western Ghats. Fourteen species observed are included in the protected list, six belonging to Schedule-I and five to Schedule II.



Danaid Eggfly is included in both the Schedules I and II of the Wildlife Protection Act. Diversity of species was higher in evergreen and moist deciduous forests.

**GIS analyses:** Data collected on birds and butterflies were overlaid on to the map to get their distribution. Study sites in shola, evergreen and moist deciduous forests have higher species richness, diversity and also higher number of endemic species. Community based GIS coverage for Irulas, Kurumbas and Mudugas showed that Irulas caused highest anthropogenic pressures in Attappady followed by Kurumbas.

### Recommendations

The recommendations of the study included the following; provide protection for the shola-grassland ecosystem in the Thudukki and evergreen forests in Muthikulam and Kurukkan Kuntru for conservation; reduce the pressure in the mixed dry deciduous forests in the Mulli area which is facing high pressure from the local communities; give high priority to Irula hamlet areas for habitat restoration and livelihood improvement activities followed by those of Kurumbas and Mudugas; start

### Abstract

The Attappady Hills Area Development Society (AHADS) has been working in Attappady, Nilgiri Biosphere Reserve for improvement and restoration of the habitats and also for the uplift of the living conditions of the tribals. We surveyed birds and butterflies in 40 localities in different habitats and overlaid these information and those provided by AHADS using remote sensing and GIS techniques. Evergreen and shola forests showed higher biodiversity values while Irulas caused highest anthropogenic pressures in Attappady followed by Kurumbas. Necessary recommendations were given for conservation action and awareness. The open source software programme and the products installed at AHADS were used for appending data, monitoring and management practices.

activities for preservation of the natural habitats with Biodiversity entrepreneurship programmes first in Mudugas' area where disturbance was minimal followed by Kurumba areas. The open source software programme and the products installed at AHADS should be used for further addition of data, monitoring and management practices.

## 2. Ecology and Conservation of the Spot-billed Pelican in Andhra Pradesh

Research Student	: N Sheeba
Research Guide	: Lalitha Vijayan
Co-guide	: S N Prasad
Duration	: October 2006 to September 2011
Start Date	: October 2006
Funding Agency	: University Grants Commission
Total sanctioned amount	: Rs. 10.2/- lakhs
Funds available for the reporting period	: Rs 2.5/- lakhs
Status	: Ongoing

### Background

The Spot-billed Pelican *Pelecanus philippensis*, a globally threatened species till recently, is now listed as a near-threatened species by the BirdLife International. Population of this species has been fluctuating in different locations in Andhra Pradesh. A new breeding population has been identified at Uppalapadu, a small village tank where a detailed study is being conducted.

### Objectives

- Assess the current status and regional population of this species and ecological value of Uppalapadu wetland, a potential home of Spot-billed Pelican
- Study its habitat selection, social organization and association with other species
- Understand its foraging and breeding ecology, and
- Examine potential threats to the population of this species, and suggest conservation measures.

### Methods

Study on the status and ecology of the Spot-billed Pelican (*Pelecanus philippensis*) was continued by conducting surveys in different seasons in selected sites and intensive observations at Uppalapadu. In order to study the dispersal and detailed behavioral observations at Uppalapadu, individual birds were marked. Noose traps made up of nylon twines were placed in the shallow water region to trap birds.

### Results and discussion

Uppalapadu (16° 16' 26" N, 80 ° 21' 58" E), a village water reservoir, covers around 14 ha, part of which, nearly 3.74 ha, is conferred as Birds Protected Area. Spot-billed Pelican start arriving Uppalapadu after northeast monsoon, in October 2008. A peak in its population was reached in November. More than 1000 Pelicans including adults and sub-adults were sighted in the area; in January 2009, 489 nests were seen in the core area. The number fell to 217 in March 2009. Little Cormorant, Little Egret and a few Darters arrived for nesting in March. 387 Painted Stork nests were also found in the area. 2452 Openbills and 50

Black-headed Ibis and 654 Black-crowned Night Heron were also counted. Four Pelicans were caught and marked with rings (L-2961, L-2962, L-2963, L-2964). The birds were also marked with Picric acid for easy observation. However, these individuals could not be seen later.

At Ramachandrapalayam (16° 17' 11.2" N, 80° 29' 44.2"E) a breeding colony of the Spot-billed Pelican, Painted Stork and Ibis is being established at a private fish tank about 2 km from Uppalapadu. During the current year, 368 nests, higher than the previous year, were recorded here.

#### Abstract

Pelicans in Uppalapadu and Ramachandrapalayam in Andhra Pradesh are being monitored since October 2006. A few pelicans are also marked for behavioral studies. The study is in progress.



### 3. *In-situ* & *Ex-situ* conservation of the Edible-nest Swiftlet *Collocalia fuciphaga* in the Andaman & Nicobar Islands

Principal Investigator	: R Sankaran (up to January 2009) and Lalitha Vijayan (Since then)
Co-investigator	: P Pramod
Research Fellows	: Manchi Shirish S
Duration	: Long term
Start Date	: December 1999
Funding Agency	: MoEF & Dept. of Environment and Forests, A&N Islands
Total Sanctioned Amount	: Rs 10/- lakhs
Funds available for the reporting period	: Nil
Collaboration with	: Dept. of Environment and Forests, A&N Islands
Status	: Ongoing

#### Background

Edible-nest Swiftlet *Collocalia fuciphaga* produces, edible nests, a valued item in Chinese cuisine and pharmacy, and its international demands are very high. Due to the high demand and overexploitation of the nests populations of the Edible-nest Swiftlet have declined remarkably across their range, requiring immediate implementation of conservation measures. If not, the species is likely to become extinct in most islands of A&N group in a few years. Based on an intensive survey of the Edible-nest Swiftlet by SACON, between 1995 and 1997, two conservation measures, *in-situ* and *ex-situ* were proposed.

#### Objectives

- ◆ Developing protection systems at Edible-nest Swiftlet nesting caves where sustainable nest harvesting regimes will be initiated and developing farming of the species in houses.
- ◆ Initiate Phase 3 and extend the *in-situ* conservation through out the Andaman and Nicobar Islands.

#### Methods

The *in-situ* conservation measures give round the clock protection to some caves in the Andaman Islands, during the nesting season of

the Edible-nest Swiftlet. A cave at Interview Island has been protected since December 1999, and a complex of over 28 caves at Pathi Level, North Andaman has been protected since January 2001. Six more potential sites in the Island group were identified to extend the *in-situ* conservation.



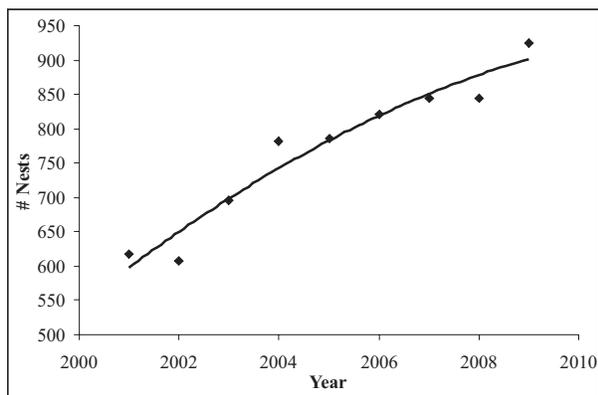
The *ex-situ* conservation measures proposed includes providing special houses in which the Edible-nest Swiftlet will breed, thereby significantly building up populations in these islands, and providing an alternate source of livelihood for nest collectors, farmers, and poorer sections of the community forming an important source of revenue for the islands.

#### Results and discussion

The population at the cave on Interview Island which was declining at the rate of about 30% per annum, by 2006 has stabilized. Counts in 2009 indicate significant growth between 2008 and 2009 and growth was the maximum ever recorded here. At Chalis Ek, preliminary counts indicate that the population continues to grow, and the colony has now doubled as a result of protection during the first year.

At the pilot programme, 'house' at Tugapur broods were selected and experimental transfer of Edible-nest Swiftlet eggs into nests of the White-bellied Swiftlet were undertaken. First egg was found laid by Edible-nest Swiftlet under *ex-situ* conditions in 2007.

Though there was no breeding attempt recorded in the *ex-situ* house, the birds were observed roosting in. Renovation of the house, where *ex-situ* experiment is progressing, is going on to maintain appropriate light, temperature and humidity inside.



Impact of Protection on the population of the Edible-nest Swiftlets in Andaman and Nicobar Islands

A serious limitation in the *ex-situ* experiment is the position of the Edible-nest Swiftlet in the Wildlife Protection Act. Since the final notification from the Government of India for

delisting the Edible-nest Swiftlet from the Wildlife Protection Act (although approved in principle by the National Board for Wildlife) is yet to come, the proposed phase 3 of the project (including *ex-situ* conservation) is awaiting sanction to pursue.

#### Abstract

The study is a continuation of the *in-situ* and *ex-situ* conservation measures of the Edible nest Swiftlet that SACON has been pursuing in A&N Islands with the collaboration of the Andaman Forest Department. At the sites where *in-situ* conservation is implemented, the population has been increasing. At the *ex-situ* site also, the results are promising. However, further progress in this regard requires delisting of the species from Wildlife Protection Act (WPA).



#### 4. Monitoring post-tsunami coastal ecosystem recovery in the Nicobar Islands to develop site-specific restoration measures

Principal Investigators	: R Sankaran (up to Jan 2009) and Lalitha Vijayan (since then)
Co-investigators	: DCF (A&N Forest Dept.), P Balasubramanian & SN Prasad
Research Fellows	: AP Zaibin & Navonil Das
Duration	: Three years
Start Date	: December 2008
Funding Agency	: Dept. of Environment and Forests, A&N Islands
Total Sanctioned Amount	: Rs.30.1/- lakhs
Funds available for the reporting period	: Rs. 7/- lakhs
Date of completion	: December 2011
Collaboration	: Dept. of Environment and Forests, A&N Islands
Status	: Ongoing

The mega earthquake and tsunami of December 2004 destroyed large areas of coastal and mangrove forests in the Nicobar Islands. SACON undertook a rapid assessment of the impacts immediately after the tsunami and the damages were reported by Sankaran (2005). The areas from the beach to 10-12 m ASL were significantly damaged. The present study is undertaken as a continuation of the previous study.

##### Objectives

- ◆ Assess and monitor vegetation along the coast,
- ◆ Monitor the fauna of this area,
- ◆ Develop and implement site specific strategies to restore damaged habitats, and
- ◆ Aid regeneration through targeted restoration activities.

##### Methods

Field surveys of the tsunami affected coastal areas will be conducted. Specific areas will be selected to do intensive studies on vegetation and fauna. Vegetation studies will be conducted by plot sampling to assess the impact of tsunami and the regeneration of species. Restoration of habitats will be done with the collaboration at the forest department. Site specific species will be identified for this purpose.

##### Results

After the sudden demise of the Principal Investigator (RS), the project has been entrusted to another PI (LV) and works are being initiated after receiving the necessary entry permits. One JRF has resigned and the replacement was done.

##### Abstract

The study has been just initiated. Pilot surveys are being carried out.

#### 5. Mumbai trans-harbour link project: Study of flamingos and migratory birds

Principal Investigators	: Lalitha Vijayan, SN Prasad & S Muralidharan
Research Associate	: S Somasundaram
Senior Research Fellow	: R Jayakumar
Junior Research Fellow	: P Jayanthi
Duration	: September 2006 – October 2008
Start Date	: September 2006
Funding Agency	: Maharashtra State Road Development Corporation, Mumbai
Status	: Consultancy project, Completed

##### Background

The Mumbai Trans Harbour Link (MTHL) alignment of 21 km proposed by the Mumbai State Road Development

Corporation (MSRDC) mainly passes over the sea (Thane Creek) and a stretch of about 5 km over the land at Sewri and Nhava ends. It passes over the mudflats area identified as an Important Bird Area (IBA) harboring a large population of birds including the Lesser



Flamingo. Upon the request from M/s MSRDC, SACON undertook the study in September 2006 to look at the population of birds with emphasis on the Flamingos which will help take necessary steps for protection of the birds and the area. The final report was submitted in December 2008.

### Objectives

- ◆ Study population of birds with emphasis on the Flamingos, their behavior and the quality of the habitat, and
- ◆ To document the magnitude of environmental contamination.

### Methods

At least two counts of flamingos and other birds were done in each month. The abundance estimates were arrived at by direct and photographic counting of flamingos. Activity of the flamingos was recorded by scan sampling. Water and soil samples were analyzed from Flamingo feeding and non-feeding areas using portable water analysis kit. Plankton abundance was studied by collecting water samples from the same sites using plankton net. Plankton was analyzed qualitatively and quantitatively by our consultant and his team at CUSAT, Kochi. The habitats of the

study area were mapped using satellite data (IRS P6 LISS IV) procured from NRSA Data Centre (NDC) and LANDSAT ETM<sup>+</sup> datasets downloaded from GLCF site. Distribution of the flamingos and also the sediment load were overlaid on the imageries.

Contamination levels in water, sediment and fishes were studied following standard methods using Atomic Absorption Spectrophotometer (AAS) for heavy metals, GC-ECD for organochlorine pesticides and Polychlorinated biphenyls (PCB), and HPLC for Polycyclic aromatic hydrocarbons (PAH).

### Results and discussion

**Water and sediment quality:** Dissolved oxygen levels in water were low, indicating greater input of industrial and domestic wastes. Mahul recorded very high turbidity, while COD was high in Sewri, followed by Mahul. Nhava had the highest total alkalinity, and oil and grease. Mahul also had levels of oil and grease higher than the prescribed limit. The high concentration of phosphate, sulphate and nitrate in the water may be due to surface run off. This might help better growth of plankton and algae. Total organic carbon levels of the sediments in all three regions were lower than levels reported elsewhere as contaminated.

**Noise:** Among the three locations, namely Sewri, Mahul and Nhava, Sewri had higher noise levels (ranging from 71 to 79dB) followed by Nhava (68 to 75dB). The lowest noise was recorded at Mahul region (52 to 64dB). The flamingos' feeding ground recorded maximum of 60dB of noise which is considered to be normal.

**Heavy metal contamination in water, sediment and fish** samples from the study locations showed that the levels were high in Iron, Nickel and Copper in the sediment at Sewri and, Chromium and Cadmium at

Mahul because of effluents from industry, domestic sewage and ship repairs. These would cause toxicity to the biota on a long-term exposure.

**Organochlorine pesticide residues (OCPs) in sediment, water and fish** samples showed higher levels of Hexachloro Cyclohexane (HCH) in the fishes but within the permissible limits. Polychlorinated Biphenyls (PCBs) and Polycyclic Aromatic Hydrocarbons (PAHs) in sediment, water and fish samples showed higher levels above the guideline values in Sewri and Mahul, which is of concern.

**Abundance and distribution of birds:** Abundance of birds in the Sewri-Mahul region was much higher than in Nhava; >53000 birds of 54 species in 2008 at the former locations and >2000 of 26 species at the later. The Lesser Flamingo population started reaching the area during December 2006, increased to about 12000 in May 2007. The birds left the area in June-July 2007. During 2007-2008, they arrived early and increased to about 14000-15000 birds in April 2008 and departed earlier, in June 2008. Only a few (about 340)



Greater Flamingos were recorded during 2007 - 2008 which left in March 2008. The flamingos used more of Mahul- Sewri mudflats. Some

birds used some other locations in the east coast of the Thane creek, Zasai, JNPT salt pans and Vasi (below the bridge). Distribution of the correlated with the food availability of plankton and benthos which corresponded with the sediment load as found through remote sensing studies. Disturbance was caused by the ship repair activities at Sewri and tourists reaching closer to the flamingos by boat.

### Recommendations

Recommendations proposed by us were mainly for taking necessary action for reducing the levels of PCBs and PAHs in the area, shifting the ship repair activities from Sewri, construction of the bridge to be done in the flamingo area when the birds are absent or were in lesser numbers, and to undertake further detailed studies on the flamingos and to monitor them.

### Abstract

The Mumbai Trans Harbour Link (MTHL) alignment of 21 km proposed by the Mumbai State Road Development Corporation (MSRDC) mainly passes over the sea (Thane Creek) and a stretch of about 5 km over the land, including Sewri mudflats, an Important Bird Area (IBA). The flamingos and other migratory birds and their habitats were studied for two years focusing on the levels of nutrients, food abundance, the relation of flamingos with these environmental factors and the alignment of the proposed bridge. Environmental contamination of the area also was examined. The final report with recommendations was submitted to M/s MSRDC.

## 6. Strengthening Community Conservation Efforts in Nagaland: A Programme to Impart Technical Support on Biodiversity Conservation and Livelihood Options to Communities; Phase 1: Phek, Tuensang, Longleng, Kiphire and Mon Districts

Programme Coordinator	: Venkota Nakro, NEPED, Kohima
Associate Coordinators	: Ravi Sankaran (till 17 January 2009); S Bhupathy & P A Azeez (since February 2009)
Research Associate	: Amay Angami
Duration	: Three Years
Start Date	: April 2007
Funding Agency	: Sir Dorabji Tata Trust, Mumbai
Total sanctioned amount	: Rs 287.13/- lakhs
Funds available for the reporting period	:Rs. 37.25/- lakhs
Status	: Ongoing

### Background

The Eastern Himalayas including the mountain ranges in Nagaland is one of the two biodiversity hotspots of India. Nagaland also borders the Indo-Burma biodiversity hotspot. The Indo-Burma region of northeast India is known to have large number of plant species including several primitive and ancient flowering plants, and several faunal species. Similar to the other biodiversity hotspots in Asia, this ecologically rich and culturally diverse region also face serious threat to biodiversity and other nature resources for various reasons. The area is in urgent need of actions aiming at conservation of the local resources, especially biodiversity. The prevalence of two major human activities, the practice of *jhum* (slash-and-burn cultivation) and hunting, pose severe pressure on the nature here. These and related issues needs attention with a perception of the local culture, traditions, values and livelihood needs

individuals, clans or traditional community institutions own 93% of the forests in Nagaland. The owners depend largely or fully upon their land holding for their livelihood, mainly through the practice of *jhum*. This makes it crucial that the conservation actions essentially have to be based upon self-imposed/voluntary restrictions on the use of local natural resources. It also means that they essentially need to be assisted in finding alternative means of realizing their livelihood from land holdings. Of late, several community reserves have been set aside where self-imposed restrictions on hunting and intent to preserve the forests have lead to discernable improvements in biodiversity.

This project intends to develop mechanisms by which such community conservation efforts are strengthened and expanded. This is expected to be achieved basically by capacity building and assisting in exploring various alternative livelihood options. The approach is that of training and capacity building of a core group of individuals, Facilitators of Community Conservation (FCCs), from different tribes who will help developing a resource group with expertise in biodiversity conservation and livelihood options. The FCCs are selected from each of the 9 tribes who live in the target districts.



### Objectives

- ◆ To assist villages, which have or propose to have community

Community Conservation Areas, eastern Nagaland				
District	Total	Primary forest	Secondary forest	Plantation
Mon	474	132	267	21
Tuensang	104	67	18	0
Kiphire	77	54	12	0
Phek	94	49	41	0
Longleng	25	8	14	0

- ◆ conservation areas, in developing biodiversity registers, resource maps
- ◆ and management plans, and develop the process by which biodiversity registers are legally protected
- ◆ Advocate and assist in establishing community conservation areas where such efforts are currently lacking,
- ◆ Documentation of Indigenous Ecological Knowledge,
- ◆ Identify technical, developmental and financial requirements of community conservation areas,
- ◆ Provide necessary technical support and linkages on information, processes, markets and developmental and financial programs, to villages who are developing community conservation areas, and
- ◆ Use the Blyth's Tragopan which is the state bird of Nagaland as a flagship species in enhancing conservation reach.

### Results and discussion

**Area Coverage:** The districts covered in the present project are Phek, Tuensang, and Mon. The Tuensang district has recently been trifurcated into Tuensang, Kiphire and Longleng. The programme initially was intending to cover 458 villages spread over 5 districts, but based on reconnaissance surveys, this was brought down to 375. Of these participating in the program, baseline socioeconomic data was gathered from 324 villages populated by the 9 indigenous people / tribes. Information on primary forest, if available, was collected from 354 villages.

Although the programme aims to cover all the villages in the area mentioned above, considering the huge work required those villages that already have, or propose to establish Community Conservation Areas (CCAs) during the course of this programme, or have in their control areas, that have potentials to be developed in to a CCA will be given priority. Such villages will be 150 – 200 in number.

**CCA Database:** A database on 774 of the existing Community Conservation Areas is being compiled. The information that will be incorporated in the data base includes type of forest, ownership, year and mode of establishment. The mapping of existing reserve boundaries using GPS is also in progress.

**Setting up of CCA:** Several village Council meetings have been conducted with villages where areas with potential to develop CCA s' were identified and the process of facilitation have been started with the help of FCC s' and the resource persons.



**Indigenous Ecological Knowledge:** The people of Nagaland have vast indigenous knowledge, which is gradually eroding. Hence, it is very essential to documenting the Indigenous Ecological Knowledge (IEK), preferably in the local dialects. IEK of plants is being recorded in 16 local dialects. Ethnobotanical information was gathered and herbarium sheets prepared

for proper taxonomic identification. Free lists focusing largely on floral component have been completed for 236 villages to supplement the IEK. This exercise is being sustained aiming to cover all logistically possible villages. This work need to be continued. Documentation of animal IEK has just been initiated.

Resource Maps for 292 villages are drawn up by the villagers themselves with technical assistance from the FCC s'. The FCCs are trained in geospatial data collection procedures. All these information are being processed in a GIS platform.

Capacity building: As noted above the program intent to work through the indigenous inhabitants / people. Capacity building is one of the major activities of the whole program. The success of the whole program depends primarily on the affectivity of the facilitators of community conservation in taking the message

to the locals. From the nine tribes inhabiting the project area, twenty nine Facilitators of Community Conservation (FCC) were selected for training. Workshops were conducted to familiarize the FCCs with the programme objectives and the methodology to be used. Techniques taught to the FCCs included use of binoculars, Global positioning systems and field guides for identification of birds, mammals, snakes and butterflies. For the purpose of capacity building the program is drawing expertise from various organizations. The scientific staffs of SACON gives input to the program on their respective fields of specialization.

Village level workshops are also being conducted throughout the project area for capacity building of the FCC s' so that they could take the lead in the area they belong to or they are expected to reach out.

<b>Progress of the program</b>											
<b>No</b>	<b>District</b>	<b>FCC</b>	<b>Vil</b>	<b>FL(N)</b>	<b>FL(O)</b>	<b>RM</b>	<b>PrF</b>	<b>VB</b>	<b>C.R.S</b>	<b>GP S</b>	<b>IEK</b>
1	Kiphire	5	71	45	61	64	72	60	51	44	4
2	Tuensang	8	100	50	45	67	90	85	74	53	8
3	Phek	6	75	47	27	57	72	65	47	49	3
4	Mon	7	97	69	33	73	93	86	62	52	7
5	Longleng	2	26	25	17	25	25	26	24	24	1
6	Kohima	1	1				1	1	1		
7	Peren		1				1	1	1		
8	Zunbhoto		4								
<b>TOTAL</b>		<b>29</b>	<b>375</b>	<b>236</b>	<b>183</b>	<b>286</b>	<b>354</b>	<b>324</b>	<b>260</b>	<b>222</b>	<b>23</b>
FCC = Number of FCC, Vil = Number of Villages, RM= Resource mapping, Pr F = Primary forest, VB = Village Background, GPS = number of GPS, FL (N) = Free listing new, FL (O) = Free listing old, CRS= Community Reserve Survey, IEK= Indigenous Ecological Knowledge											

**CCAs are to be declared** to conserve the rich but eroding biodiversity of Nagaland. The program has identified certain important areas and discussions are on with the concerned villagers who own those area. Locations such as Saramati Range, Helipong and Meluri have large primary forests, which have high potentials to be CCA. It will be possible to declare a few of these areas as CCA in the near future. The biodiversity rules for the state are being worked out and expertise and knowledge acquired from the program by NEPED and SACON may be used to appropriately formulate the same.

### Recommendations

To strengthen the community conservation efforts initiated by locals, a long term programme with appropriate funding is required. Funds for protection of CCA from intruders, creation of corridors between CCA to make the conservation sustainable, and further awareness programme to take locals in to confidence are needed.

### Abstract

The program in Nagaland was initiated in April 2007 which covers 375 villages. Of these participating in the program, baseline socioeconomic data was gathered from 324 villages populated with the 9 indigenous people / tribes. Information on primary forest, if available, was collected from 354 villages. Works are in progress for capacity building, study of potential sites for CCAs and documentation of IEK, both on plants and animals. Appropriate funds are to be made available for CCAs, corridors and awareness programs.

## 7. Ecology of the Endangered Indian Rock Python, *Python molurus* in Keoladeo National Park, Bharatpur, Rajasthan, India

Principal Investigator	: S Bhupathy
Research Fellow	: C Ramesh
Duration	: Three years
Start date	: August 2007
Funding Agency	: MoE F (Wildlife Division)
Total outlay of the Project	: Rs. 11.06/- lakhs
Funds available for the reporting period	: Rs. 4.53/- Lakhs
Status	: Ongoing

### Background

The Indian Rock Python, *Python molurus molurus*, one of the largest non venomous snakes of the world is endangered and listed in Schedule I of the Indian Wildlife Protection Act, 1972. Despite its wide spread distribution in the Indian subcontinent, information on its ecology is meagre. The non availability of data makes species conservation and management decision difficult and inappropriate. Hence, the present study was initiate.

### Objectives

- ♦ Study the population trend in python in KNP comparing results from earlier studies,
- ♦ Gather data on aspects of ecology of Indian python such as population, basking, burrow fidelity and ranging, cohabiting species in the burrow and food habits,
- ♦ Assess the impact of tourists on the basking and movement patterns of pythons, and

- ◆ Propose conservation plan for Indian Pythons found in the drier zones, particularly in Keoladeo National Park, Bharatpur, Rajasthan.

## Methods

*Mapping of Python Burrows:* Mapping the distribution of python burrows in KNP was done surveying on foot covering the entire park. GPS coordinates (latitude and longitude) of the burrows was recorded. Ground burrows with python signs (tracks, sloughs, snakes) were considered python burrows.

*Population Estimation:* In KNP, pythons thermoregulate during the winter by basking during the day time. This behaviour of pythons was effectively used to estimate their population in the past, and the same method has been followed for data collection during the present study. This involved repeated visits to the python burrows on regular intervals (once in a fortnight). Number of snakes at each burrow during each survey is recorded. The maximum number of sightings of pythons at a given burrow during various surveys would be considered as the number of snakes dwelling there. The sum of these figures from all burrows accounts for the population.

*Size Structure:* Size of individual snakes was estimated visually on having a full view of the snake. The length data of snakes have been categorized in to various size classes for further analyses.

*Python Basking in Relation to Disturbance:* Behaviour of pythons in burrows often visited by tourists and those found in remote undisturbed burrows is being studied at regular intervals, especially in the tourist season (November – February).

*Ranging Pattern:* The locations of sightings and re-sighting of individually identified (using natural markings) pythons are recorded with GPS coordinates to understand their ranging, movement and activity patterns.

*Food Habits:* Scat samples are being collected to determine the food of pythons. Mammalian prey species will be identified using micro-histology technique.

*Cohabiting Animals:* Tracks and signs of (co-habiting) animals visiting the python burrows are quantified. Camera traps are being used to confirm the cohabiting species with pythons in the burrows and their interactions, if any.

**Breeding:** The incubating python was monitored once in 15 days during May-July 2008; nest and ambient temperatures were recorded using a digital thermo-hygrometer. Other details were recorded visually.

**Vegetation Data:** Changes in the vegetations in the python habitat is being monitored using quadrat (10X10m) sampling on seasonal basis.

## **Results**

**Assessment of the population** of pythons and their burrow has been continued (April 2008 - March 2009). It is estimated that 105 pythons inhabit in 33 ground burrows (excluding temporary burrows in aquatic area) during this report period. Python burrows were marked on a map and submitted to the Forest Department. Number of burrows used during 1986-87, 1999-2000, 2007-08 and 2008-09 was 38, 22, 28 and 33 respectively. Estimated number of pythons in the Park was 110-120 (during 1986-87 to 1999-2000), 60 (2007-08)

and 105 (2008-09). Lower estimate during 2007-2008 was due to disturbance by the large number of labourers removing *Prosopis* in the park. The presence of workers would have forced the pythons to retreat into the burrows. Four pythons were found dead during April 2008 to March 2009, two due to attack from Jackals and the other two for unknown reasons.

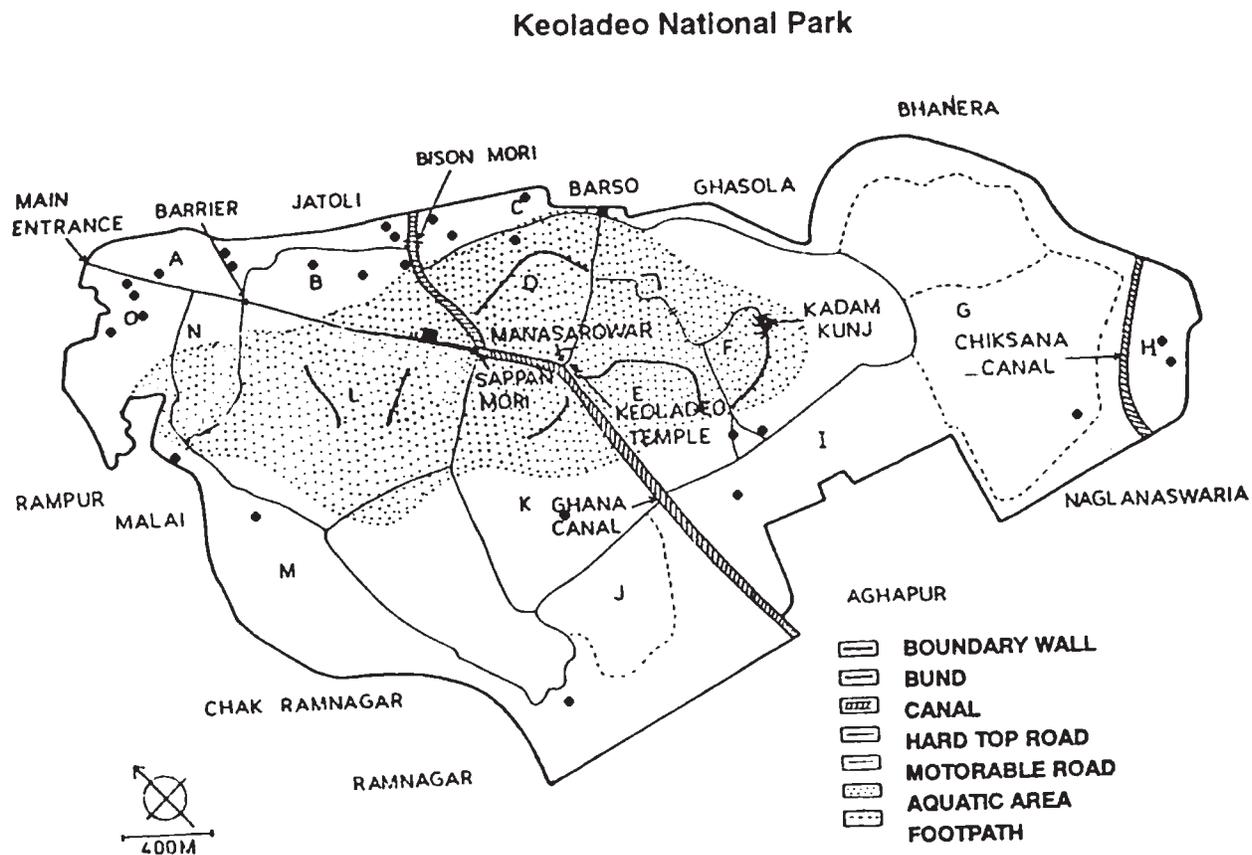
**Size Structure** of pythons in KNP shows that majority of snakes are 8-10 feet long.. Thirteen hatchlings were observed during surveys in winter. Snakes measuring over 14 feet were also observed during this reporting period.

**Basking behaviour:** Average basking duration of snakes in the undisturbed area ranged from 2 to 3 hours/ day. The basking duration was shorter (only 1-2 hours/ day) in snakes living in areas visited / disturbed by tourists. Regular basking is required for proper reproduction to maintain a sustainable population in the case of poikilotherms.



**Movement of individuals:** Observations on the movement of individually identified snakes are being monitored and accurate data on ranging pattern and distance travelled (home

during next year. A few pythons have been re-sighted in the same burrow, while others moved up to 1000m from its first observation site.



Distribution of Python burrows (Marked as large black dots) in Keoladeo National Park in 2008-2009.

Block	1986-87		1999-2000		2007-2008		2008-2009	
	Burrows	Pythons	Burrows	Pythons	Burrows	Pythons	Burrows	Pythons
A	5	11	5	7	3	4	3	6
B	5	15	1	2	7	10	7	17
C	2	13	1	15	4	7	4	21
F	4	20	2	14	2	6	2	0
G	1	3	0	0	1	1	2	9
H	3	2	2	7	2	3	2	2
I	5	15	3	34	1	2	3	10
K	3	14	1	3	1	1	1	6
M	3	6	3	16	3	10	3	17
N	1	0	1	0	1	1	1	3
O	6	6	3	13	4	7	5	3
Aquatic area	5	6	3	8	3	7	1	0
Total	43	111	25	119	32	59	33	105

Python burrows and population in KNP, Bharatpur during 1986-87, 1999-2000, 2007-08 and 2008-09



**Faecal analysis:** Twenty-five faecal samples of pythons have been collected during this year and all of them barring three (bird) had mammalian remains (hair, hoof). The prey species involved in these samples are being analysed using tricolological/ micro-histological technique.

**Cohabiting species:** Surveys of species cohabiting with pythons in the burrows show that out of 32 burrows on land signs of Indian porcupines were found in 31. Observations in 10 burrows during dusk (1900-2100 hr) showed that 3-5 porcupines and 3-350 bats live in the same burrow cohabiting with pythons.

**Breeding:** During 2008, two nests were observed and the same have been monitored continuously. Data with respect to breeding of pythons in the wild is being reported for the first time; incubation period - 72 days, hatching success - 95% and hatchling size 60 cm. It is observed that nest temperature of python falls in a narrow range through out the incubation (31.1 - 33.9° C). These observations provide pertinent information with respect to maintaining the pythons in captivity.

**Vegetation Changes:** Vegetation changes in python habitats after removal of *Prosopis juliflora* from the park is being monitored. The area is being colonised by *Calotropis* sp in the first season. However, shade trees such as *Salvadora persica* are getting revived.

### Recommendations

The study is in progress. Closure of disused open wells in the Park, which are death traps for many snakes and animals were suggested, and the same has been undertaken by the Rajasthan Forest Department. The duration of basking of the snakes are reduced by the disturbance from visitors. A visitor management plan for the Park in consultation with the authorities is being developed.

### Abstract

Ecology of the endangered Indian Rock Python, *Python molurus molurus* is being studied at Keoladeo National Park, Bharatpur since August 2007. Aspects such as population, size structure, ranging pattern, food habits, breeding and cohabiting animals with python are being studied. A few suggestions made during this study are being implemented by the Rajasthan Forest Department.

## 8. A Study on the Herpetofaunal Communities of the Upper Vaigai Plateau, Western Ghats, India

Principal Investigator	: S Bhupathy
Research Fellows	: G Srinivas & N Sathish Kumar
Duration	: Three years
Start date	: February 2006
Funding Agency	: MoEF (Eastern Ghats & Western Ghats Programme)
Total outlay of the Project	: Rs. 10.37/- lakhs
Funds available for the reporting period	: Rs. 1.69/- Lakhs
Status	: Completed

### Background

Over the last few centuries, intensive land use has considerably reduced the forests cover and the extent of natural forests. Recent estimates show that the species extinction rates are likely to be at least 10000 times greater than the past. Like any other tropical region, the Western Ghats is undergoing rapid transformation. The deforestation rate is high and the forests are being transformed into agriculture and monoculture plantations. The Indian herpetofauna are highly diverse, but poorly studied. Implementation of species conservation plans without understanding their taxonomy and ecology would be futile. Understanding the distribution patterns of biotic communities is important for planning conservation of biological diversity at local and regional levels. Hence, the present study was

initiated in Vaigai river catchments (Highway Mountains, Megamalai, Vellimalai, Cumbam valley, Suruli and Mavadi).

### Objectives

- ◆ Determine the distribution patterns of herpetological communities in various forests (vegetation) types, and altitudinal gradient in and around the Vaigai river catchments,
- ◆ Assess the conservation value for plantations such as tea, coffee and cardamom in the area with respect to the endemic herpetofauna, and
- ◆ To propose strategies to conserve rare and little known fauna such as reptiles and amphibians for Vaigai river catchments.

### Methods

The environs of Vaigai river catchments were sampled for herpetofauna taking aspect, slope, plateau and presence of valleys into consideration. Sampling was done in the above transects on seasonal basis (wet season: June-November; dry season: December- May) from January 2007 to December 2008 using Time constrained Visual Encounter Surveys and Quadrats. On observing a reptile or amphibian

the following data were recorded; species, GPS coordinates, forest type, altitude, microhabitat, vertical position from the ground and vicinity to water.

On each transect during each seasonal sampling 100 hours (x3 men) i.e. 300 man hours of Visual encounter survey and 100 quadrats (10x10m) totaling 1 ha was sampled. Data presented here include one sampling each for Wet and Dry season: 3600 man hours of survey and 12 hectares of quadrat sampling. Point Centered Quadrant (PCQ) method was used to record the tree species present at every 50 meters along each belt transect to determine the vegetation types available in the area. Anthropogenic disturbances such as lopping signs, cattle dung and grazing at each quadrant points were also recorded.

## Results

**Sampling:** The herpetofaunal sampling covered two dry and wet seasons each. The Visual encounter surveys (VES) yielded higher number of species and individuals of herpetofauna compared to quadrat sampling. Variation in number of herpetofauna between the methods was significant (Amphibians:  $U=88$ ,  $df=41$ ,  $p<0.001$ ; Reptiles:  $U=646.5$ ,  $df=109$ ,  $p<0.001$ ). Both higher number of species and individuals of herpetofauna were recorded

during dry season (December- May) compared to wet season (June-November), although the difference was not statistically significant.

**Tree Diversity:** A total of 419 quadrants were examined along three transects, of which 276 had trees. In all, 1104 trees of 156 species including 27 endemics were observed.

**Herpetofaunal Richness:** Including opportunistic observations, in total 34 species of amphibians and 72 species of reptiles were observed during this study. This is 20.6% ( $n=133$ .) of amphibians and 43.63% ( $n=165$ ) of reptiles reported so far from the entire Western Ghats. This indicates the importance of Vaigai Plateau with respect to the conservation of herpetofauna of Western Ghats.

**Range Extensions:** Two new range extensions have been recorded during this period; Anamalai Spiny Lizard, *Salea anamallayana* and Malabar False Tree Frog, *Rhacophorus pseudomalabaricus*.

**Herpetofaunal Abundance:** A total of 21 species of amphibians (3166 individuals) and 55 species of reptiles (3374) were recorded during the regular sampling. Density of 27.91 amphibians/ ha and 0.88 amphibians/ man hour effort was found. Similarly, density of 30.83 reptiles/ ha and 0.83 reptiles/ man hour was sighted during this period.

**Altitudinal Distribution of Herpetofauna:**

Amphibians showed a trend of increase in species richness along the altitudinal gradient. Higher proportion of endemic species was found at higher elevations (over 80% of amphibians above 1200 m). Reptiles showed monotonic decline in species number with elevation. 80% of the species found in high hills (1600-1800 m) are endemic, highlighting the importance of medium and high hills for the conservation of endemic herpetofauna in the Western Ghats.

**Herpetofaunal Distribution in Various**

**Vegetations Types:** The highest of 15 and the lowest of five species of amphibians were found in Evergreen and Riverine forests respectively. The highest of 37 reptile species was observed in Dry Deciduous forest and the lowest of only five species in Shola and Grassland. All reptile species observed in Shola and Grasslands were endemic.

**Dependency by Locals:** Dependency on forest by local people (for wood and cattle grazing) is largely restricted to the lower (400-800 m) and patches of higher

(1400-1600m) altitudes. Appropriate livelihood options, if made available, would control or minimize this dependency further.

**Herpetofaunal Communities:** The amphibian community of the area was dominated by the Family Rhacophoridae in terms of number of species. In the case of reptiles the family Colubridae was the dominant. Only a few amphibian families such as Bufonidae were found throughout the hills ranging from low to high altitudes. Number of *Rhacophorus* species was high in the high hills. With respect to the abundance, Pterobatids were high in most of the hills, Ranidae to lower hills and Rhacophorid to high hills. Reptile families such as Scincidae, Agamidae and Gekkonidae together contributed over 80% abundance of reptiles.

**Recommendations**

The present study area falls under the Reserve Forest Category. The following points are to be noted. The study area (Meghamalai, High wavy, Cumbham valley) connects the western side of the Western Ghats (Periyar TR and other southern areas of Kerala) with that of the



eastern side (Varshanad valley, Tamil Nadu). The area also connects Varshanad Valley with the Srivilliputtur Grizzled Giant Squirrel Sanctuary, and acts as corridor for several larger mammals. The area still hold rich biodiversity with several regional (Western Ghats) and local endemics. Several forest / vegetation (dry - wet) types are available in the area and harbor higher diversity. Most of the area is controlled and managed by the Tamil Nadu Forest Department. As on today the dependency on these forests by villagers and others appears low.

Looking at the biodiversity and related issues, the Vaigai catchments deserve a higher Protected Area Status, such as Wildlife Sanctuary. If considering for a Wildlife Sanctuary status, infrastructure and other surveillance mechanisms and equipments must be acquired. This is important in view the

socio-economic scenario (i.e. operations of smugglers and other antisocial elements) in the region.

Alternatively, the area may be considered under Biosphere Reserve (BR) Programme incorporating larger area from Tamil Nadu (Varshanad, Meghamalai, Cumbam Valley, Vellimalai, Srivilliputtur Grizzled Giant Squirrel Sanctuary) and Kerala (Periyar Tiger Reserve and adjoining areas). Biosphere Reserve model may work well as several estates, intact forests and tourism spots are located in the area and are likely to help conserve the area for wildlife and improve the livelihood of the people. Options with respect to nature awareness, alternative livelihoods and further research are also to be considered.



### **Abstract**

Herpetofaunal communities of the Vaigai river catchments were studied during 2006-09. Time constrained Visual Encounter Surveys (3600 man-hours) and Quadrat sampling (12 ha) was used for data collection, covering two dry and wet seasons. In total 34 species of amphibians and 72 species of reptiles were observed; 20.6% of Amphibians and 43.63% of reptiles reported so far from the entire Western Ghats.

Amphibians showed increase in species richness with increasing altitude while in reptiles monotonic decline was seen. Medium and high hills are important for the conservation of endemic herpetofauna in the Western Ghats. The present study area falls under the Reserve Forest Category. Due to high richness and endemism of several taxa, this area deserves a higher Protected Area Status. Biosphere Reserve model may work well as several estates, intact forests and a few tourism spots are located in the area.



## B. LANDSCAPE ECOLOGY

### 9. Establishment of ENVIS center at SACON on theme 'Wetlands of India'

Coordinators	: S N Prasad & Lalitha Vijayan
Research Fellows	: Chiranjibi Pattanaik, Santosh Gaiikwad (since November 2008), Madhu Routhu
Duration	: Long term
Start Date	: April 2006
Funding Agency	: Ministry of Environment & Forests
Total sanctioned amount	: Rs. 4.80/- lakhs
Funds available for the reporting period	: Rs. 4.80/-lakhs
Status	: On going

#### Background

SACON has been entrusted to establish and manage ENVIS centre, "Wetlands of India" since 2006.

#### Objectives

- ♦ Creation of a web site on wetland ecosystem with regional language interface
- ♦ Monthly compilation of news items on wetland ecosystem
- ♦ Identification of information/data gaps in the specified subject areas and action taken to fill these gaps
- ♦ Contribution of news items of ENVIS newsletter on quarterly basis
- ♦ Establish and operate a distributed clearing house to answer and channel queries related to wetlands
- ♦ Establish linkages with information users, carriers and providers from among government, academia business and non-governmental organizations including that with ENVIS

#### Methods

Satellite data of different time periods and different resolutions will be used for the extraction of wetlands. Initially, the orthorectified data from Landsat Thematic Mapper data (1990 to 1992) was downloaded from the Global Land Cover Facility (GLCF) website. The digital image processing was carried out on WINDOWS workstation using ERDAS IMAGINE 8.6 and ARSGIS 8.0 software. An interactive classification approach using both supervised and visual techniques will be adopted to delineate various wetland categories viz., Lakes, Ponds, Reservoirs, Mangroves, Saltpans, other aquatic vegetation etc., of the study area.

#### Results and discussion

- ♦ Revamped ENVIS wetland website,
- ♦ Simple maps were developed on Prioritized Maps on Inland Wetlands of India using DjVu plug-in technology,
- ♦ Wetland Forum is added new to the home page,
- ♦ Wetland Wiki also added to the website,
- ♦ World Wetland Day was celebrated on 2<sup>nd</sup> February 2009 at Uppalapadu swamp,
- ♦ Prioritized wetlands are shown on Google map using KML,
- ♦ ENVIS centers are listed as per 7 thematic areas,
- ♦ In Database section, experts' database (subject experts) is added, and
- ♦ Important news items were added to blog features.

Map portal (Web- GIS) is developed for wetlands of India by creating simple maps and interactive maps. Previously, the Internet connected public can view digital



wetlands data, in the form of simple JPEG / PDF maps only.

Wetland Wiki has been developed to know the status of wetlands in India. This is the first kind of wetland wiki in India which contains the information of wetlands of all states. Anyone can add some useful information through this. All the vector layers of different states are gradually uploaded to the Google maps using open source software.

**Remote Sensing & Wetland:** The spatial data on wetlands using Landsat TM data for 1990 finished for the state of Kerala and Orissa. Wetland maps and area statistics were generated for 28 districts of Karnataka and 23 districts of Andhra Pradesh. Database generated on wetlands is first kind of its region giving importance of below 56 ha wetland areas. Wetlands maps will be uploaded in the ENVIS website



Wetland Wiki – a new addition to the “wetlandsofindia” website

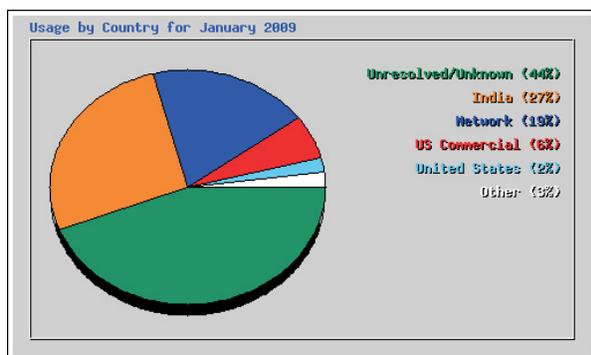
Month	Daily Avg				Monthly Totals					
	Hits	Files	Pages	Visits	Sites	Articles	Visits	Pages	Files	Hits
Mar 2008	2242	1550	297	169	1433	1618706	3061	5356	27915	40358
Feb 2008	2602	1446	354	182	2653	2163755	5115	9912	40498	72857
Jan 2008	2652	1644	342	185	2716	2709146	5765	10611	50973	82225
Dec 2007	2667	1416	585	197	2377	1925625	6108	18147	43910	82705
Nov 2007	2621	1477	462	209	2764	2415585	6289	13687	44311	78847
Oct 2007	2432	1408	489	216	2894	2288075	6710	15175	43870	75408
Sep 2007	2185	1506	468	221	2301	1936908	6644	14059	45204	65570
Aug 2007	2399	1713	759	170	2491	1857519	6285	23513	53124	74190
Jul 2007	2585	1564	370	140	2757	2620250	4367	11479	48501	80171
Jun 2007	2864	1696	404	184	2953	2732953	4945	12135	47581	85943
May 2007	2012	1409	401	206	3552	2769723	8391	12440	43681	62393
Apr 2007	2046	1304	334	169	3668	2195737	5074	10039	39120	61390
<b>Totals</b>						<b>27205983</b>	<b>65744</b>	<b>156456</b>	<b>528478</b>	<b>861855</b>

### Tables and Charts



Revamped wetlands of India website





Country wise usage of wetlandsofindia website for the month of March 2008

- ◆ Interoperability feature using web services so to promote data exchange or sharing,
- ◆ More Regional Language interfaces for Wetlands of India, and
- ◆ Intensive education activities for creating awareness among the local people on wetlands.

## Recommendations

The following recommendations will be added in Wetlands of India website.

- ◆ Mapping of wetlands of size 2 ha and above for the 1990 base year in rest of the states of India,
- ◆ Mapping of Ramsar sites of India and comparing with the present status,
- ◆ Habitat change assessment and creation of spatial databases by using Landsat TM & ETM datasets of 1990 and 2000,
- ◆ Development will be done using FOSS or free tools and other FOSS tools as per the requirement,
- ◆ Interactive web mapping using FOSS software with Google maps,
- ◆ Developments of data acquisition tools and make the available to other organizations to digitize data related to the wetland,

### Abstract

Wetlands of India website is updated with many features. Wetlands of Andhra Pradesh and Karnataka were extracted from Landsat Thematic Mapper data of 1990 using remote sensing and GIS. The district wise distribution of wetland category and overall area statistics of two states were finished. Wetland thematic maps were finished for 51 districts of Andhra Pradesh and Karnataka. The website of wetlands of India is revamped with additional new features such as wetlands of India Forum, Wetland Wiki, experts' database, news clippings etc.

## 10. Inventorisation of wetlands in North Kerala

Principal Investigator	: S N Prasad
Co-Principal Investigator	: Lalitha Vijayan,
Project Staff	: Chiranjibi Pattanaik
Duration	: 24 months
Start Date	: Apr 2008
Funding Agency	: Kerala State Biodiversity Board (KSBB)
Total sanctioned amount	: Rs 4.50/- lakhs
Funds available for the reporting period	: Rs 4.50/- lakhs
Status	: ongoing

### Background

The Kerala State Biodiversity Board has taken up the exercise of inventorying the wetlands of Kerala. SACON is dealing with North Kerala part and Kerala Forest Research Institute is handling the southern Kerala part.

### Objectives

- ◆ Wetland mapping and inventory of North Kerala on 1:25,000 scale, using one-season Resourcesat-1 LISS IV multi-spectral data, assessment of the wetland dynamics from 1992 to 2006,

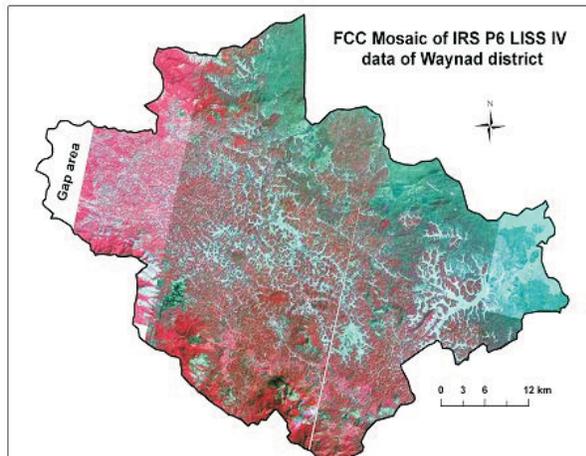
- ◆ Identification of important wetlands for conservation, and
- ◆ Preparation of district wise wetland atlas.

### Methods

The overall methodology to be adopted is given below.

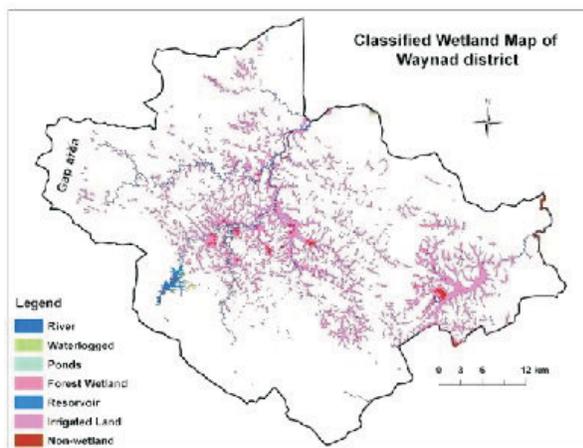
- ◆ Satellite data procurement.
- ◆ Generation of spatial framework in GIS environment on the basis SOI graticule grids for database creation and organization.
- ◆ Geo-referencing of satellite data with rectified images.
- ◆ Mosaicing of the data and extraction of different districts.
- ◆ Visual interpretation of satellite data and giving them proper attributes.
- ◆ Reconnaissance survey using SOI toposheets, FCC and GPS.
- ◆ Updation of classified wetland map after thorough ground check.

Inland Wetland		Coastal Wetland		Man-made Wetland	
Class	Code	Class	Code	Class	Code
Freshwater Lake	01	Mangrove	21	Reservoir	41
Ox-bow Lake	02	Lagoon (brackish)	22	Barrage	42
River/Stream/Creek	03	Estuary	23	Village Ponds	43
Marshes/Swamp	04	Creek	24	Village Tanks	44
Waterlogged (seasonal)	05	Backwater	25	Canal/Drainage/Channel	45
Pond/Ditches	06	Coral reef	26	Irrigated Land	46
Forest Wetland	07	Salt marshes	27	Abandoned Quarries	47
Non-Forested peat land	08	Rocky Coast	28	Ash Pond	48
		Mudflat	29	Aquaculture	49
		Freshwater Delta	30	Salt Pans	50
		Beach/Sand	31		



FCC of Waynad district, Kerala

- ◆ Creation of a digital database for each district as per spatial framework.
- ◆ Mosaicing/edge matching of all these maps to create seamless database.



Classified map of wayanad district

### Results and Discussion

- ◆ Mapping of Wayanad and Kozhikode districts of Kerala has been finished.
- ◆ Mapping of rest of the four districts are going on.

The classification of wetlands is followed by combining SAC classification and Ramsar classification. The details are given below.

This classification system is followed for classifying the wetlands of Kerala. In addition to this, the vector maps provided by KFRI on 1:12,500 scale to be put on Google maps for the benefit of the users.

Class	ID	Area in Ha
River/Stream	3	703
Waterlogged (seasonal)	5	126
Pond	6	31
Forest wetland	7	15
Reservoir	41	360
Irrigated land	46	15054
<b>Total</b>		<b>16289</b>

Area statistics of wetlands in Waynad district, Kerala

### Recommendations

The following recommendations are made for incorporation in the Kerala wetland project in future.

- ◆ Field data on different biodiversity units have to be collected on prioritized wetlands
- ◆ Emphasis will be given for prioritized mapping and monitoring of those wetlands
- ◆ Updation of data with aid of ISRO's 1:12,500 scale maps
- ◆ End product should be in OpenJump GIS domain so that further updation can be possible
- ◆ A list of prioritized wetlands must be made at country level of Panchayat and district levels

### Abstract

Mapping of wetlands have been finished for Wayanad and Khozikode districts. The rest of the four districts of North Kerala are going on using IRS LISS IV MX satellite data. The vector database received from KFRI on 1:12,500 scale are added to Google maps. The transfer of Desktop GIS to Web GIS will help the user community to conserve the remaining wetlands.

## 11. Pollination and seed dispersal by animals in the dry deciduous forests in Southern Eastern Ghats

Principal Investigator	: P Balasubramanian
Research Fellows	: M Murugesan, T Selvarathinam & P Manikandan
Duration	: Two Years
Start Date	: March 2007
Funding Agency	: Tamil Nadu Forest Department-Research Wing
Total Sanctioned amount	: Rs. 10/- Lakhs
Funds Available for the reporting period	: Rs 5.65/- lakhs
Status	: Completed

### Background

The Tamil Nadu Forest Department has entrusted this project to SACON, to identify and suggest suitable indigenous tree species for afforestation in southern Eastern Ghats. The major goal of this project is to identify woody plant species in the dry forest tracts of Eastern Ghats that attract insect and bird pollinators and avian seed dispersers.

The study was carried out in the dry deciduous forests of five hill ranges in Tamil Nadu Eastern Ghats namely, i) Dhimbam Ghats (Sathyamangalam Forest Division), ii) Andhiyur (Erode Division), iii) Kolli hills (Namakkal Division), iv) Shervaroy hills (Salem Division) and v) Javadi hills (Vellore Division). Although five study locations were identified for the study, it was resolved to make a detailed investigation in Dhimbam Ghats, Hasanur

Plateau in Sathyamangalam Forest division during the 1<sup>st</sup> year and conduct a rapid vegetation inventory in other four hill stations in the 2<sup>nd</sup> year.

### Objectives

- ♦ Study the reproductive phenology and find out the flowering, fruiting periods of woody species in the dry deciduous forests in southern Eastern Ghats.
- ♦ Study the animal visitation to flowers and fruits and find out the pollinators and seed dispersers in dry deciduous forests.
- ♦ Suggest native tree species that can attract key pollinators and seed dispersers for reforestation.

### Methods

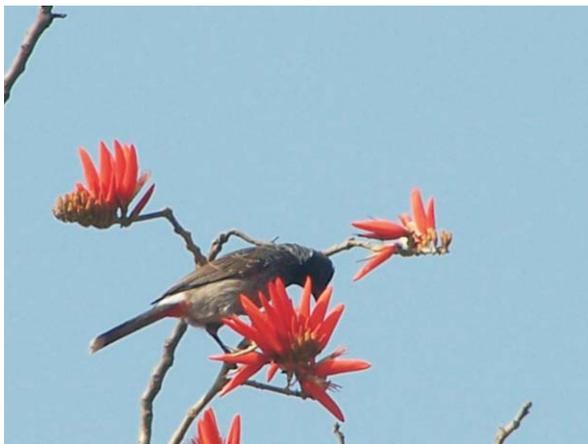
To assess the flowering and fruiting seasonality of plants, a total 400 individuals belonging to 40 woody species were tagged in the dry deciduous forests and observed. To quantify woody flora, vegetation sampling was done by quadrat method. Sampling was done in two types of habitats, namely undisturbed and degraded dry deciduous forests. 1 ha in each of the study sites were laid and vegetation quantified. Insect visitors to trees were documented by direct observations. Observations were carried out on the inflorescences of select trees, using a pair of binoculars as well as by using a hand held lens. Frequency of various insect visitors, number of flowers visited during each visit and foraging behavior were noted. Avian frugivores and pollinators were documented by recording the activities of birds foraging on fleshy fruits or nectar. Two methods were followed. In the first method, birds foraging on fruits or nectar were

recorded while walking along the census transects. Observation was carried out between 06:00 am to 10:00 am and 3:00 pm to 6:00 pm since these are the peak foraging period of birds. In the second method, extended watches were carried out on focal tree to record the avian nectarivore and frugivore visitation. Frequency of visits by birds, duration of each visit and foraging behavior were noted.

### Results and discussion

**Flowering and fruiting seasonality in the dry deciduous forests:** The number of species in flowers attained a peak (n=26) during summer followed by south-west monsoon (n=19). A dip was noticed in north-east monsoon (n=6). Peak fruiting (n=32) was observed during south-west monsoon and a dip during the post monsoon (n=12). Phytosociological analysis revealed the occurrence of 317 trees belonging to 30 species in the undisturbed site and 56 trees belonging to 14 species in the degraded site.

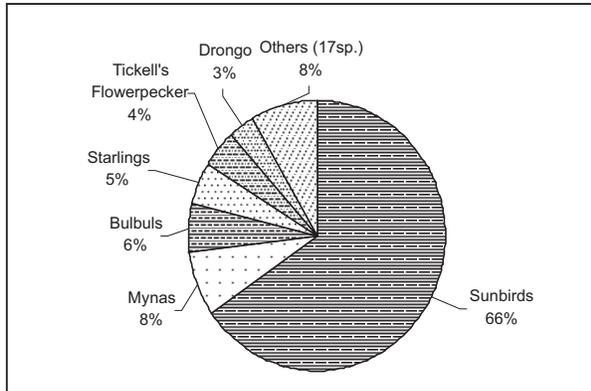
**Major insect pollinators comprised butterflies and bees:** To identify the flower visitors and pollinators, 25 plant species were observed for 600 hrs. 80 species of insects visited the plants, which included 25 species that could not be identified.



Important flower visitors belonged to Lepidoptera (butterflies and moths, 32 species) and hymenoptera (bees, wasps and ants, 23 species). Highest number of insect species were attracted by *Ligustrum perrottetii* (n=32) followed by *Zizyphus rugosa* (n=30), *Zizyphus mauritiana* (n=27) and *Tarennia asiatica* (n=20). To know the impact of degradation on pollinator diversity, a comparative study of insect



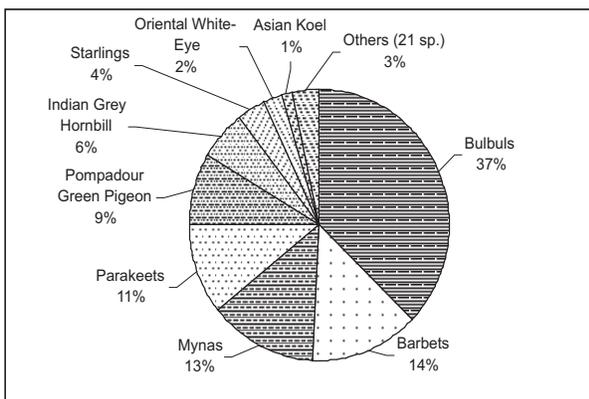
visitors to four tree species was made. Observations in disturbed and undisturbed dry deciduous forest habitats showed low diversity of insect pollinators in the disturbed site. Butterflies used the floral nectar of 21 plant species in the dry deciduous forests. Highest number of butterfly species was recorded on *Lantana camara* (27), followed by *Canthium dicoccum* (13), and *Ligustrum perrottetii* (11). Observations on honey bee-tree interactions revealed that in the dry deciduous forests 22 plant species were visited by honey bees. Four species of honey bees *Apis dorsata*, *A. indica*, *A. florea* and *Trigona iridepennis* were involved. *Apis indica* visited maximum number of plant species. Species such as *Pongamia pinnata*, *Terminalia bellirica*, *Tamarindus indica* attracted all the four honey bee species and appear to be very important for sustaining the honey bee population in the dry deciduous forests.



Avian pollinators recorded in the dry deciduous forests

**Major pollinators and seed dispersers:**

Thirty six species of nectar-feeding birds were recorded in the dry deciduous forests. Majority of the nectar feeding visits were made by Sunbirds (66%). Among the 36 plant species that attracted nectarivorous birds, *Eucalyptus tereticornis* attracted the maximum number of species (25) followed by *Butea monosperma* (20), *Bombax malabaricum* (19) and *Gmelina arborea* (15). 37 species of fruit-eating birds were recorded in the dry deciduous forests. Bulbuls (37%), Barbets (14%) and Mynas (13%) were found to be the major frugivores in the study area. Highest number of bird species was attracted by *Ficus benghalensis* (n=20) followed by *Ficus drupacea* (n=20), *Vitex altissima* (n=19), *Ficus infectoria* (n=18) and *Ficus microcarpa* (n=17).



Avian seed dispersers recorded in the dry deciduous forests

**Recommendations**

30 indigenous woody species that attract major pollinators and seed dispersers are recommended for planting in the degraded dry

deciduous forests of southern Eastern Ghats. The species suggested includes both bird-attracting and pollinator attracting plants. While the fleshy-fruit yielding species would attract fruit-eating birds, nectar-yielding species can sustain nectarivorous birds and insect pollinators.

In the dry deciduous forests of Andhiyur, Kolli hills, Shervaroys and Javadi hills the vegetation analysis indicated the occurrence of 58, 77, 91 and 65 woody species respectively. Appropriate tree species were suggested for afforestation of dry forest tracts of these hill stations.

**Abstract**

Study on plant-animal interactions with special reference to insect-flower, bird-flower and bird-fruit interrelationships were conducted in the dry deciduous forests of Sathyamangalam Forest Division, southern Eastern Ghats. Vegetation analysis revealed occurrence of 317 trees belonging to 30 species in the undisturbed site and 56 trees belonging to 14 species in the degraded site. 80 species of insects visited the plants. Important flower visitors belonged to Lepidoptera (butterflies and moths, 32 species) and hymenoptera (bees, wasps and ants, 23 species). While butterflies used the nectar of 21 plant species, honey bees used 22 species. Four species of honey bees *Apis dorsata*, *A. indica*, *A. florea* and *Trigona iridepennis* were also involved. Thirty six species of nectar-feeding birds were recorded in the dry deciduous forests. Majority of the nectar feeding visits were made by Sunbirds (66%). A total of 37 species of fruit-eating birds were recorded in the dry deciduous forests. Bulbuls (37%), Barbets (14%) and Mynas (13%) were found to be the major frugivores in the study area.

Vegetation analysis in the dry deciduous forests of Andhiyur, Kolli hills, Shervaroys and Javadi hills indicated occurrence of 58, 77, 91 and 65 woody species respectively. Appropriate native tree species for afforestation of dry forest tracts of 5 hill stations in southern Eastern Ghats have been recommended.

## 12. Study on pollinators and seed dispersers in scrub, dry evergreen and shola forest ecosystems of Tamil Nadu

Principal Investigator	: P Balasubramanian
Research Fellows	: C Anbarasu, R Aruna, S Silambarasan (X Baskaran, A Sivakumar up to Sept. Oct. 2008)
Duration	: Two years
Start Date	: May 2008
Funding Agency	: Tamil Nadu Forest Department – Research Wing
Total sanctioned amount	: Rs. 11 lakhs
Funds available for the reporting period	: 5.84 lakhs
Status	: Ongoing
Collaborative agency	: Tamil Nadu Forest Department

### Background

The process of pollination and seed dispersal are fundamental to the long-term sustainability of plants. The mechanism of pollination among the higher plant groups has been under investigation from very early times and it is highly significant in biological studies. Pollination process involves mutual relationship of plants with that of birds, insects and other animals. Seed dispersal has a major influence on plant fitness because it determines the locations in which seeds, and subsequently seedlings, can live or die. Though there are many inventories on flora and vegetation diversity in different vegetation types of Tamil Nadu, information on tree species that sustain key pollinators and seed dispersers are lacking. Hence, the present study has been undertaken with the collaboration of Tamil Nadu Forest Department's Research Wing.

Study sites identified for this project include i) Pacchamalai hills of Trichirappalli Forest Division for dry deciduous forests ii) Long Wood, Ebenad Shoals in Nilgiris for shola forest, iii) Point Calimere Wildlife Sanctuary

for Tropical dry Evergreen Forest, iv) Kanchipuram Forest Division (Chengalpet) for Scrub jungle.

### Objectives

- ◆ Study the flowering and fruiting phenology of the woody flora in the scrub, dry evergreen and shola forests.
- ◆ Study the animal visitors to flowers and fruits and find out the pollinators and seed dispersers.
- ◆ Identify the pivotal plant species that support pollinators and seed dispersers.
- ◆ Prepare a list of plant species that sustain key pollinators and seed dispersers in shola, dry evergreen and scrub forests and provide the same to the Tamil Nadu Forest Department for inclusion in their reforestation/afforestation programs.

### Methods

Pollinators and seed dispersers were documented by direct observations on nectar-yielding/fruit-bearing tree species. The flower visitors were observed from a spot, usually 10-20 m away from the focal plant using a pair of binoculars. At the focal plant extended watches were made. The details noted were i) the time of the day; ii) species visiting the plant, iii) number of flowers visited, and iv) foraging behaviour. Presence of pollen on the forehead of birds, wings of butterflies and body of other visitors were recorded as far as possible to find out the potential pollinators. Frugivores were determined based on the extended observations made on fleshy-fruited plants. Birds that frequent the focal tree for eating the fruits were also documented. Frequency of visits and foraging behaviour were also recorded.

### Results and discussion

***Insect pollinators:*** Honey bees in the dry deciduous forests & shola forests, butterflies in the tropical dry evergreen forest formed the

most probable insect pollinators. In the dry deciduous forests of Pacchamalai hills, four tree species were observed to be insect pollinated. In total, 17 species of insect pollinators were recorded. Bees, especially



honey bees (79.05%) formed the predominant visitors. In the tropical dry evergreen forest of Point Calimere, on four tree species that were observed, a total of 16 species of insect pollinators visited the flowers. Butterflies (61.04%) followed by bumble bees (15.14%) and honey bees (10.97%) formed the frequent flower visitors. In the Shola forests of Nilgiri hills, three tree species were studied for insect pollination which was visited by 13 insect pollinator species. Honey bees (31.17%) followed by flies (31.17%) formed the most frequent flower visitors here.

**Avian pollinators:** Sunbirds are the principal pollinators of trees in dry deciduous & dry evergreen forests and Thick-billed Flower pecker in shola forests. In the dry deciduous forests, among the six nectarivorous bird species, sunbirds (67.93) formed the principal flower visitors. In the shola forests of Nilgiris, of the 5 nectarivorous bird species Thick-billed Flowerpecker (37.70%) and Great Tit (24.78%) formed the frequent flower visitors. In the tropical dry evergreen forest, 4 nectarivorous bird species were recorded, of which sunbirds (82.41%) followed by Common Myna (12.04%) formed important flower visitors.

**Avian seed dispersers:** Bulbuls in scrub forests, crows in dry deciduous and dry evergreen forests and Nilgiri Laughing Thrush in shola forests form the principal frugivores. In the scrub forest, 52 woody plants and 27 bird species were recorded. Nine bird species were observed eating fruits, of which bulbuls, mynas and babblers formed the principal frugivores. In the shola forests, 23 fleshy fruited species were recorded. Observations on eight plant species indicated occurrence of 11 fruit-eating birds. Nilgiri Laughing Thrush (23.61%) followed by Jungle Crow (22.32%) formed the major frugivores. In the dry deciduous forests of Pachamalai hills, 11 frugivorous species were recorded. Crows (33.45%), Asian Koel (22.70%) and Common Myna 18.82%) formed the principal seed dispersers. In the Tropical dry evergreen forest, 12 species of fruit-eating birds were recorded. Crows (26.35%) followed by Mynas (26.29%) formed the principal frugivores.

### Recommendations

Bird-attracting tree species occurring in the shola forests of Nilgiris were identified and the list along with some ecological notes has been provided to the Tamil Nadu Forest Department's Working Plan wing for inclusion in the management plan.

### Abstract

Study of animal pollinators and dispersers were conducted at Pacchamalai hills of Trichirappalli Division for dry deciduous forests, Long Wood, Ebenad Shoals in Nilgiris for shola forests, Point Calimere Wildlife Sanctuary for Tropical dry Evergreen Forest, and Chengalpet and Chennai for Scrub jungles. The major pollinators and seed dispersers were identified and accordingly the important plant species that attract various animal species were identified. Such species were recommended to the forest department for plantation.

### 13. Ecology of Indian Grey Hornbill, *Ocyrceros birostris* with special reference to its role in seed dispersal in southern Eastern Ghats

Principal Investigator	: P Balasubramanian
Research Fellows	: E Santhosh Kumar
Duration	: Three years
Start Date	: February 2006
Funding Agency	: Ministry of Environment and Forests, Govt. of India
Total sanctioned amount	: Rs. 7/- lakhs
Funds available for the reporting period	: Rs. 2/- lakhs
Status	: Completed

#### Background

Hornbills are one of the most recognizable groups among birds. They are distributed in South-east Asia, India, Sub-Saharan Africa, and Australia. Among the 54 species of hornbills in the world, 9 species occur in India. Indian Grey Hornbill (*Ocyrceros birostris*) also known as Common Grey Hornbill is distributed in India, Pakistan, Nepal and North-west Bangladesh. Hornbills have specific food preferences and foraging techniques. As hornbills are primarily frugivorous, they interact with a variety of fleshy-fruited species for their food requirements. Habitat destruction and loss of nest trees are reported to affect the population of this species. Hence, a study was undertaken in Hasanur Range in Sathyamangalam Forest Division (11°40'-12.20' N latitude and 77°07'- 87° 7' E longitude), Southern Eastern Ghats in Tamil Nadu.

#### Objectives

- ◆ Study the foraging ecology and breeding biology of Indian Grey Hornbill and determine its predominantly frugivorous habits.
- ◆ Study the hornbill-plant interactions and assess the role of Indian Grey Hornbill in seed dispersal and regeneration of its food plants.



#### Methods

To assess the fruiting phenology of trees, 210 individuals belonging to 21 fleshy-fruited species were tagged. Flowering and fruiting activities in these species were recorded once in a fortnight. By focal animal sampling, fruit utilization by the hornbills during the non-breeding season was determined. In the breeding season, 10 active nests were selected and monitored for 720 hr. Data on number of visits made by the male, number of fruits delivered by the male to the nest inmates and fruit species fed were gathered. Fruit use was also assessed by identifying the seeds from nest and roost middens. Fruit preferences of Indian Grey Hornbill were assessed using Ivlev's Preference Index. Nest site characteristics such as tree girth at breast height, tree height, and nest height, girth at nest height, inner depth of the cavity, and length and width of the nest entrance were recorded to find out the nest site preferences. To assess the role of Indian Grey Hornbill in seed dispersal and regeneration of its food plants, seeds collected from the middens were taken for germination experiments and compared with control seeds collected from the plants. Midden deposit under the nest and roost trees were also monitored to record natural regeneration of hornbill's food plants.

## Results

The phytosociological analysis revealed the occurrence of 322 trees belonging to 30 species in the 1 ha plot of the dry deciduous forest with Shannon's Diversity Index of 2.64. A total of 588 trees belonging to 64 species of trees were recorded in the riverine habitat with the Shannon's Diversity Index of 3.40. Predominant tree species in the riverine habitat include *Pongamia pinnata*, *Terminalia arjuna* and *Mangifera indica*. *Vitex altissima*, *Erythroxylum monogynum* and *Bambusa arundinacea* dominate the dry deciduous forests. Assessment of fruit availability revealed that at least five species had fruits every month. Peak in fruiting was observed in May and July in both the years. While many species showed seasonal fruiting behaviour, figs were aseasonal.

### **Figs formed major diet of the species:**

During the non-breeding season, a total of 3086 feeding observations were made on Indian Grey Hornbill. 38 fruit species belonging to 21 plant families were consumed. Six species of *Ficus* (*Ficus benghalensis*, *F. drupacea*, *F. infectoria*, *F. microcarpa*, *F. racemosa*, *F. religiosa*) constituted 25% of the diet. Among the non-fig fruit species, *Diospyros montana* (Ebenaceae) and *Vitex altissima* (Verbenaceae) was consumed in large quantities. Ivlev's Preference Index showed that *Bridelia crenulata* (0.97), *Ficus religiosa* (0.95), *Solanum erianthum* (0.95), *Drypetes roxburghii* (0.94), *Ficus drupacea* (0.94) were the preferred food plant species.

Thirty two active nests were recorded during the breeding seasons 2007 and 2008.

Nest trees included *Melia dubia*, *Syzygium cumini*, *Mangifera indica*, *Albizzia odoratissima*, *Terminalia arjuna* and *Terminalia bellirica*. Ivlev's Preference Index showed that Indian Grey Hornbill's most preferred nest tree was *Melia dubia* (Meliaceae) (PI=0.27).

The nesting season lasted for about three months, from March to June and the nesting period averaged 87 days. During the breeding season, nest inmates were fed by loads of food items by the male. Fruits of 26 plant species belonging to 16 plant families were consumed during the breeding season. Of these 14 species were identified by monitoring the nests and 12 species from nest midden analysis. A total of 13680 observations were made at the focal nests. Food items delivered to the nest inmates comprised both vegetable (64%) and animal (36%) matter which showed that this hornbill species is predominantly frugivorous.

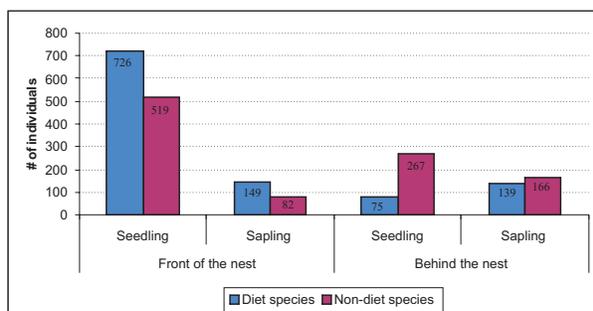
### **Hornbills aid in seed dispersal of their food**

**plants:** Altogether, Indian Grey Hornbill consumed 41 plant species belonging to 22 plant families. In twenty, 3x3 m quadrats laid in front of and behind the nest trees, 44 species of seedlings and saplings were recorded, among which 24 species (54.5%) were found to be the food plant species of Indian Grey Hornbill. Number of seedlings and saplings of hornbill's food plant species in front of the nests was higher than that of non-diet species.

### **Indian Grey hornbills enhance seed germination:**

Seeds of various species collected from the nest middens were segregated and sowed in polythene bags with a mixture of soil and sand. Seeds collected from the trees were grouped in to i) seeds with pulp

and ii) pulp removed seeds that were used as control. Seeds collected from the hornbill droppings showed higher percentage of germination indicating the role of Indian Grey Hornbill in enhancing the germination efficiency of seeds of their food plants. Several economically important tree species including the sandal were benefited by the seed dispersal role of the Indian Grey Hornbill.



Number of seedlings and saplings of diet and non-diet species in front and behind the nest trees of Indian Grey Hornbill

about three months, from March to June and the nesting period averaged 87 days. Six nest tree species were used by Indian Grey Hornbill. *Melia dubia* was found to be the most preferred nest tree. Germination experiments indicated that the Indian Grey Hornbill enhance the germination efficiency of seeds of their food plants. Several economically important tree species including the sandal are benefited by the role of the Indian Grey Hornbill in seed dispersal.

### **Abstract**

Ecology of Indian Grey Hornbill *Ocyrceros birostris* with reference to its role in seed dispersal was studied in Sathyamangalam Forest Division, southern Eastern Ghats. The hornbill use dry deciduous forests for foraging and riparian habitat for foraging and nesting. All the trees on which hornbills nest were located in riparian forests. Assessment of vegetation indicated higher species richness and diversity in the riparian forests. Indian Grey Hornbill is found to be predominantly frugivorous. It ate fruits both in the breeding and non-breeding season. In all, 41 fruit species belonging to 22 families were consumed. The nesting season lasted for



## C. ECOTOXICOLOGY

### 14. Impact of agricultural pesticides on the population status and breeding success of select species of fish-eating birds in Tamil Nadu

Project Investigator	: S Muralidharan
Co-investigator	: C Sivasubramanian
Research Fellows	: V Dhananjayan
Technical Assistant	: S Jayakumar
Duration	: 3 Years
Start Date	: January 2007
Funding Agency	: MoEF
Total Sanctioned amount	: Rs.14.62/- Lakhs
Funds Available for the reporting period	: Rs. 4/- lakhs
Status	: Ongoing

#### Background

Pesticides are widely used agrochemicals having serious impacts on various living species such as birds. In view of the ecological, ecotoxicologic and population implications the present study was undertaken to assess the impact on birds in select traditional breeding colonies in Tamil Nadu.

#### Objectives

- ◆ Conduct surveys and locate heronries in Tamil Nadu,
- ◆ Monitor breeding ecology, nesting success in select species of fish-eating birds,
- ◆ Identify factors responsible for population decline and or breeding failure, and
- ◆ Generate database on the eggshell thickness and residue levels of persistent chemicals.

#### Methods

Direct count method was adopted to estimate the number of species and individuals in the study locations. Focal nest method was followed for studying the breeding ecology. Multi residue extraction method was followed

with appropriate solvents for extraction and residues were estimated with Gas Chromatography fitted with Electron Capture Detector.

#### Results and Discussion

**Vedanthangal:** 12 species are breeding in the Vedanthangal Bird sanctuary where the population of the fish eating birds was the maximum in March 2009. During April 2008 – March 2009, 18 species of fish-



eating birds were observed. Population of the fish eating birds was the maximum (27,706) in March 2009 and minimum (3,648) in September 2008. Of these, Cattle Egret, Glossy Ibis, Painted Stork, Grey Pelican and Little Cormorant were the predominant species.

White-breasted Kingfisher and Pied Kingfisher were seen only in a few numbers. Out of 18 species found in the sanctuary, 12 species were observed breeding. However, we monitored only eight species, namely Spot-billed Pelican, Asian Openbill, White Ibis, Painted Stork, Grey Heron, Little Cormorant, Darter, Eurasian Spoonbill and Little Egret. Altogether 2958 nests belonging to the referred eight species of birds were studied. Among the species the maximum number of nests was of Grey Pelican (872) followed by Asian Openbill (525) and Painted Stork (455). Nests of Darter and Little Egret were a few. About 295 nests were studied using focal nest method to assess the breeding outcome.

**Vettangudipatti Bird Sanctuary:** Six colonial species breed in Vettangudipatti Bird Sanctuary. The population and number of the species were relatively less than Vedanthangal. Total population was the maximum (1493) in December 2008 and minimum (22) in July 2008. Among the species observed, Cattle Egret, Little Egret, Asian Openbill and White Ibis were more in numbers and White-breasted Kingfisher was only a few. Six species, Asian Openbill, White Ibis, Little Cormorant, Black-crowned Night Heron, Intermediate Egret and Little Egret were observed nesting here. However, we monitored only four species, namely Asian Openbill, White Ibis, Little Cormorant and Intermediate Egret. Among the species, Asian Openbill (451) was the predominant species followed by White Ibis (82). About 91 nests



were studied using focal nest method to assess the breeding outcome.

**Koonthankulam Bird Sanctuary:** 12 species breed in Koonthankulam Bird Sanctuary. Maximum population was observed in March. During the study, from April 2008 to March 2009, 20 species of fish-eating birds were observed. Total population was the maximum (23,175) in March 2009 and minimum (10,103) in April 2008. Of which Cattle Egret, Glossy

Ibis, Painted Stork, Grey Pelican and Indian Cormorant were the dominant species. White-breasted Kingfisher and Pied Kingfisher were a few in numbers. Out of 18 species found in the sanctuary, 12 species were breeding. However, we monitored only nine species, namely Spot-billed Pelican, Painted Stork, Indian Cormorant, Darter, Intermediate Egret and Little Egret. Altogether 2806 nests belonging to the eight species of birds were located. Among the species the maximum number of nests was of Painted Stork (1323) followed by Grey Pelican (839) and Indian Cormorant (230). Nests of Darter and Eurasian Spoonbill were a few. About 230 nests were studied using focal nest method to assess the breeding outcome.

**Pesticides contamination:** Samples of water and fishes have been collected from three intensive study sites during pre monsoon and post monsoon period. Sample analyses are at different stages for pesticide residue estimation. Seven species of birds, namely Grey Heron, Grey Pelican, Little Cormorant, Indian Cormorant, Little Egret, Painted Stork and White Ibis found dead were analyzed for pesticide residues in various tissues. Higher levels of organochlorine pesticide residues were detected in the tissues of Little Egret followed by Grey Heron and Little Cormorant. Among various organochlorine pesticide residues analyzed, isomers of HCH were the maximum followed by Heptachlor epoxide. Total HCH ranged between 4.9 ppb in liver of Grey Pelican and 572 ppb in brain of Little Egret. Heptachlor epoxide, total endosulfan and total DDT ranged from 1.0 ppb to 226 ppb, 1.7 ppb to 225 ppb and 2.1 ppb to 382 ng/g respectively. Comparatively low levels of dieldrin, ranging between below detectable

levels (BDL) and 148 ppb were recorded among the tissues of birds. On the whole the higher levels of organochlorine pesticide residues were detected in the tissues of Little Egret followed by Grey Heron and Little Cormorant, while tissues of Painted Stork had low levels.

Organochlorine pesticides levels detected in these species are almost comparable with the levels reported in select species of fish-eating birds collected from Nilgiris (Vijayan and Muralidharan, 1996). In general, as these pesticides are capable of creating certain abnormalities, especially reproductive deformities, the levels found in the present study are required to be viewed with concern. In brief, pesticide contamination in all the three locations exists at different magnitudes. Further studies on contamination and breeding outcome in a select species of birds are expected to help understand the situation better.

### **Abstract**

Of the 41 traditional breeding sites, three namely Vedanthangal Bird Sanctuary, Vettangudipatti Bird Sanctuary and Koonthankulam Birds Sanctuary have been selected for intensive investigations. The population of fish-eating birds was high during the breeding season due to congregation. Among the three intensive study sites, number of species of fish-eating birds was higher in Koonthankulam (19 species) followed by Vedanthangal (17 species) and Vettankuddipatti Bird Sanctuary (13 species). Among the birds, Cattle Egret, Glossy Ibis, White Ibis, Asian Openbill and Painted Stork were high in the intensive study sites.

To assess the pesticide contamination, samples of water and fishes were seasonally collected and analyzed. Birds were collected only when found dead. Among the seven species of birds analyzed, varying levels of residues were recorded in the tissues. Although the residue levels are lesser than the levels considered to be lethal, it can be viewed with concern because these pesticides are capable of creating several abnormalities.



## D. ENVIRONMENTAL IMPACT ASSESSMENT

### 15. Conservation of Kottuli wetlands, Calicut, Kerala

Principal Investigator	: PA Azeez,
Research Fellows	: Nikhil Raj & R Chandra
Duration	: 6 months
Start Date	: February 2008
Funding Agency	: M/s TRKL, Kerala Government
Status	: Consultancy project, Completed

#### Background

The Kottuli wetland is one among the wetlands of national importance identified by the Government of India for conservation action under National Wetland Conservation Programme (MoEF, 2006-2007). The Kerala government has proposed an ecotourism project in the area, activities of which is expected to go with the conservation actions. The *Sarovaram* Project, at Kottuli, covers wetlands (260 acres) and vegetated dry land (13 acres). Since the water bodies in the project area are connected with the Connolly canal, the water is brackish, and supports some species of mangroves. Except for some uninhabited houses, the project area is generally devoid of any human settlement. Documentation of biodiversity in a project area and its immediate surroundings is advisable in the case of any developmental projects, to ensure that ecological setup of the area do not degrade. Upon the request of M/s Tourism Resorts Kerala Limited, Government of Kerala, SACON undertook the work.

#### Objectives

- ◆ Assess the flora in the project area,
- ◆ Assess the fauna in the area emphasizing on avian species,
- ◆ Identify probable impacts of the project to the biological and ecological environment, and
- ◆ Prepare an ecological management plan for the ecotourism project.

#### Methods

To collect data and information on specific components of the ecological system and pertinent issues widely used standard scientific methods were adopted. Rapid field surveys were undertaken during February to June 2008 for collecting data.

The avian fauna in and around the wetland was documented by surveying during morning (06:00 to 10:00 hr) and evening (17:00 to 19:00 hr). Random walks as well as circular plots were used to document the species.



To document the vegetation of the area and for floral enumeration, quadrat method was followed. For recording the trees, the quadrats of 10 x 10 m were used. All individual plants having more than 10 cm GBH (Girth at Breast Height) were included in the tree category. Plots of 5 x 5 m and 1 x 1 m were laid within each tree quadrat at its each corner to record the shrubs and herbs respectively. In each

quadrat, species and their number were recorded. The data were used for analyzing secondary parameters such as density, frequency and abundance using standard phytosociological methods.

In order to find out people's opinions on the project a brief socio-economic survey was also conducted. Randomly selected individuals from various locations of the city were presented about the project and their responses were elicited. To reduce/ avoid bias in terms of professional or any other interests of the respondents, we contacted almost equal samples from people engaged in different occupations.

### Result

**Plants:** From the Kottuli wetlands, the total number of mangrove species recorded during the present study was 5 and mangrove associates were 29. In total 240 floral species, belonging to 85 families and 198 genera were recorded. Of the 240 species of plants, 8 species were climbers, 3 epiphytes, 8 ferns, 16 grass, 47 herbs, 11 sedges, 26 shrubs, 6 stragglers, 18 sub-shrubs, 85 trees, 12 twiners/vines. The family with largest number of species was Fabaceae, represented by 20 members.

**Birds:** The wetland and the mangroves provide habitats for several species. Since the present study was emphasizing on avifauna in the area no attempt was made to scientifically survey lower animal taxa. During our survey, the total bird species recorded in and around the wetland were 69, which include 29 aquatic and 40 terrestrial species. Of this, 9 species are migratory birds.

**People's opinion:** In our brief survey of people's opinion, 89% of the respondents supported the project assumptive that it

will boost up the development of the state in general and the city in particular. Only 5% of the respondents were aware of the need for conserving their local biodiversity and the project's implications on the same. Those responding in unconcerned manner (6%) were either not aware of the project or do not have any special regards for such projects or were not touched upon by such issues. Our study identified various threats to the wetland that included entry and mixing of municipal sewage and other discharges, municipal solid waste, weed infestation, automobile exhaust and pollution, and noise.

### Recommendations

Kottuli wetland with the mangroves being one of the important areas in Kerala, calls for care during both construction and operation phase of the project. Proper and planned management with active public participation is needed for maintaining its biodiversity and for ecological value addition. Large scale construction work is likely to impose pressures on the existing system. However, proper planning during construction may help reduce the impacts.



Pneumatophores growth in a mangrove patch

Regular monitoring and documentation of the flora and fauna in and around the Kottuli wetlands should be undertaken during the construction as well as post-implementation phase since the floral and faunal changes

are the easily assessable indicators of environmental changes. Attempts also may be made to protect neighboring wetlands and prevent their filling, as they offer supplementary habitats for many wetland species.

#### **Abstract**

The Government of India identified Kottuli wetland at Kozhikode as one of the wetlands of National Importance. As a means of conservation and development of the area M/s TRKL proposes to develop an ecotourism centre in the area. M/s TRKL requested Sálim Ali Centre for Ornithology and Natural History (SACON) to investigate and explore the area for possible threats.

The rapid survey recorded 69 species of birds. In all 240 plant species were recorded. Of this 5 are mangrove species and 29 mangrove associates. Kottuli wetland being one of the scarce areas with mangroves in Kerala, calls for care during both construction and operation of the project. Proper and planned management with active public participation in conserving the nature is needed for maintaining its biodiversity and for ecological value addition. Large scale construction work is likely to impose pressures on the existing system. However, proper planning during construction may help reduce the impacts. Attempts also may be made to protect neighboring wetlands and prevent their filling, as they offer supplementary habitats for many wetland species.

## **16. Investigating the causes of decline of House sparrow (*Passer domesticus*)**

Research Fellow	: Dhanya R
Supervisor	: P A Azeez
Duration	: Three year
Start Date	: April 2006
Status	: Ph.D project ongoing

### **Background**

The House sparrow is one of the most widespread and abundant birds in the world. The decline of the species is reported from different parts of the world. There are different hypothesis associated with the decline of these synanthropic bird. As urbanization extents, it almost engulfs the natural habitats of the bird. The urban habitat would not be conducive enough to support its survival. The present study investigates the ecology of House sparrow at different grades of urbanization in Coimbatore city and its environs. Coimbatore, a fast growing industrial city of southern India, is 105.6 Km<sup>2</sup>, of which 52% are developed area, and the remaining agricultural, unused and wasteland.

### **Objectives**

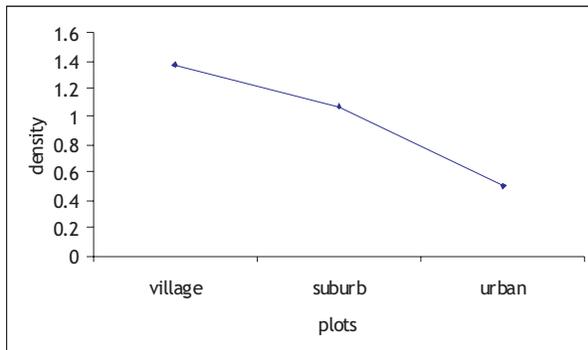
- ◆ Study the population of House sparrow at different grades of urbanization
- ◆ General ecology of the bird that focus on breeding and roosting, and
- ◆ Study the habitat variables that determine the population

**Methodology**

Population of the species is monitored by the Point count method (Bibby *et al.* 1992). Data on the nesting and roosting, habitat characteristics are collected to understand the ecology of the bird. To collect information on habitat variable imageries, GIS software and ground-truthing will be adopted.

**Result and discussion**

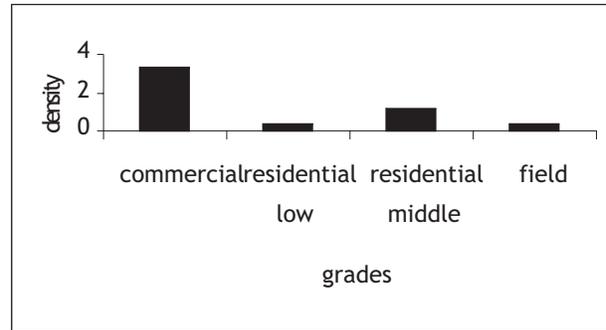
**House sparrow population:** There is a considerable reduction of the House sparrow population in the highly urbanized areas. To find the distribution pattern of House sparrow at different grades of urbanization, we have considered locations falling under commercial, residential (high, middle and low class), temple premises, bus stand, field and industrial areas. Village commercial area holds highest number of the species compared to the other grades.



Population density of House sparrow at different scales of urbanization

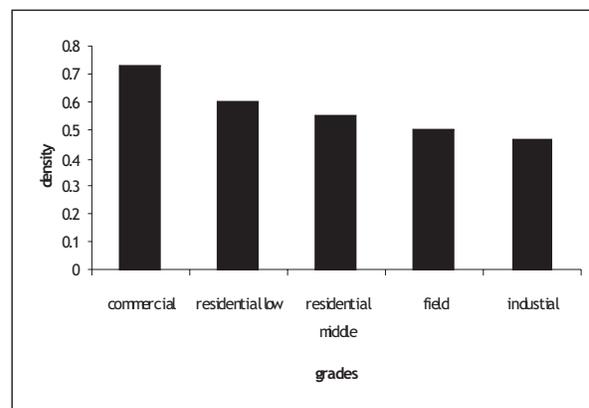
Commercial areas serve enough food materials (cooked food from the hotels and waste dumps) and nesting places. After commercial area, residential middle class areas hold highest density of this species. In suburban area also the population trend was high in commercial area followed by residential (low and middle class) locations. In urban area the trend was more or less similar to other two urbanization gradient.

**Nests, breeding and roosting:** House sparrow is a social breeder but the nests are widely spread in the colony. As per literature, the nests are “dome” shaped, but the birds are found mostly making nests fitting the shape of the substratum. The nests have two layers; functional layer and lining. Functional layer



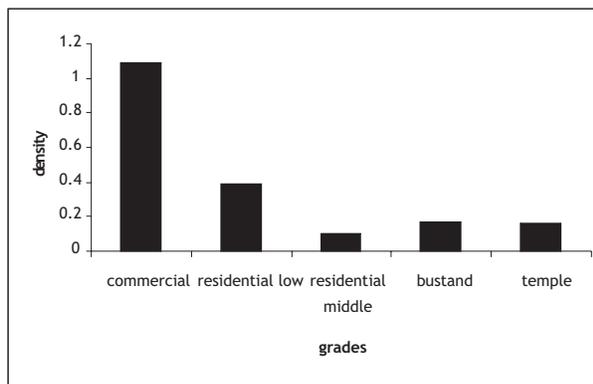
Distribution of House sparrow - Village

forms the base of the nests, occupies almost 75-95% of nest volume and the rest form the lining. The functional layer is made up of dry grass, herbs, and leaves, coir and jute ropes. Grass inflorescence can be seen in both the functional layer and the lining. While the functional layer is mainly made up of plant matter, the lining is made of fine animal and plant matter. It consists of materials such as chicken feather, hair, cotton, fine jute and coir, and paper pieces.



Distribution of House sparrow – Suburban area

During 2007 and 2008 high nesting activity was observed in April and during October to November no active nests were recorded. House sparrow used eight different nesting substratums, which include shutter hoods, roof and display boards. Sparrows preferred nesting heights 0-5 m, followed by 6-10 and 16-20 m. Nesting success was 31% in village while in suburb it was 29%.



Distribution of House sparrow - Urban area

House sparrow preferred small (5m) and solitary trees ( $8.2 \pm 3.24m$ ) for roosting. Roosting trees were nearer to the human habitations and closer to the road ( $0.9 \pm 0.66m$ ). It can be a survival strategy to be away from the big birds, which usually roost in big and groves of trees.

**Threats:** Lack of adequate insect food source for the chick appears one of the main reasons for the decline of House sparrow. In our observations the insect food in villages constituted 52%, in suburbs 47% and in urban areas 41% of chick diet. The decline in insect food resource towards urban areas may be because of the decreasing home gardens, open areas, and grass lands in the higher urban grade. It appears, in quantitative terms, the lack of insect food is compensated by cooked food (village -38%, suburb-42%, urban -55%) although in quality the cooked food may be low compared to insects.

### **Abstract**

The House sparrow is one of the most widespread and abundant birds in the world. However in recent years the species is reportedly declining in different parts of the world. The present study investigates the ecology of House sparrow at different grades of urbanization in Coimbatore city and its environs. The study proposes to examine the population of House sparrow at different grades of urbanization, general ecology of the bird that focus on breeding and roosting, and habitat variables which will determine the population.

Population density of the species decreased towards highly urbanized locations. Commercial area holds highest population density of the species followed by residential areas. Nesting seasonality was discrete with a peak in April. Composition of nest materials is found to change from village to urban area. A decline in the insect food resource in the chick diet is also seen in city.



## 17. Adaptation and tolerance of birds to urbanization – a critical evaluation with emphasis on life strategy

Principal Investigator	: Ranjini J
Supervisor	: P A Azeez
Duration	: 3 years
Start Date	: February 2007
Funding Agency	: International Foundation for Science (IFS), Sweden
Total sanctioned amount	: Rs. 4.0/- lakhs
Status	: Ph.D project

### Background

The tolerance of a species is based on their inherent adaptations and innovative abilities. Both habitat and behavioral characteristics has an important role in determining the survival of a species in a changed habitat. The ability to identify the analogues of the original habitat requirements in the changed habitat such as nesting or roosting in artificial structures, or feeding on manmade food, and also the ability to survive in the remnant patches with certain behavioral changes such as compromised territories and flocking nature may determine the survival of a species in an urban area. Finding and identifying analogues might also involve cognitive / innovative abilities of a species. In this background the present study was undertaken to explore the life strategy of urban birds.

### Objective

- ♦ Explore the reasons behind the dominance of very few species in urbanized areas.

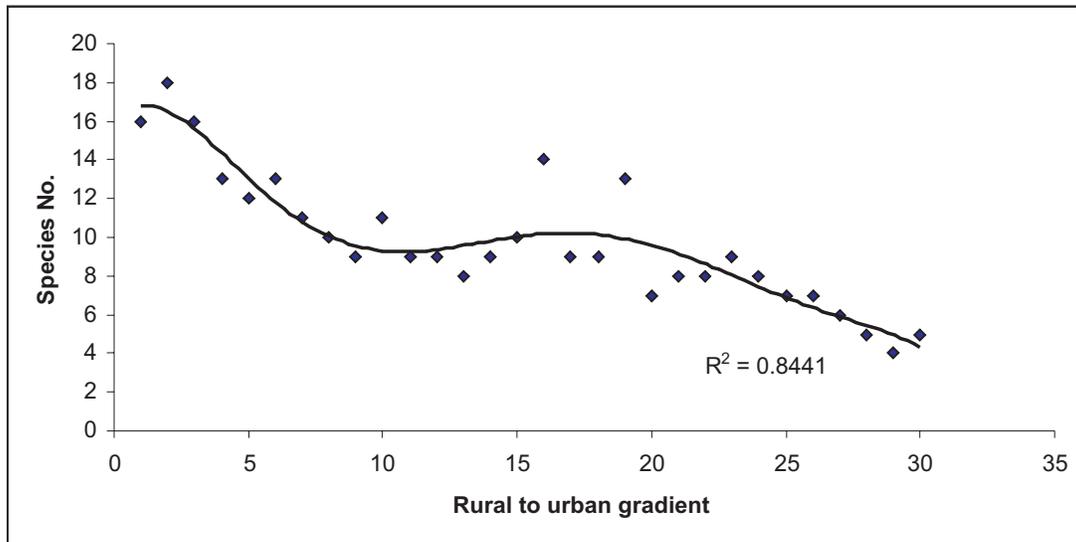
### Methodology

Field surveys were undertaken for resident birds nesting in different grades of urbanization ranging from rural to city. Habitat parameters were quantified with the help of satellite imageries and ground truthing. The study locations included areas where there are few human habitations adjacent to forests areas, villages with residences, agricultural areas and commercial centers, suburban and urban areas with mosaics of different land uses such as open areas, agricultural areas, industries and housing colonies.

### Results and discussion

In total, 45 breeding species of birds were observed during the survey of the urban to rural gradient of Coimbatore city. As the urbanization intensity increased, the diversity of species decreased (the data presented here contains 150 point samples distributed within 30 locations along a rural to urban gradient of Coimbatore city). Urbanization, as it progressed to the higher levels, filtered out majority of birds which could not meet their needs. Species numbers were high in the very rural locations; while it declined towards higher levels of urbanization, suburban areas showed a slight rise in the species numbers, it is noted by many studies in urban areas, and could be related to the diverse land uses and habitat variables. No additional species were recorded from the suburb or urban grades other than the species seen in rural areas.

Species that was observed in urban areas shared certain common characters. The majority species that were present in the urban areas were omnivorous and ground feeders (75%), platform / cavity nesters, or species that flocked either intra or inter species guilds for roosting / feeding. The House crow *Corvus splendens*, Jungle crow *C. macrorhynchus*,



Number of species along a rural to urban gradient of Coimbatore city

Blue rock pigeon *Columba livia*, House sparrow *Passer domesticus*, Common myna *Acridotheres tristis* were seen in areas falling in higher levels of urbanization. However, the presence of sparrows and Myna tend to be fewer in these locations. House crow was the most dominant species, followed by Blue rock pigeon. Tailor bird *Orthotomus sutorius*, Purplerumped sunbird *Nectarinia zeylonica* and Asian koel *Eudynamys scolopacea* were seen sparsely.

The species were distributed differently in each grade. Pigeons were high at the heart of the city, where multi-storied buildings dominated, whereas crows dominated the area with parks or tree patches. House sparrows were seen in the village townships with go-downs. The common mynas were more at suburb and village open grazing lands, whereas they club together in higher number for roosting in the city parks. This point to the fact that the species presence in an urban area could be related to their ability to find the artificial structures analogous to their original habitat where they could find the nesting or roosting spaces, such as building as analogue to the rock where rock pigeon originally inhabited.

#### **Abstract**

Urbanization is a fast growing process occurring all over the world. The present study is an attempt to explore the life strategy of urban birds, in the context of various hypothesis put forth to explain the dominance of certain species in urban setup. Several study locations were identified and surveyed to find out the factors that determine the survival of a species in fast changing in environment. The study locations cover a gradient from rural areas to urban centers. It is apparent that even though few characters were common for the species that survive in urban areas, the survival of each species is determined by unique reasons.

## E. NATURE EDUCATION

### 18. SACON Nature Education Programmes for Coimbatore

Coordinator	: P Pramod
Assistance	: Volunteers
Duration	: April 2008 – March 2009
Funding	: SACON and Local Programme sponsors

The regular Nature Education programmes such as guest lectures, one-day nature camps, Sálim Ali Nature competitions, and wetland day / forestry day celebrations were continued. In 2008-09, the following events were organized.

**One day Nature camps:** Twenty two one-day nature camps were conducted during this period in SACON. About 1200 students and 40 teachers participated in the programmes. Each one-day program had one nature camp of about 2-3 hours, slide show, a short film show, discussion and interactions.

**Sálim Ali Trophy Nature Competitions 2008-09:** Sálim Ali Rolling Trophy Nature Competitions were conducted in two days this year; 24<sup>th</sup> of January and 1<sup>st</sup> of February. About 2500 students from 45 schools participated in the event. Competitions were conducted in various categories of painting, pencil shading, Elocution, essay / poetry / short story writing in both Tamil and English, Quiz and Bird Watching. 132 students from 23 schools won the prizes. The defending champion, the GD Mat Hr Sec School, retained the Sálim Ali Trophy for this year. On the Forestry Day 2009, apart from forestry day celebration, the prize distribution function of Sálim Ali Trophy Nature Competitions was also conducted.



**Nature camp for mentally challenged children:** A nature camp was conducted at SACON for 45 mentally challenged children on 24-26 January. The children stayed in the campus and were taken on nature walks. A field trip was also conducted in Nilgiris for a day.

**Sálim Ali Nature Forum:** Sálim Ali Nature Forum continued its regular nature awareness meetings and activities. Ten meetings and two field trips were conducted for the forum members.

**Project Protect Environment:** With the assistance of the Sálim Ali Naturalist Forum, and in collaboration with Rotary club of Coimbatore and Young Indians of CII, Nature Education Division of SACON initiated a project named “Project Protect Environment” for inculcating the love and concern for nature in the Coimbatore citizens. As part of the programme, movies were screened followed by discussion in Essorie Hall, Coimbatore. Three wildlife and environmental films were screened under this banner in city followed by discussion.

**Environmental Awareness for College students:** In collaboration with Outreach Foundation Coimbatore, SACON conducted 20 one day nature awareness programmes for college students of Coimbatore, attended by about 1100 students.

**Vatavaran Environmental & Wildlife Film Festival:** SACON in collaboration with Centre for Media Studies (CMS), New Delhi, organized the 3<sup>rd</sup> VATAVARAN Environmental & Wildlife Film Festival in Coimbatore. The festival was conducted during 17 - 19 October 2008 at Corporation Kalaiarangam, and State Forest Staff College, RS Puram, Coimbatore. Worshipful Mayor of the Coimbatore Corporation inaugurated the festival on 17<sup>th</sup> October. 25 award winning environment – wildlife movies were screened for the public on the occasion. About 9000 persons (including school children) witnessed the screening. Select Hollywood films on the Festival theme 'Climate change' were screened in the panorama session at 5.00 pm every day. An introduction to the films in both Tamil and English prefaced each screening.



Film makers and personalities such as Mr. K.P. Sasi and Mr. Suresh Elamon interacted with the audience. Other respected personalities visited and interacted with the audience in environmental, wildlife and conservation issues include Shri. D.R. Karthikeyan, former chief of CBI and advisor of Human Rights affairs, Dr. Bhaskar Rao, Chairman CMS, Mr. E. Kunhikrishnan, Naturalist, Wildlife photographer and Film Maker, Shri. V.K. Shanmugham, Commissioner, Coimbatore Corporation, Shri. R. Kannan, Conservator of Forests, Coimbatore, Mr. I Anwardeen, Divisional Forest Officer, Coimbatore, Dr. Thirukumaran, Director, VOC

park Zoo, Mr. Pon Chandran, President, Konangal Film Society, Scientists from SACON, IFGTB, and Principals of several schools and colleges in Coimbatore. Many civil society organizations and NGOs volunteered to conduct the programme.

In the venue of the festival, an exhibition on climate change, exhibition of the painting on climate change by the children, photo exhibition on the endangered animals of Western Ghats and a Film Bazaar were also organised.

### 19. DBT's Natural Awareness clubs for Andamans.

Coordinator	: P Pramod
Project Personnel	: Raja Mamannan M A & Rajan P
Project Duration	: April 2008 – March 2009
Funding Agency	: DBT through MSSRF
Status	: Ongoing

DBT's Natural resources Awareness Clubs for School Children (DNA Clubs) is an initiative of the National Bioresource Development Board of the Department of Biotechnology, Government of India. It proposes to promote deeper awareness among school students about the importance of our environment, biodiversity, biotechnology and their relation with day to day life. DBT has identified SACON as the Regional Resource Agency for Andaman to implement DNA club programme.

SACON has initiated DNA clubs in five schools, geographically well distributed in Andaman Islands. The schools are the Govt. Sr. Sec. School (North Andaman), Govt. Sr. Sec. School, Mayabunder (North of Middle Andaman), Govt. Sr. Sec. School Rangat (south of Middle Andaman), Kendriya Vidyalaya No.1 Port Blair (South Andaman), Govt. Sr. Sec. School, Hutbay, Little Andaman. After the inauguration, the first in the sequence was a teacher's orientation programme conducted at Mini Zoo, Port Blair. Afterwards a series of programmes were arranged for the members of

the clubs in these schools. The programmes primarily involves the students as partners in collective learning process than teaching or preaching to them the facts, figures, and bits and pieces of information.

Programmes were continued in all the five member schools in Andaman Islands. Laboratory experiments, student projects and field trips for the students along with the guest lectures by scientists were included in the programs. PI of the project visited the schools twice during the period to assess the progress. He also gave lectures on ecology and biodiversity. Competitions in essay writing, painting and logo design were also conducted for the students during this period. All the schools were provided with essential equipments such as computer, printer, binocular, field guides and laboratory equipments such as hygrometer, haematometer and digital balance.

**Laboratory experiments:** The programmes conducted between October 2008 and April 2009 includes laboratory activities such as Blood group testing, Water quality testing, study of mitosis using onion root tip, and herbarium preparation in the schools.

**Student Projects:** The student members have undertaken minor student projects with the following titles.

1) Diversity of wild flowers, 2) Medicinal plants of Andaman, 3) Diversity of leaf and leaf architecture, 4) Diversity of Butterflies,

5) Shells and other life in coastal ecosystems, 6) Mushroom culture, 7) Making and maintenance of aquarium, 8) Pollution and spread of communicable diseases, 9) Importance of mangrove plants as coastal defense, 10) Bird diversity, 11) Diversity of corals 12) Diversity of plants in the region, 13) Insect diversity in residential areas, 14) Pesticide usage in agriculture fields, and 15) Vermiform compost.



**Field Visits:** Educational field trips were organized for children to the nearby biodiversity rich areas. Students visited important conservation areas such as Saddle Peak National Park, Chidiyatapu Biological Park, Kalpong Hydroelectric project area, Ramnagar Beach, Forest area of Panchavati and nearby sea shores to study biodiversity of the area and for its documentation.

**New Web site for SACON Nature Education (<http://www.saconeducation.org>):** On 22<sup>nd</sup> March 2009, a new interactive web site was inaugurated for the nature education division of SACON. The web site showcases the nature education activities of SACON such as Salim Ali Nature Club Network, Salim Ali Nature Forum, and DNA club in Andaman & Nicobar Islands. It has a special login facility through which nature lovers can interact with SACON and among them.

## UNIVERSITY DEPARTMENTS

Zoology				
V. S. Vijayan, Director (Retd.)	P Balakrishnan	Ph.D	Status, distribution and ecology of the Grey-headed Bulbul <i>Pycnonotus priocephalus</i>	Degree awarded
Lalitha Vijayan	Bhoj Kumar Acharya	Ph.D	Bird communities along the Elevation Gradient of Teesta Valley, Sikkim	Degree awarded
	K S Anoop Das	Ph.D	Bird Community Structure along the Altitudinal Gradient in Silent Valley National Park, Western Ghats, India	Degree awarded
	Ezhilarasi N	Ph.D	Status and ecology of the Andaman Crake	Submitted
	Raja Mamannan M A	Ph.D	Avifaunal diversity of the Andaman Islands	Ongoing
	Sheeba N	Ph.D	Ecology and conservation of Spot-billed Pelican <i>Pelecanus philippensis</i>	Ongoing
	Deivanayaki M	M.Phil	An Assessment of the Spatial Distribution Pattern and Status of Birds in the Nilgiris,	Degree awarded
Ravi Sankaran	Shirish Manchi	Ph.D	<i>In-situ</i> & <i>Ex-situ</i> conservation of the Edible-nest Swiftlet <i>Collocalia fuciphaga</i> in the Andaman & Nicobar Islands	Ongoing
S Bhupathy	Basundhara Chettri	Ph.D	Distribution and Resource Use Patterns of Reptiles along the Teesta Valley, Eastern Himalayas, Sikkim, India	Degree awarded
	Jaya Thapa	Ph.D	Communities of small mammals and small carnivores in the Teesta Basin, Sikkim Himalaya, India	Degree awarded
	J Gokulakrishnan.	Ph.D	Ecology of Sea turtles along the Nagapattinam Coast, Bay of Bengal	Ongoing
	G Srinivas	Ph.D	Ecology of amphibians in High Wavy Mountains, Western Ghats	Ongoing
	N Sathish Kumar	Ph.D	Ecology of Reptiles in High Wavy Mountains, Western Ghats	Ongoing
	C Ramesh.	Ph.D	Ecology of the Indian Python in Keoladeo National Park, Bharatpur.	Ongoing
	M Kamala-kannan	M.Phil	Diurnal activity of the Indian Python in Keoladeo National Park, Bharatpur	Ongoing

<b>Botany</b>				
P Balasubramanian	Gunasekaran, M	Ph.D	Studies on taxonomy, ecology, distribution and conservation values of sthalavrikshas (temple trees) in Tamil Nadu	Degree awarded
	E Santhoshkumar	Ph.D	Ecology of seed dispersal by Indian Grey Hornbill in Southern Eastern Ghats	Ongoing
	R Aruna	Ph.D	Studies on seed germination and nursery techniques of some bird-dispersed trees in Western Ghats	Ongoing
	Anbarasu, C	M.Phil	Studies on woody species diversity and regeneration in two forest sites of southern Eastern Ghats	Degree awarded
	K Amirthalingam	M.Phil	Studies on flora at Minichigully Valley, Eastern Ghats	Ongoing
<b>Environmental Science</b>				
P A Azeez	Nikhil Raj	Ph.D	Ecological impacts of hydel projects in Bharathapuzha river basin. Environmental Sciences	Ongoing
	Ranjini J	Ph.D	Adaptation and tolerance of birds to urbanization – a critical evaluation with emphasis on life strategy.	Ongoing
	Dhanya R	Ph.D	Urbanization and environmental transition: a study of the impact of developmental activities with special reference to EMR on the House Sparrows.	Ongoing
	Rachna Chandra	Ph.D	Bioremediation of mine tailings	Ongoing
	M Baladhandapani	Ph.D	Techno economic evaluation of Common Effluent Treatment Plants (CETP) in Tirupur	Submitted
S Muralidharan	V Dhanajayan	Ph.D	Impact of environmental contaminants in Indian avifauna	Submitted
	A Alaguraj	Ph.D	Organic contaminants in the marine fishes available in Coimbatore and their suitability for human consumption	Ongoing
	P Jayanthi	Ph.D	Organochlorine Pesticides residues in the commercial marine fishes of Coimbatore and their suitability for human consumption	Ongoing
	S Jayakumar	Ph.D	Impact of agricultural pesticides on the population status and breeding success of select species of fish-eating birds in Tamil Nadu.	Ongoing
	S Sindhu	M.Phil	Accumulation of inorganic contaminants in water, sediment and fish samples collected along the harbour line, Mumbai	Awarded
	Vinny R Peter	M.Phil	Persistent organic contaminants in water, sediment and fishes collected along the harbour line, Mumbai	Awarded
P Pramod	L Joseph Reginald	Ph.D	Diversity and habitat preference of bats (Order Chiroptera) of Coimbatore	Ongoing
	Chetan Nag	Ph.D	Addressing the issue of taxonomic position of peninsular Indian Hanuman langurs ( <i>Semnopithecus entellus</i> ) through a multidisciplinary approach	Ongoing

## WORKSHOPS, SEMINARS, SYMPOSIUMS, CONFERENCES AND TRAINING PROGRAMMES

### WORKSHOPS

A workshop on the challenges in **wildlife and environmental film making** was conducted in collaboration with CSM Vatavaran for media studies, New Delhi at 2.00 – 4.00 pm on 19<sup>th</sup> October 2008. Film makers, Mr. K.P. Sasi and Mr. E. Kunhikrishnan lead the workshop giving lot of insights to the young upcoming students of visual communication and enthusiasts of Coimbatore.

### SEMINARS

A national seminar on '**Climate Change**' was conducted on 18<sup>th</sup> October 2008 at State Forest Service College, Coimbatore, as part of the Film Festival. About 140 registered participants attended the seminar, chaired by Dr. Paul P Appasamy, Vice Chancellor, Karunya University, Coimbatore. The lead speaker was Dr. Murari Lal, IPCC member from New Delhi. Other Speakers were Dr. Indu K Murthy from Centre for Sustainable Technology, Indian Institute of Science, Bangalore, Dr. B. Sundaramoorthy and Dr. Mohanraj from Bharathidasan University, Trichy.

### SYMPOSIUMS

One national symposium on the theme '**conservation and the livelihood security**' was also conducted as part of the Vatavaran Film Festival on 19<sup>th</sup> October between 10.00 am and 1.00 pm at SFSC. The symposium was chaired by Dr. Bhaskar Rao, chairman, CMS and the lead speaker was Dr. Seema Bhat, Biodiversity expert and consultant of CMS. The other speakers were Shri. P.N. Unnikrishnan IFS, Chief Conservator of Forests, Kerala, Dr. Arivudai Nambi, MS Swaminathan Research Foundation, Chennai, and Mr. Jose Mathew IFS, Principal, State Forest Service College, and Dr. P. Balasubramanian and Dr. P.Pramod from SACON. About 60 persons attended the symposium.

### TRAINING PROGRAMMES

#### **Vacation Training Programme on Bioresources for School children in Andamans:**

This vacation training programme was a complete residential camp from where the students returned home only after the completion of the program. The venue cum residence, Krishi Vigyan Kendra of Central Agricultural Research Institute Campus, surrounded by mangrove forests, water bodies and orchards was an apt venue. The participants stayed together along with the Course Director, scientists and research scholars of SACON during the whole camp period. They attended 55 hours of lecture in 32 classes by 27 experts from 12 institutions. They have been to field and labs for about 128 hours to learn and experience the diversity of bioresources in the company of professionals in field taxonomy and ecology. Late in the evenings, they were shown movies on bioresources and ecology, involved in discussions with research scholars and scientists. Each one of them completed a project in the 20 days, presented the results



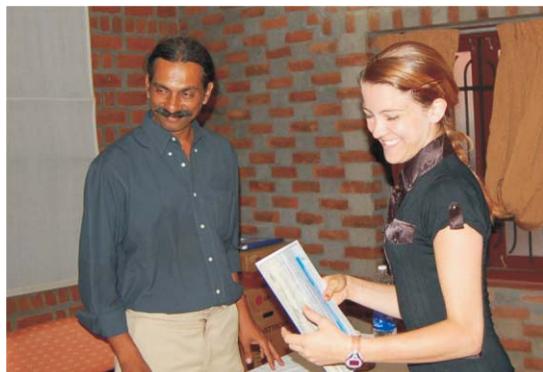
and submitted the hand written project report during the valedictory experience the diversity of bioresources in the company of professionals in field taxonomy and ecology. Each one of them completed a project in the 20 days, presented the results and submitted the hand written project report during the valedictory session. The 20 days passed giving a lot of special experience for both the teachers and the students.

**A training course on Instrumentation and Analytical Techniques** was organized by the Division of Ecotoxicology during June 2008. Dr. K. Natarajan, Director, School of Chemical Studies, Bharathiar University, Coimbatore inaugurated the programme. Students (B.Sc., M.Sc, M.Phil) from premier academic institutions and industries, such as Bharathiar University, PSG College of Arts & Science, PSGR Krishnammal College of Arts and Science, Coimbatore, Vinayaga Mission University, Salem, Tamil University, Tanjore and A.V.C College, Mayiladuthurai participated. The course was designed to give the students theoretical and practical exposure to various analytical tools towards qualifying and quantifying many inorganic and organic constituents in a variety of biological and non-biological matrixes.



## OTHER ACTIVITIES

Drs Barnett A Ratner , Ecotoxicologist and B John French, Research Manager from Patuxent Wildlife Research Centre (PWRC), USA visited SACON in February 2009. During their stay, we had discussions on executing research on pesticide contamination with collaboration between the two institutions. They also visited field stations and delivered lectures at SACON.



Ms Nichole Bennett, a graduate student from Clemson University, South Carolina, USA worked as a volunteer in the Ecotoxicology Laboratory during May – July 2008. She also attended a training programme on Instrumentation and Analytical Techniques during the period. Ms Bennett interactively learnt contaminant analysis procedures in the laboratory.

## Analytical Service

During the year we extended analytical service to academic and industrial institutions, namely Pricol, Seed Trust, Coimbatore and Sarasvathi Narayanan College, Madurai.

## PUBLICATIONS

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#### **4. PAPERS IN CONFERENCES/ SEMINARS/PROCEEDINGS/EDITED VOLUMES**

##### **a. National**

Acharya B.K., Vijayan L. & Chettri B. (2008) Altitudinal distribution of species and protected areas in Sikkim, Eastern Himalaya: a conservation perspective (Extended Abstract). *Proceedings of the Silver Jubilee Symposium on Dimensions of research applications in animal sciences*, University of North Bengal, Siliguri, India.

Azeez PA & R Chandra. *Prosopis juliflora*, the tree of the poor: Challenges and Management Options. National Symposium on *Prosopis*: Ecological, Economic Significance and Management Challenges, 20th – 21st February 2009, Bhuj, Gujarat.

Balasubramanian, P. 2009. Distribution and dispersal ecology of *Prosopis juliflora* in Tamil Nadu, India. *Proceedings of the National symposium on Prosopis: ecological, economic significance and management challenges*. GUIDE, Bhuj, Gujarat. Pp.46-50.

Chandra R & PA Azeez. Management options for Conservation of Mangrove Ecosystem and its associated biodiversity; a case in Calicut, Kerala. National Seminar on Coastal Wetland Ecosystems of Kerala: Perspectives and Conservational Strategies,, 16th - 17th October, Kannur, Kerala.

Chandra R, BAK Prusty & PA Azeez. Impact of *Prosopis Juliflora* on herbaceous diversity in Keoladeo National Park, Bharatpur. National Symposium on *Prosopis*: Ecological, Economic Significance and Management Challenges, 20th – 21st February 2009, Bhuj, Gujarat.

Dhanya R, J Ranjini & PAAzeez. Conserving an urban wetland – the case of Pallikarainai, Tamil Nadu, India. International conference on Biodiversity Conservation and Management, 3-6 February 2008, Cochin University of Science and Technology, Cochin, Kerala

Dhanya R, Ranjini J & PA Azeez (2009). Monitoring the insect food sources of House sparrow chicks at different scales of urbanization in Coimbatore, India. International congress of global warming and biodiversity of insects: Management and conservation. 9 – 12 February 2009, Organized, Organized by GW – BIMC. 2009.

Gaikwad, S., Chiranjibi Pattanaik & S. N. Prasad (2008). Long-term monitoring strategies for coastal habitats: A paradigm shift for use of FOSS geospatial tools. (Full paper communicated to FERAL proceedings).



- Muralidharan, S & Dhananjayan, V (2008) Impact of agricultural pesticides on birds in India: In proceedings of the seminar "Impact Assessment of pollution from Agriculture" Organized by US Education Foundation in India at Cuttack, 8<sup>th</sup> - 11<sup>th</sup> April 2008.
- Muralidharan, S & Dhananjayan, V (2009) Diclofenac residues in tissue and plasma samples of vultures collected from Ahmadabad, India at the conference "Conserving Nature in a Globalizing India" organized by the BNHS, Feb 17-19 2009, Bangalore
- Nikhil Raj & PA Azeez (2008). Analysis of the general rainfall trend using the historical data: a case from Palakkad plains of Kerala. International Conference on Climate Change, Biodiversity & Food Security in the South Asia Region 3 - 4 November, 2008. Punjab state council for science and technology, Chandigarh.
- Nikhil Raj & PA Azeez (2008). Public opinion on conserving a mangrove wetland- A case from Kerala. National seminar on Coastal wetland ecosystems of Kerala: Perspective and conservational strategies, 16- 17 October 2008, S, S N College, Kannur.
- Nikhil Raj & PA Azeez (2009). Cropping the 'real estate'; does money play the desperado? A brief from Kerala's agriculture wetlands. National seminar on emerging issues in biodiversity management, January 8-9 2009, Bharathidasan University, Tiruchy.
- Nikhil Raj, Ranjini J & PA Azeez (2008). Spatial variation of wetland conversion- the case of Kole - Vembanad wetlands Kerala. Lake 2008: Conservation and management of river and lake ecosystems 22 - 24 December, 2008, IISC, Bangalore.
- Nishadh KA, R Chandra & PA Azeez (2008). Pollution Status and Conservation of Lakes in Coimbatore, Tamil Nadu, India. Lakes 2008. : Conservation and management of river and lake ecosystems 22 - 24 December, 2008, IISC, Bangalore.
- Pattanaik Chiranjibi, Debadatta Swain, S. N. Prasad & S. B. Choudhury (2008). Conservation and restoration of wetlands in India: a strategic approach for sustainable management. (Full paper for *Environment Awareness* book by L. Patro).
- Prasad, P.R.C., Chiranjibi Pattanaik & S, N Prasad (2008). Wetlands as components of green growth: a case study of Gujarat wetland resources using remote sensing and GIS. (Full paper submitted to IBS International symposium).
- Prasad, P.R.C., Chiranjibi Pattanaik & S.N. Prasad (2008). Assessment and monitoring of wetland dynamics in Andhra Pradesh using remote sensing and GIS. (Full paper for *Biodiversity Conservation and Management* book by L. Patro).
- Prasad, P.R.C., Chiranjibi Pattanaik & S. N Prasad (2008). Wetland inventory and the dynamics in Karnataka – a geospatial approach. Full paper on LAKE 2008 proceeding.
- Ranjini J & PA Azeez (2008). Birds with higher cognitive ability survive higher level of urbanization? Workshop on Neuro informatics and neurobiology (NBNI) 08'. Organized by Department of Neurobiology. CUSAT, Kochi. India.
- Ranjini J, R Dhanya & PA Azeez (2009). Species survival and role of habitat analogues in an urban environment. BNHS International conference: 'Conserving nature in a globalizing India'. 17 – 19 February 2009, Bangalore.

## 5. POPULAR ARTICLES

Maheswaran, B. & Balasubramanian, P. 2008. Enchanting hornbills, Deccan Chronicle, 19.

## 6. NEWSLETTERS

Pattanaik Chiranjibi, S. Gaikwad, L. Vijayan, & S. N. Prasad (2008). SAROVAR SAURABH Newsletter, Vol-4, No-4, pp 1-8

Pattanaik Chiranjibi, L. Vijayan, & S. N. Prasad (2008). SAROVAR SAURABH Newsletter, Vol-4, No-3, pp 1-8.

Pattanaik Chiranjibi, L. Vijayan, & S. N. Prasad (2008). SAROVAR SAURABH Newsletter, Vol-4, No-2, pp 1-10.

Pattanaik Chiranjibi, L. Vijayan, & S. N. Prasad (2008). SAROVAR SAURABH Newsletter, Vol-4, No-1, pp 1-9.

Santhosh Kumar, E. & Balasubramanian, P. 2009. Sand bathing by Indian Grey Hornbill, SACON Newsletter

## 7. PARTICIPATION IN SEMINARS/ CONFERENCES/MEETINGS/ COURSES

Acharya B.K., Vijayan L. & Chettri B. (2008). Altitudinal distribution of species and protected areas in Sikkim, Eastern Himalaya: a conservation perspective. Oral presentation at the Silver Jubilee Symposium on Dimensions of research applications in animal sciences held during 2-3 December 2008 at University of North Bengal, Siliguri, India.

Acharya, B.K. & Vijayan, L. 2008. Conservation priorities based on altitudinal distributions of species in Sikkim, Eastern Himalaya. Oral presentation at 22<sup>nd</sup> Annual meeting of Society for Conservation Biology (SCB), University of Tennessee, Chattanooga, Tennessee, USA. 13-17 July 2008.

Anitha K., Gaikwad S.S., Somasundaram.S., Vijayan, L., Radhakrishnan P., Uniyal V.K., & Prasad, SN. 2008. Role of FOSS tools in a desktop to web enabled GIS: A case study of an eco-restoration project of degraded forest of Attappadi hills, Palakkad district, Kerala. National conference on "Open Source Software". 19 November 2008. Cochin University of Science & Technology, Kochi.

Aruna, R. presented a paper titled 'A study on the cultivated exotic medicinal trees of Tamil Nadu' in the National symposium on Herbal drug research (NSHDR – 2008) during 25<sup>th</sup> & 26<sup>th</sup> September 2008, organized by Department of Botany, Bharathiar University, Coimbatore.

Aruna, R. presented a paper titled 'A study on wild edible plants of Chengelpet district, Tamil Nadu' in National Seminar on Recent Trends in the conservation and utilization of under-utilized wild edible plants' (CUWEP, 2009) during 20<sup>th</sup> & 21<sup>st</sup> March 2009, organized by Department of Botany, Bharathiar University, Coimbatore.

Aruna, R. (2008), attended "The Darwin Scholarship Programme-Monitoring and Communicating Biodiversity", 8-18 August 2008 at Preston Montford Field, Centre, Shrewsbury, U.K

Azeez PA, (2009), attended 4<sup>th</sup> World Conservation Congress at Barcelona, Spain, 5-14<sup>th</sup> October 2008.

Balasubramanian, P. (2009). Attended and presented a paper on "Vegetation features and restoration initiatives in the Indian Grey Hornbill habitats in Sathyamangalam Wildlife Sanctuary, Eastern Ghats, India" in the 5<sup>th</sup> International Hornbill Conference, Singapore.



- Balasubramanian, P. 2008. "Medicinal plants: their relevance in the conservation of biodiversity and enhancement of local livelihoods", Symposia on Conservation and Livelihood Security, Organized by CMS, New Delhi and SACON, at SFSC, Coimbatore
- Bhupathy, S. Core Faculty- SERC (DST) 2<sup>nd</sup> School in Herpetology. September 1-15 2008. Wildlife Institute of India, Dehra Dun.
- Bhupathy, S., Annual Research Seminar, Keoladeo National Park, Bharatpur, Rajasthan. 15 March 2009.
- Bhupathy, S., Meeting of the review of MoEF projects (Eastern and Western Ghats Projects), 4-5 December 2008, Bangalore.
- Bhupathy, S., Planning Committee meeting. SERC (DST) 3<sup>rd</sup> School in Herpetology. 28<sup>th</sup> March 2009. North Orissa University, Baripada.
- Gaikwad, S., Chiranjibi Pattanaik and S. N. Prasad (2008). Long-term monitoring strategies for coastal habitats: A paradigm shift for use of FOSS geospatial tools. Abstract in Conference on Restoration of Coastal Habitats (FERAL), 20-21 August, Mahabalipuram, pp 34-35.
- Mamannan. M.A.R. & Vijayan, L. (2009) Impact of coastal habitat alteration on the population of Andaman Teal *Anas albogularis*. Poster presented by Mamnnan at the BNHS International conference "Conserving nature in a globalizing India" 17-19 February, 2009. IISc., Bangalore. (Abstract).
- Nikhil Raj (2009), attended and presented a paper on Historical analysis of the first rain event and the number of rain days in the western part of Palakkad gap, south India. The IARU International Scientific Congress on Climate Change, 10 – 12 March 2009, Copenhagen, Denmark
- Pattanaik Chiranjibi & S. N. Prasad (2008). Assessment of wetland resources of Andhra Pradesh using remote sensing and GIS applications: a case study of Kolleru lake. Abstract in 1<sup>st</sup> AP Science Congress, 14-16 November, Osmania University, Hyderabad, p-130.
- Pattanaik Chiranjibi & S. N. Prasad (2008). Restoration of Kolleru wetland: issues and challenges. Abstract in National Conference on Environmental Issues and Challenges 21<sup>st</sup> Century, 28-29 March, Osmania University, Hyderabad, p-38.
- Pattanaik Chiranjibi, S. N. Prasad & C. S. Reddy (2008). Role of remote sensing and GIS in conservation of mangrove ecosystems of India. Abstract in National Seminar on Mangrove Ecosystems of India: Past, Present and Future, 25-26 September, Bankim Sardar College, Tangra Khali, Kolkata, p-16.
- Prasad, P. R. C., Chiranjibi Pattanaik and S. N. Prasad (2008). Wetland inventory and the dynamics in Karnataka – a geospatial approach. Abstract in LAKE 2008, 22-24 December, Indian Institute of Science (IISc), Bangalore.
- Sankaran, R. & Manchi, S. (2009). Species recovery: Edible-nest Swiftlet in the Andaman and Nicobar Islands. Invited talk delivered by Manhi on behalf of Sankaran at the BNHS International conference "Conserving nature in a globalizing India" 17-19 February, 2009. IISc., Bangalore.
- Sheeba, N. & Vijayan, L. 2009. Use of *Prosopis juliflora* by the Spot-billed Pelican *Pelecanus philippensis* at Uppalapadu, Andhra Pradesh. National Symp. on *Prosopis*: Ecological, economic significance and management challenges. 20-21 February, 2009, Gujarat Institute of Desert Ecology, Bhuj.

Vijayan, L, Prasad, S. N, & Pattanaik, C. (2009). Wetlands of Tamil Nadu and their conservation. Invited talk at the workshop on Biodiversity conservation organized by the Forest Dept of Tamil Nadu at Chennai. 24 March 2009.

Vijayan, L. (2008). Attended meetings of the Management Advisory Committee at Haridwar for the Brain-storming workshop on Ornithological Science in India: 26-27 June 2008.

Vijayan, L. (2009). Attended a meeting convened by the Forest Dept of Kerala at Munnar to discuss the project "On the trails of Salim Ali: revisiting the sites surveyed by Dr Salim Ali in Kerala in 1933." 2 January 2009

Vijayan, L. 2009. Conservation of wetlands and wetland birds. Invited talk on 9<sup>th</sup>. National Seminar on Conserve the Mother Earth: Need of the Hour. 9 -10 March 2009. JA College for Women, Periyakulam, Tamil Nadu.

Vijayan, L. (2008). Behavioural studies on birds. Plenary lecture in 31<sup>st</sup> Annual Conference of Ethological Society of India. 11 April 2008. GKVK Campus, Bangalore.

Vijayan, L., Vijayan, VS. & Venkitachalam, R. 2009. Wetland birds of Keoladeo National Park: an overview. Annual Research Seminar of Keoladeo National Park 2009. 15 March 2009.

## 8. TALKS DELIVERED

Balasubramanian, P. 2008. Conservation of Birds, Lecture delivered at PSGR Krishnammal College for Women, Coimbatore.

Balasubramanian, P. 2008. Conservation of Birds, Lecture delivered at Vellalar College for Women, Erode.

Balasubramanian, P. 2008. The world of Birds, Lecture delivered at Bannari Amman Institute of Technology, Sathyamangalam.

Balasubramanian, P. 2009. Conservation of Forests, Lecture delivered at Bharathiyar University, Coimbatore.

Balasubramanian, P. 2009. Conservation of Birds, Lecture delivered at Bharathiyar University Coimbatore.

Balasubramanian, P. 2009. Vegetation of Point Calimere, Talk given in the One day Workshop on Point Calimere.

Muralidharan, S. "Toxins and birds" at the Refreshers' course at the Bharathiar University, Coimbatore, 9th March 2009

Muralidharan, S. "Application of chromatography in environmental studies" at Department of Zoology, Bharathiar University, Coimbatore. 31st October 2008.

Muralidharan, S. "Application of chromatography". Department of Zoology, Bharathiar University, Coimbatore. 31st October 2008

Muralidharan, S. "Impact of agricultural chemicals on birds: Indian scenario" - Refreshers course at Bharathiar University, Coimbatore — 26th August 2008.

Muralidharan, S. "Impact of Environmental Contaminants on Birds" at SFSC, Coimbatore. 25th July 2008.

Muralidharan, S. "Impact of Environmental Contaminants on wildlife" at the Refreshers course: SFSC, Coimbatore – 25th September 2008.

Muralidharan, S. "status of contamination in Indian wetlands" at the "Southern regional seminar on wetlands" organized by the Karunya University, at Alapuzha: 22nd March 2009.

Somasundaram, S. (2008). Invited lecture on "Studies on wetland birds and their conservation" in "Workshop on Wetland birds and their Importance" organized by Andhra Pradesh Forest Department, Sulurpet. 16 October 2008

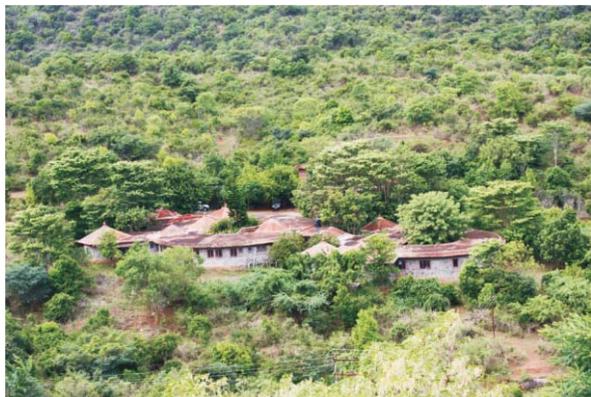
Vijayan, L. (2009). "Research priorities for the Western Ghats". Invited talk in the Save Western Ghats workshop on 9th held at Peaceful Society, Kundai, Goa. 8-10 February 2009.

Vijayan, L. (2009). "Wetland birds". Talk at the Workshop on World Wetlands Day and nature education programme for the school students at Uppalapadu organized by SACON ENVIS Centre. 2 February 2009.



## INFRASTRUCTURE

SACON's location at Anaikatty with the backdrop of the Western Ghats, one of the 'hot spots' of



biodiversity in the world, offers endless opportunities to undertake long-term studies on various aspects of its varied avifauna and on the biological principles and phenomena involved in the functioning of the ecosystems. The tri-junction of Kerala, Tamil Nadu and Karnataka in the Western Ghats, one of the best wildlife areas in the country having a large extent of Protected Areas, is only a few hours drive away. SACON sets up field stations in various parts of the

country according to the requirements of the research projects.

### LABORATORY FACILITIES

Currently, the SACON laboratory is equipped with 1) UV Spectrophotometer, Perkin Elmer Model Lambda, (2) HPLC Agilent Technology Model 1100 series with DAD and Florescence detector, (3) Ultra Deep Freezer (-800 C), New Brunkswick, (4) Flame Atomic Absorption Spectrophotometer (AAS) Perkin Elmer, Model 3300 with 13 lamps for analyzing metal residues, (5) Graphite Furnace Atomic Absorption Spectrophotometer for analyzing metal residues, (6) Mercury Hydride Generator for



AAS, Perkin Elmer for analyzing mercury and other hydride forming elements, (7) Gas Chromatograph, Hewlett Packard Model 5890 Series II with three detectors, (Electron Capture Detector - ECD, Nitrogen Phosphorous Detector -NPD and Flame Photometric Detector –FPD) for analyzing pesticide residues and organic pollutants, (8) Microwave Digestion System, Milestone Model 1200 for digesting samples for analysis in the AAS, (9) Dissolved Oxygen (DO) Analyzer, (10) Biochemical Oxygen Demand (BOD) Incubator (11) Flame Photometer, (12) Vertical Laminar Flow Chamber, (13) High volume air sampler for sampling suspended particulate matters (SPM), Oxides of Nitrogen (NOx) and Sulphur (SOx), (14) Ultra Centrifuge, (15) Walk-in cold room, (16) Rotary Flask Evaporator, (17) Micrometer, (18) Digital Camera, (19) Thermo-hygrometer, (20) All Quarts Double Distillation unit, (21) Millipore water purification system, and (22) Water Quality analyzer– Multi Parameter TROLL– 9500.

For safeguarding the above equipment from frequent electricity fluctuations, an Uninterrupted Power Supply (15 KVA) with five hours backup has been installed in the laboratory.



## **Computer facilities**

40 Personnel Computers and 6 Laptops, other accessories to the tune of approximately Rs. 30/- lakhs, are in use in SACON campus. SACON has acquired round-the-clock uninterrupted Broadband (Dataone BSNL) internet connectivity facility with a speed of 512 kbps -2 mbps connected through a Local Area Network and Wireless connection. Almost, all Scientists of SACON have been provided with a laptop computer and desktop. All research and administrative divisions of SACON are provided with desktop computers, scanners and software for automation of their work. The common computer facility of the centre currently has two servers, desktop computers, colour and ordinary scanners, and printer for the use of research students of SACON and visiting scientists. In addition to the existing facilities, three 10 KVA UPS with three hours power back up supports all Computers.

## **Library and Documentation**

23 hard copies of books, and electronic version of high impact books/ journals/reports such as Auk Vol 01-38 (1884-1921), Condor Vol 01-24 (1899-1922), Journal of Field Ornithology Vol 1-70 (1930-1999), Journal of Raptor Research. Vol 21-39 (1987-2005), State of Forest Report (1987-2005), and 75 e-books (The flora of British India, Field Techniques, birds, entomology, Wetland Directory, Ecology, and Plants) have been added to the Library this year.

76 SACON project reports are converted into digital format (PDF) during the year with the help of newly procured high speed Scanner and edited to fit the purpose of Digital Library. OPAC (Online Public Accession Catalogue) and Bar Coding the documents & non-documentary sources of literature are done and the data bases updated in the Library Software.

SACON has online subscription to JSTOR Archives of journals on Biological Sciences. This facility is accessible by 55 individual user's accounts held by Scientists and Researchers.

Total holding of the library in 2008-09 is 3203 Books, 2508 back volumes of periodicals, 62 Current periodicals (Indian 42; International 20), 2706 maps and 89 CD ROM/DVD of reference materials, which includes Interactive state of Environment Atlas, Database of Environmental Experts in India, Documentary films such as The Many Faces of Madness, Web of Life, Baphlimali, and Journal of Bombay Natural History Vol.1-100 (1886-2003).

## Appendix : Members of the SACON Society

1	Mr Namu Narain Meena President – SACON Society & Hon'ble Minister of State for Environment and Forests (Environment) Government of India Ministry of Environment and Forests Paryavaran Bhawan CGO Complex, Lodhi Road New Delhi – 110 003		
2	Mr Vijai Sharma, IAS Secretary to the Govt. of India & Chairperson, SACON (GC) Ministry of Environment and Forests Paryavaran Bhawan CGO Complex, Lodhi Road New Delhi – 110 003	3	Mr E K Bharat Bhushan, IAS Jt. Secretary and Financial Advisor Government of India Ministry of Environment and Forests Paryavaran Bhawan CGO Complex, Lodhi Road New Delhi – 110 003
4	Mr A K Goyal, IFS Jt. Secretary to the Govt. of India Ministry of Environment and Forests Paryavaran Bhawan CGO Complex, Lodhi Road New Delhi – 110 003	5	Mr P R Sinha, IFS Director Wildlife Institute of India P B No. 18, Chandrabani Dehra Dun – 248 001 Uttar Pradesh
6	Dr G Thiruvassagam Vice Chancellor Bharathiar University Maruthamalai Road Coimbatore – 46	7	Dr A R Rahmani Director Bombay Natural History Society Hornbill House, Salim Ali Chowk Shaheed Bhagat Singh Road Mumbai - 400 023
8	Dr R Sukumar Chairman Centre for Ecological Sciences Indian Institute of Science Bangalore – 12	9	Prof Hafiz Shaeque A Yahya Professor Department of Wildlife Sciences Aligarh Muslim University Aligarh- 202 002
10	Prof P C Bhattacharjee Department of Zoology University of Gauhati Guwahati – 781 014	11	Mr R G Soni, IFS (Retd) 40/74, Swarn Path Mansarovar Jaipur – 302 020 Rajasthan
12	Dr P Pushpangadan Sree Sailam, T.C.X/910 Mannammoola, Peroorkada Trivandrum – 895 005 Kerala	13	Prof. C K Varshney 88, Vaishali Pitampura Delhi – 110 034

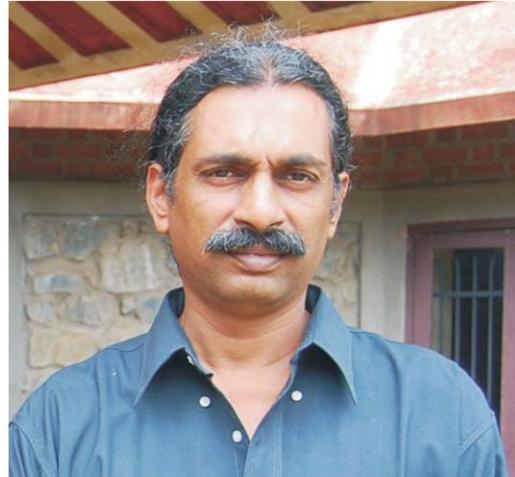


14	Dr S K Dutta PG Dept of Zoology North Orissa University Sriramchandra Vihar, Takatpur Baripada – 757 003, Mayurbhanj Orissa	15	Dr Krishna Kumar Director Indian Institute of Management – Kozhicode 11, Campus Post Kozhicode – 673 570
16	Dr Sundaramoorthy T Head Biodiversity Conservation Education CPR Environmental Education Centre 1, Eldams Road Chennai 600 018	17	Dr Lalitha Vijayan Sr. Principal Scientist Division of Conservation Ecology SACON Coimbatore
18	Dr S Bhupathy Sr. Scientist Division of Conservation Ecology SACON , Coimbatore	19	The Principal Secretary Department of Forest and Wildlife Govt. of Kerala, Secretariat Thiruvananthapuram – 695 001
20	The Principal Chief Conservator of Forests (WL) Office of the Principal Chief Conservator of Forests Government of Andhra Pradesh Aranya Bhawan, Saifabad Hyderabad – 4	21	Dr Ramakrishna Director Zoological Survey of India Prani Vigyan Bhavan M Block, New Alipore Kolkata – 700 053
22	The Director Dachigam National Park The Director & The Wildlife Warden, Central Division, Dachigam National Park, P.O New Theed, Harwan,, Srinagar, Kashmir (J&K)	23	The Wildlife Warden Silent Valley National Park Mukkali P.O Mannarghat Palakkad Dist
24	Mr Shantanu Kumar (DGP retd.), Firdauz Farms Kalwar Road Zone C Bypass, Jotwara Jaipur – 302 001	25	Dr (Mrs) Priya Davidar Salim Ali School of Ecology Pondicherry University R V Nagar, Kalapet, Pondicherry - 605 014
26	Mrs Tara Gandhi Raj Bhawan Salt Lake Kolkatta	27	Dr Mustafa Shah, P.C Department of Zoology University of Kashmir Srinagar – 190 006 Jammu & Kashmir
28	Dr P A Azeez, Member Secretary & Director Incharge SACON Coimbatore		

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**Homage**  
**Dr Ravi Sankaran, Director, SACON**  
**(1963 – 2009)**

Dr Ravi Sankaran, Director of SACON, an excellent conservationist, remarkable field biologist and prominent champion of the cause of conservation, fondly called Ravi, passed away in the early hours of the 17<sup>th</sup> January 2009 at his residence in Coimbatore due to cardiac arrest.



Dr Ravi Sankaran took over the charge as Director of SACON on 12<sup>th</sup> June 2008 at a young age of 45 with a mission of making SACON a vibrant conservation and research institution relevant in addressing present day issues of biodiversity conservation and economic

development. It was his perspective that we not only need to undertake scientific research and its communication, but must go the extra mile to initiate and implement conservation and developmental plans whose focus is on the preservation of local, regional and global biodiversity, while remaining consistent with the socio-economic characteristics and aspirations of the region. An outstanding ornithologist with high leadership quality by any yardstick, he always claimed as a field biologist.

Dr Ravi Sankaran, a simple and down-to-earth personality, was exemplary in his dedication to research work, for which he had the power to face any consequences. His work on the Bengal Florican, Nicobar Megapode, Edible-nest Swiftlet with blistering passion and analytical mind is well known and second to none. His tireless efforts in getting the Edible-nest Swiftlet delisted from the Schedule I species are remarkable and now the species is on the verge of being removed from Schedule I. Recently, Dr Ravi Sankaran involved himself in the community conservation initiatives in Nagaland as he firmly believed any conservation effort without people's participation is futile.

Dr Ravi Sankaran's death is a severe loss to the fraternity of wildlife conservation in India. SACON salute the efforts of Dr Ravi Sankaran in the field of biodiversity conservation and pledge to carry forward his works. Dr Ravi Sankaran is survived by his wife and a five-year old daughter.

Director Incharge & Staff

