



**SÁLIM ALI CENTRE FOR ORNITHOLOGY
AND
NATURAL HISTORY**



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2012 - 2013**

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The Director

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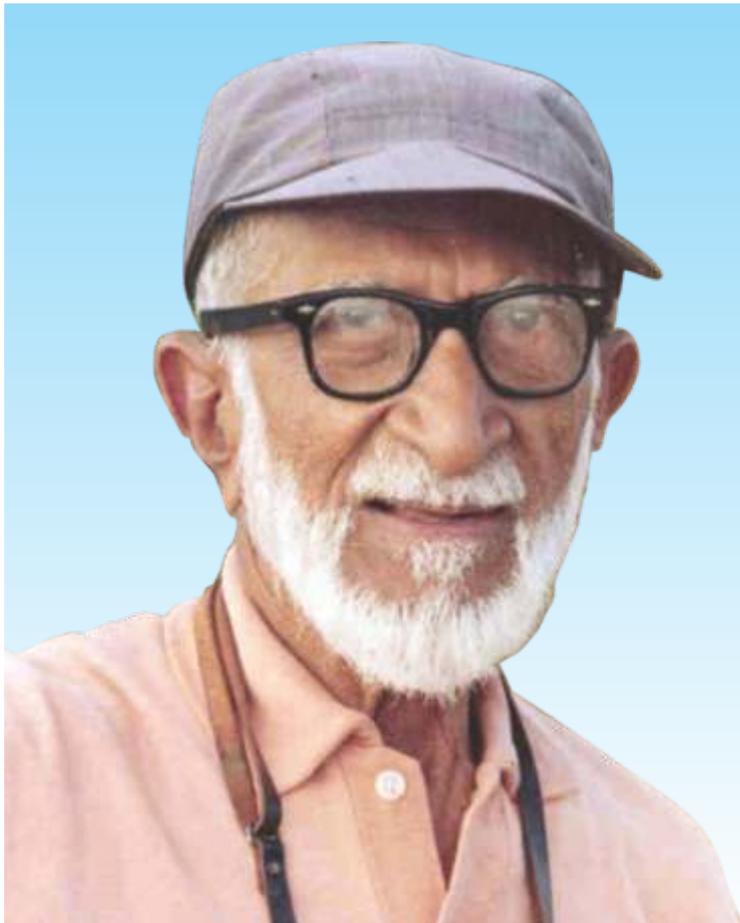
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(1896-1987)

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BACKGROUND

Sálim Ali Centre for Ornithology and Natural History (SACON) established in 1990 is funded by the Ministry of Environment and Forests (MoEF), Government of India. The management of SACON is vested in a Governing Council. The President of the SACON society is the Honourable Minister for Environment and Forests, Government of India and the Chairperson of the Governing Council is the Secretary to the Government of India, Ministry of Environment and Forests. Realizing the significance of holistic approach in avian studies and conservation, the major objectives of SACON have been designed to cover the entire field of natural history focusing on ornithology.

MISSION

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

OBJECTIVES

- Design and conduct research in ornithology, covering all aspects of biodiversity and natural history
- Develop and conduct regular courses in ornithology and natural history at the level of M Sc., M Phil., and Ph.D. and also short-term orientation courses in related subjects
- Create a data bank on Indian ornithology and natural history, and disseminate knowledge relating to ornithology and natural history for the benefit of the community.



During the reporting period 2012-2013, SACON has taken up 23 research and environmental assessment projects. Of these five were funded by the MoEF (Government of India), four by the Department of Science and Technology (GoI), one by the Planning Commission (GoI) and 13 by other agencies.

SACON's research and conservation activities are being taken up under various thematic and interactive divisions. Recently under the theme "avian physiology and genetics" a program for looking at RNA transcripts in avian sperms and their relation to fertility was initiated. The program is launched taking domestic fowl as a model, later to be tested in other wild species.

Under "Conservation Ecology" the work on conservation of the Edible-nest Swiftlet in the Andaman and Nicobar Islands has continued, which has resulted in very encouraging outcomes. A reassessment of the overall status of the species in the islands, shows that the species in unprotected caves face substantial pressure. However, of the 325 caves surveyed by us during 1998, 249 caves are still occupied by Edible-nest Swiftlet. This study emphasizes the need for participatory conservation actions with respect to the species. On the Narcondam Hornbill, restricted to the island of same name, we have initiated a study during this year. The study shows that overall the disturbances to the Narcondam Hornbill seems to have reduced and the species is doing relatively well in the island with a significant role by the security forces stationed there. On to the mainland, under the same theme SACON is pursuing a study in the Agasthyamalai Hills (Western Ghats, Kerala) to bring out the patterns of faunal (birds and reptiles) distributions and the factors determining the same.

The "Conservation Biology" team has completed the survey of Fishing Cat along the Coastal Kerala. The study suggests the absence of the species in coastal Kerala. The study also points at further detailed

explorations to check its presence in the Western Ghats that, needs to be examined through longer and detailed surveys. A study of the endemic Nicobar Long-tailed Macaque (*Macaca fascicularis umbrosa*) initiated during the year focuses on its social organization, behaviour, and phylogeography. In the islands, upon the request from the Andaman & Nicobar Forest Department we also made an estimation of abundance of feral elephants in Interview Island Sanctuary. As per the study the estimated (minimum) population size of feral elephants in the island was only 11. The distribution survey of the nocturnal primate Slender Loris in parts of Kerala and Tamil Nadu is in progress; the survey in Kerala part is almost midway, while that in Tamil Nadu is yet to be initiated awaiting permissions from the concerned department. In continuation of our previous studies on the largest populations of Lion Tailed Macaque in Aghanashini-Lion tailed Macaque Conservation Reserve, Western Ghats), we have attempted to develop a model for sustainable harvest of Garcinia fruit with minimal effect on the macaques and the forest, its stand structure and regeneration. We hope that the model would bring out a sustainable resource conflict resolution between the macaque and the local people.

An ecological investigation in the riverine forests of Athikkadavu Valley (Western Ghats) focusing on nest tree use by birds was undertaken by the Landscape Ecology division. From the study area 31 cavity nesting bird species were recorded. Twenty-three cavity bearing tree species belonging to 18 families were also recorded. Another study of ours on avian frugivory and seed dispersal of endemic tree species (Thai shola forest of Nilgiri hills) have recorded 12 endemic fleshy-fruited tree species and 24 species of birds depending on those tree species. These studies will bring out valuable quantitative data on the interrelations between the birds and the tree species.

Ecotoxicology work included a comparative study of pesticide residues in an agro-ecosystem

adopting organic and chemical farming (Padayetti village, Palakkad District, Kerala), and Monitoring and surveillance of environmental contaminants in birds in India.

Ecological assessment has been an important activity of SACON since its inception. Although the projects are related to environmental impacts of various developmental projects of that is handled in a research mode and offers us a different learning experience. During 2012-13, we have initiated a three-year study on the impacts of Jangi wind power farm (91.8 mw) with special reference to birds and bats. The study, perhaps the longest in the country on such an important alternative source of energy project, would bring out valuable information. We have also partnered with other organizations in cumulative EIA of hydro electric projects in Sutlej river basin and river Yamuna, Tons and tributaries. We have done a study on impact of construction of high-rise towers on migration of avifauna in East Kolkata Wetlands, a new study of its kind.

Keoladeo National Park is widely studied with respect to various ecological aspects. In this context, a historical review of environment in Keoladeo National Park and its catchment was done with financial support from the Planning Commission of India. In view of wide and crucial interactions between the park ecosystem and its catchment we have taken up a study on impact of agrochemicals on avifauna in the catchment of the Keoladeo National Park funded by DST (Govt) which is in progress.

Wetlands and wetland birds have been an important theme for SACON. During the reporting period we have initiated a study on morphological diversity of colonial water birds using a novel approach, essentially photogrammetric. The study is funded by the DST (Govt).

SACON has been running the ENVIS centre on theme "Wetland ecosystems including the inland wetlands".

During the year SACON conducted an exhibition 'Indian ornithology – past, present and future' and screened a documentary under the same title during the COP-II of CBD at Hyderabad, which was widely appreciated.

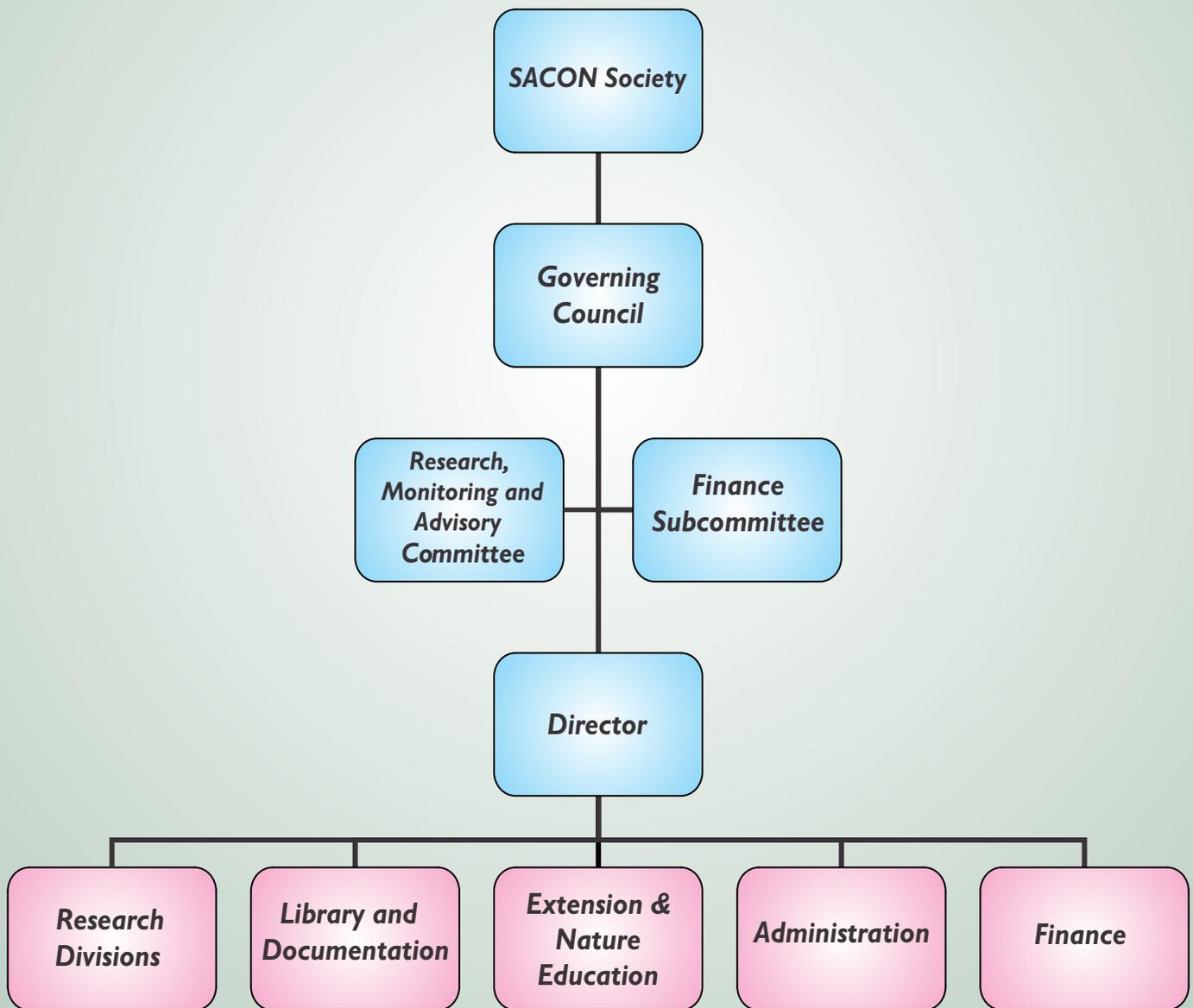
Under our extension activities a documentation of ecological and ethno-cultural aspects of rice paddies is in progress. The study has documented valuable traditional ecological knowledge focusing on several indigenous and endemic varieties in south India.

SACON's nature education programmes have been taking the message of conservation to thousands of students and public. Nature education activities regularly being taken up in Coimbatore, includes Salim Ali Trophy Nature Competitions and nature camps. In addition, we have been running DNA clubs (a programme of Department of Biotechnology) for Andaman Islands, in selected schools. Eco-development Plan for the Mount Harriet National Park has been drafted and submitted to the Andaman & Nicobar Forest Department.

SACON has been pursuing human resource development and capacity building in the field of conservation science since its inception. During the reporting period, 17 students are working on their PhD dissertation. Publication being the second most crucial aspects of research, we are disseminating our research findings in the form of technical reports and publications of various kinds - peer reviewed and popular. During the reporting period, we have published 30 papers in journals of repute, and 43 papers were presented in international and national conferences. We have also conducted workshops, and the one on Seabirds Identification for the staff of Fishery Survey of India (FSI) was first of its kind. The aim of the workshop was to equip the staff of FSI to make use of their resources to conduct studies on marine birds.

P A Azeez
Director

ORGANIZATION STRUCTURE OF SACON





ORGANIZATION

SACON Society

The SACON Society comprises the President, the members of the Governing Council and experts in the field of ornithology, wildlife sciences and management. The Honourable Minister of Environment and Forests or Minister of State of Environment and Forests is the President of the SACON Society and the Director, SACON is the Member Secretary. The total members in the SACON Society are 29.

The 22nd Annual General Meeting (AGM) of the SACON Society was held on 28th March 2013 at Chennai under the Presidentship of Smt. Jayanthi Natarajan, Honourable Minister of State for Environment and Forests (Independent Charge), Government of India & President, SACON Society.

Welcoming the members of the SACON Society to the 22nd AGM of the SACON Society, the President appreciated SACON for its work in ornithology and biodiversity conservation. The President advised SACON to initiate research programmes, which sensitize the public, particularly the youth. The President commended SACON for conducting the first International Conference on Indian Ornithology at SACON, Coimbatore during 19-23 November 2011 and advised to conduct the next conference during 2013 at Coimbatore.

Members of the SACON Society

<p>1. Smt. Jayanthi Natarajan Hon'ble Minister of State for Environment and Forests & President – SACON Society Government of India Paryavaran Bhawan, CGO Complex, Lodhi Road, New Delhi – 110 003</p>	<p>2. Dr T Chatterjee, IAS (Till Dec 2012) Chairman – SACON (GC) & Secretary to the Government of India Ministry of Environment and Forests Paryavaran Bhawan, CGO Complex Lodhi Road, New Delhi – 110 003 Dr V Rajagopalan, IAS, (From Dec 2012)</p>
<p>3. Shri. S S Mohanty, IAS, Financial Advisor Ministry of Environment and Forests Paryavaran Bhawan CGO Complex, Lodhi Road New Delhi – 110 003</p>	<p>4. Dr J R Bhatt Advisor, Govt. of India Ministry of Environment and Forests, Paryavaran Bhawan CGO Complex, Lodhi Road New Delhi – 110 003</p>

<p>5. Shri. C V Shankar, IAS Principal Secretary to the Govt. of Tamil Nadu Dept. of Environment and Forests Govt. of Tamil Nadu Fort St. George, Chennai – 9</p>	<p>6. Shri. P R Sinha, IFS Director Wildlife Institute of India P B No. 18, Chandrabani Dehradun – 248 001 (UP)</p>
<p>7. Dr G James Pitchai Vice Chancellor Bharathiar University Maruthamalai Road Coimbatore – 46</p>	<p>8. Dr A R Rahmani Director Bombay Natural History Society Hornbill House, Sálím Ali Chowk Shaheed Bhagat Singh Road, Mumbai - 400 02</p>
<p>9. Dr Renee Borges Chairperson Centre for Ecological Sciences Indian Institute of Science Bengaluru – 12</p>	<p>10. Dr. Erach Bharucha Director Bharati Vidyapeeth Deemed University Institute of Environment Education and Research Katraj-Dhanakawadi Pune- 411 043, Maharashtra</p>
<p>11. Prof Bonny Pilo 204 Janardhan Apartments 14 Pratap Gunj Vadodara- 390 002</p>	<p>12. Dr J S Samant Professor (Retd) Development Research, Awareness and Action Institute (DEVRAAI) 'RAAI' - 379, R K Nagar, Kolhapur – 416 013</p>
<p>13. Prof. C K Varshney Emeritus Professor School of Environmental Sciences Jawaharlal Nehru University New Delhi</p>	<p>14. Dr K N Ganeshiaiah University of Agricultural Sciences Department of Genetics and Plant Breeding G K V K Bengaluru - 560 065</p>
<p>15. Prof Anil K Gupta Professor Indian Institute of Management Vastrapur, Ahmedabad Gujarat – 380 015</p>	<p>16. Dr Sukhdev Thakkur, IFS (Retd.) 9, Bhaskaran Street VOC Nagar Pammal, Chennai – 600 075</p>
<p>17. Dr P Balasubramanian Principal Scientist Division of Landscape Ecology SACON, Coimbatore – 641 108</p>	<p>18. Dr S Muralidharan Principal Scientist Division of Ecotoxicology SACON, Coimbatore - 641 108</p>

<p>19. The Principal Secretary to the Government Department of Environment and Forests Office of the Principal Chief Conservator of Forests Van Sadan, Port Blair Andamans – 744 102</p>	<p>20. The Principal Chief Conservator of Forests & Chief Wildlife Warden (WL) Government of Nagaland Dimapur – 797 112 Nagaland</p>
<p>21. The Director Zoological Survey of India M Block, New Alipore Kolkata – 700 053</p>	<p>22. The Director Bannerghatta Biological Park Bannerghatta Bengaluru</p>
<p>23. The Director Keoladeo National Park Bharatpur – 321 001 Rajasthan</p>	<p>24. Smt. Tara Gandhi AI Uttaravedi No 7, 2nd Seaward Road Valmiki Nagar Chennai - 600 041</p>
<p>25. Dr L M S Palni GB Pant Institute of Himalayan Environment and Development Kosi-Katarmal, Almora – 263 643, Uttarakhand</p>	<p>26. Dr B M Parasharya AINP on Agricultural Ornithology Biological Control Research Laboratory Anand Agricultural University Anand – 388 110 Gujarat</p>
<p>27. Dr P S Easa Wildlife Biologist Anugraham, Apsara Gardens Nellikunnu, East Fort P.O. Thrissur - 680 005, Kerala</p>	

GOVERNING COUNCIL

The Chairperson of the Governing Council (GC) of SACON is the Secretary to the Government of India, Ministry of Environment and Forests (MoEF). The GC has 16 members; Financial Advisor to the MoEF, Advisor to the MoEF or nominee, four ex-officio members, eight nominees of the Governing Council and the Director, SACON as Member Secretary. The tenure of the Governing Council is three years. The members of the GC reconstituted in July 2011 are listed below:

Members of the Governing Council

S No	Constitution	Name
1	Secretary to the Government of India, or his nominee not below the rank of Additional Secretary, Ministry of Environment and Forests – Chairperson	Dr V Rajagopalan, IAS, Chairman
2	Financial Advisor, MoEF, or his / her nominee from the IFD of the MoEF (Ex-officio)	Shri. S S Mohanty, IAS, Financial Advisor
3	Advisor, MoEF, dealing with the matters of SACON, or his / her nominee (Ex-officio)	Dr J R Bhatt
4	Principal Secretary, Department of Environment and Forests, Tamil Nadu (Ex-officio)	Shri. Mohan Varghese Chunkath, IAS
5	Director, Wildlife Institute of India, Dehradun (Ex-officio)	Shri. P R Sinha, IFS
6	Vice Chancellor, Bharathiar University, Coimbatore (Ex-officio)	Dr G James Pitchai
7	Director, Bombay Natural History Society (Ex-officio)	Dr A R Rahmani
8	The Chairperson, Centre for Ecological Sciences, IISc, Bengaluru (Ex-officio)	Dr Renee Borges
9-11	Three experts in the field of ornithology	<ol style="list-style-type: none"> 1. Dr Erach Bharucha, Director, Bharati Vidyapeeth Deemed University, Pune 2. Prof Bonny Pilo, Professor of Zoology (Retd), M S University of Baroda 3. Dr J S Samant, Advisor and Trustee, Development Research Awareness and Action Institute, Kolhapur
12-13	Two experts in the field of ecology or in disciplines of natural history	<ol style="list-style-type: none"> 1. Prof C K Varshney, Professor (Retd), School of Environmental Sciences, Jawaharlal Nehru University, Delhi 2. Dr K N Ganeshiah, University of Agricultural Sciences, Bengaluru
14	One faculty from management institutes	Dr Anil Gupta, Professor, Indian Institute of Management, Ahmadabad
15	One representative from public sector enterprises / banks	Vacant
16	Director, SACON (Member Secretary)	Dr P A Azeez

The reconstituted Governing Council held its 63rd meeting on 17 August 2012 and the 64th meeting on 15 March 2013 at MoEF, New Delhi. The GC is advised by Finance Sub-Committee (FSC), and Research, Monitoring and Advisory Committee (RMAC). The GC has also constituted a Building Sub-Committee (BSC) to oversee and advise on the construction activities at SACON.

Research, Monitoring and Advisory Committee (RMAC)

The mandate of the RMAC is to i) advise the faculty of the SACON, ii) review research or projects developed by the Centre, iii) review and assess projects being implemented, and monitor the output; dissertations, reports, papers in scientific journals and other publications, and iv) conduct a review annually of all research and extension activities of the Centre and advise changes, if any. The panel of the Committee is given below.

1. Dr Sukhdev Thakur, IFS (Retd), Principal Chief Conservator of Forests, Tamil Nadu (Chairman)
2. Dr AR Rahmani, Director, Bombay Natural History Society, Mumbai
3. Dr V C Soni, Professor, Dept. of Biosciences, Saurashtra University, Rajkot
4. Dr B M Parasharya, AINP on Agricultural Ornithology Biological Control Research Laboratory, Anand Agricultural University, Anand
5. Prof. B C Choudhary, Wildlife Institute of India, Dehra dun
6. Dr Mewa Singh, Professor, Dept. of Psychology, Mysore University
7. Dr P Balasubramanian, Principal Scientist, SACON
8. Dr S Bhupathy, Principal Scientist, SACON
9. Dr P A Azeez, Director, SACON (Member Secretary)

The Research, Monitoring and Advisory Committee met on 11 January 2013 (25th meeting) at SACON, Coimbatore.



Staff of SACON

The core scientific staff strength of the year (until March 2013) was Seventeen; Director (1), Principal Scientist (9), Senior Scientist (2) and Scientist (6) during the period reported.

SCIENTIFIC

Director	:	Dr P A Azeez
Avian Physiology and Genetics	:	Dr R P Singh, Scientist
Conservation Biology	:	Dr S Mukherjee, Principal Scientist Dr H N Kumara, Scientist
Conservation Ecology	:	Dr S Bhupathy, Principal Scientist Dr Manchi Shirish S, Scientist
Ecotoxicology	:	Dr S Muralidharan, Principal Scientist
Environmental Impact Assessment	:	Dr P R Arun, Principal Scientist Dr B Anjan Kumar Prusty, Scientist
Extension	:	Dr Mathew K Sebastian, Principal Scientist
Landscape Ecology	:	Dr P Balasubramanian, Principal Scientist Dr P V Karunakaran, Principal Scientist
Nature Education	:	Dr P Pramod, Senior Scientist
Ornithology	:	Dr Rajah Jayapal, Principal Scientist Dr S Babu, Scientist
Wetland Ecology	:	Dr Goldin Quadros, Senior Scientist Dr Mahendiran M, Scientist

TECHNICAL

Library and Documentation	:	Mr M Manoharan, Library Assistant
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ADMINISTRATION

Finance Officer	:	Mr Aneesh K Abraham
Jr. Administrative Manager	:	Mr R Jayakumar
PA to Director	:	Mr V Vaidiyanathan
Accountant	:	Mr M Muthupandi
Administrative Assistant	:	Mr S Patturajan
Office Assistant	:	Mrs R Rajalakshmi
Stenographer	:	Mr M Eanamuthu
Receptionist/ LDC	:	Mrs M Jayageetha
Site Engineer	:	Lt Col. (Retd) N Sundararaj (on contract)
Computer Assistant	:	Mr A Srinivasan (on contract)
Drivers	:	Mr R Ravi Mr P Subramanian
Office Attendants	:	Mr A Devaraj Mrs V Santhalakshmi

New Appointment



Dr. S Babu joined as Scientist in SACON in the Division of Ornithology in May 2012. He worked as a research fellow at the Kerala Forest Research Institute and was awarded PhD by the Forest Research Institute (Dehradun) for his thesis on the owls of Western Ghats. His research interests include habitat-species interaction, conservation ecology, landscape ecology, GIS and remote sensing and species distribution modeling.

RESEARCH ACTIVITIES

IDENTIFICATION OF RNA TRANSCRIPTS PRESENT IN CHICKEN SPERM AND THEIR RELATION TO FERTILITY

Background

Male fertility requires the production of an adequate number of normal mature spermatozoa with sufficient motility and the ability to undergo acrosome reaction in order to bind and penetrate the egg membrane for fertilization. Defects in any of these necessary characteristics can lead to male infertility. In addition to this, male fertility varies from breed to breed because of difference in semen characteristics.

Therefore, selection of high fertility potential males is essential for captive breeding programmes to achieve good fertility. Until date only phenotypic traits viz. comb area, testicular weight and semen characteristics are considered for male selection. However, these phenotypic traits are not promising and do not guarantee higher male fertility. Hence, unsuitability of above conventional methods for fertility evaluation forced us to investigate the most

recent molecular approach i.e. sperm mRNA transcriptional profiling for the evaluation of male fertility. Recent interest in spermatid RNA has been motivated by the potential, which may offer as a diagnostic tool for infertility.

<i>Principal Investigator</i>	: Ram Pratap Singh
<i>Collaborative agency</i>	: Central Avian Research Institute, Izatnagar, Bareilly
<i>Research Personnel</i>	: Shafeeqe, C.M.
<i>Duration</i>	: 3 years
<i>Date of commencement</i>	: 30 July 2012
<i>Date of completion</i>	: 29 July 2015
<i>Budget</i>	: Rs. 21.00 lakhs.
<i>Funding Source</i>	: Department of Science and Technology, Gol
<i>Status</i>	: Ongoing

Objectives

- Optimization of the RNA isolation methodology for chicken sperm
- Molecular analysis of the population of RNA in chicken spermatozoa
- Expression analysis of fertility related genes in low and high fertility chickens

Methods

Optimization of the RNA isolation methodology for chicken sperm

Semen from five males were collected and used for RNA isolation. Before RNA isolation, semen samples were subjected to density gradient centrifugation to remove somatic cell contamination followed by sperm concentration measurement by spectrophotometer. Different density gradient mediums i.e. Percoll and PureSperm 100 were used to find out a proper gradient medium, which can remove somatic cells. A discontinuous gradient medium was formed by using 40% and 80% Percoll. 1 ml 1:1 diluted semen in PBS was overlaid carefully on to the Percoll medium, and centrifuged at 1600 rpm for 30 minutes. Similarly, a discontinuous gradient medium of 45% and 90% Percoll were also used at 2000 rpm for 30 min. Two different continuous gradient medium of 40% and 80% PureSperm 100 were also tried at 2000 rpm for 30 min to separate mature sperm from somatic cells and immature diploid spermatocytes. The efficiency of purification was confirmed by light microscopy examinations before and after

purification. A different number of purified sperm were further used for RNA isolation by TRIzol reagent/ RNAzol according to the manufacturer's instructions. The quantity and quality of RNA was measured using NanoDrop and denatured agarose gel electrophoresis. Genomic DNA free RNA samples were converted into cDNA by using 'RevertAid First strand cDNA synthesis kit' (MBI Fermentas, Hanover, MD, USA) according to the manufacturer's instructions. Further gDNA and somatic cell contamination was verified by PCR using exon-spanning primers of somatic cell marker genes i.e. CD4 and PTPRC.

Results

In the present study, sperm purification with a one-layer 40% PureSperm I 00 gradient at 2000 rpm for 30 min was found to be optimal (Table I, Figure I). The isolated RNA from purified sperm showed very good OD values at 260/280 nm, which is a primary measure of RNA quality (Table 2). However, DNA contamination was observed in most of the samples isolated by using Trizol. We tried DNA digestion by DNase enzyme, which resulted into RNA degradation. To overcome gDNA contamination, we tried another reagent called 'RNAzol RT', which is known for gDNA free RNA isolation. The 260/280 OD of RNA samples isolated using RNAzol has yielded well, the quantity of RNA was also comparatively higher than TRIzol. Most important, of these four RNA samples, 3 were free from gDNA as evident by PCR with PTPRC gene (Figure 2).

Figure I : A) Enriched sperm after density gradient centrifugation B) Presence of somatic cell debris in semen

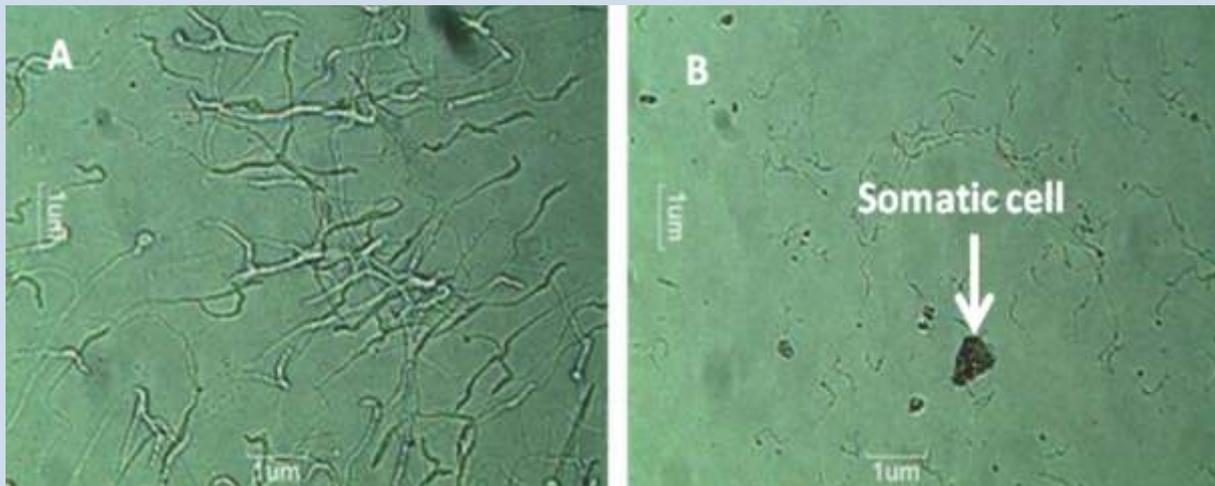


Table I : Sperm purification by using different density gradient medium

Density gradient Medium	Centrifugation speed (rpm) and time (min)	Observations	Somatic cells
80%+40% Percoll	1600 rpm for 30 min	No pellet	Present
80%+40% Percoll	2000 rpm for 30 min	Pelleted	Present
90%+45% Percoll	2000 rpm for 30 min	Pelleted	Very few
40% PureSperm	2000 rpm for 30 min	Pelleted	Rare
80% PureSperm	2000 rpm for 30 min	No proper pellet	Very few

Figure 2 : Amplification of PTPRC gene in cDNA of four different RNA samples.

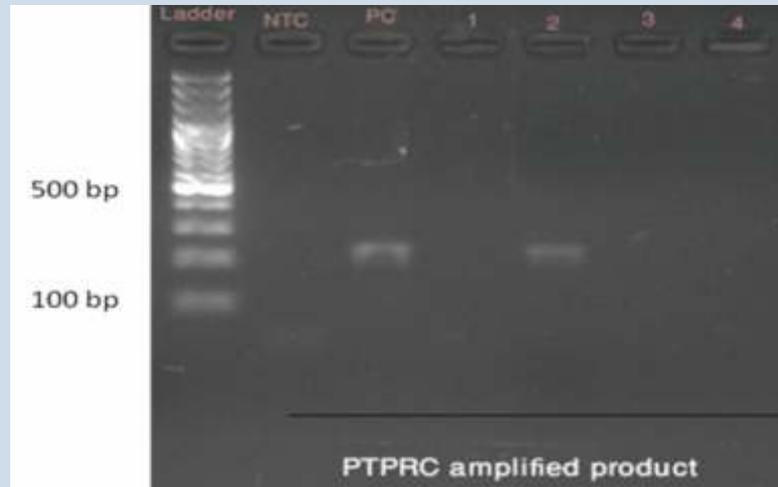


Table 2 : RNA isolation from sperm (purified by 40% PureSperm) by using 1:2 semen/TRIzol

Sample No.	Sperm count (*10 ⁶ cells)	260/280 OD	260/230 OD	RNA quantity (ng/μl)
1	1500	1.74	2.18	1061.5
2	1000	1.74	2.25	716.6
3	800	1.73	2.18	662.7
4	600	1.70	2.22	1467.0
5	400	1.76	2.32	702.5
6	<400	1.78	2.14	633.0



CONSERVATION OF THE ENDANGERED SPECIES AND HABITATS - THE EDIBLE-NEST SWIFTLET IN THE ANDAMAN AND NICOBAR ISLANDS

Background

Since 1999, significant progress has been made towards population recovery of the Edible-nest Swiftlet at the focal sites under in-situ conservation. The project demonstrates that in-situ and ex-situ conservation with the involvement of the local administration and people will lead to far wider recoveries in population of the swiftlets and positively benefit these fragile islands and people.

<i>Principal Investigator</i>	: <i>Manchi Shirish S</i>
<i>Collaborative Agency</i>	: <i>Department of Environment and Forests, Andaman and Nicobar Islands</i>
<i>Research Personnel</i>	: <i>Akshaya Mane Puniyamurthy Kristodas (since December 2012)</i>
<i>Duration</i>	: <i>5 years</i>
<i>Date of Commencement</i>	: <i>April 2009</i>
<i>Expected date of Completion</i>	: <i>April 2014</i>
<i>Budget</i>	: <i>Rs. 51.25 lakhs</i>
<i>Funding Source</i>	: <i>Ministry of Environment and Forests (through Department of Environment and Forests, Andaman and Nicobar Islands)</i>
<i>Status</i>	: <i>On going</i>

Objectives

I. Research and development

- To map the cave with breeding colonies
- To continue ongoing studies on the breeding biology of the species
- To study longevity and dispersal patterns of the Edible-nest Swiftlet
- To optimize the technology and the methodology to attract and induce Edible-nest Swiftlet to breed in human habitation

II. In-situ conservation

- The consolidation and expansion of cave sites where

conservation action is being implemented from the existing two to eight sites (5 in the Andaman and 3 in the Nicobar), where nest-collectors will be organised and supervised in scientifically managing Swiftlet colonies

- To establish scientific harvesting systems

III. Ex-situ conservation

- The development, and expansion of the number of houses in which the Edible-nest Swiftlet breed, thus establishing alternate populations and enabling widespread ranching of swiftlets from houses
- To establish scientific harvesting systems in Edible-nest Swiftlet colonies in houses

IV. Swiftlet Conservation Co-operative

- The establishment of a co-operative that will establish market linkages for nests harvested under supervised scientifically managed systems, which is fundamental to the conservation of the Edible-nest Swiftlet

Methods

- Research on population and biology of the Edible-nest Swiftlet will be studied through entry-exit counts, egg laying, hatching and fledging success, and dispersal patterns by studying marked birds
- Caves at three places, Interview Island (one cave), Chalis-Ek (29 caves) and Wraffter's Creek, Baratang Island (174 caves), are being protected and studied under the conservation programme
- Each nest is identified and numbered and its history traced from commencement of construction until the fledging of chicks, thus ensuring successful breeding within the colony and growth in populations
- Audio system will be used for playing the calls to attract the Edible-nest and Glossy Swiftlet. Glossy Swiftlets in the house were installed in all the four Swiftlet houses at Tugapur, Khara Nallha, Ramnagar and Baratang during April - May 2012
- The colony of the Edible-nest Swiftlet at the house in Tugapur will be further augmented through the cross-fostering method. New houses were designed with reference to the designs in the South-east Asia and with further modifications according to the scientific information available and requirement of the local sub-species, so that house-ranching of Edible-nest Swiftlet will contribute to the economy of the islands as well as in building up populations of the species

Results

The total protected population at all the three sites was estimated as 5569 individuals during 2012. 2715 chicks fledged by 2111 breeding pairs (number of nests) in 199 caves sites with an average breeding success of 74%.

During beginning of 2013, the initial surveys of protected caves portrayed slight increase in the population of the Edible-nest Swiftlet. Total 2251 nests (1341 at Chalis-ek, 134 at Interview Island and 776 at Baratang) were observed. Egg laying is on going at Chalis-ek and Baratang and hatching has just commenced during the mid of March. At Interview Island, the egg laying has not yet began. Roosting behavior study showed no significant difference in arrival time of birds for roosting during different lunar phases. Total 31 individuals ringed during previous years were recaptured. Eldest individual recaptured was of 11 years old, two individuals were of 10 years old, one was of 8 years old and seven were of around 6 years of age. With involvement of the forest department and the nest protectors, scientifically managed harvesting of the nests is on going. Total 1944 nests (1225 from Chalie-ek and 112 from Interview Island and 607 from Baratang Island) were harvested during the year 2012. All the harvested nests are numbered, registered, air-dried and packed in air tight container after complete drying.

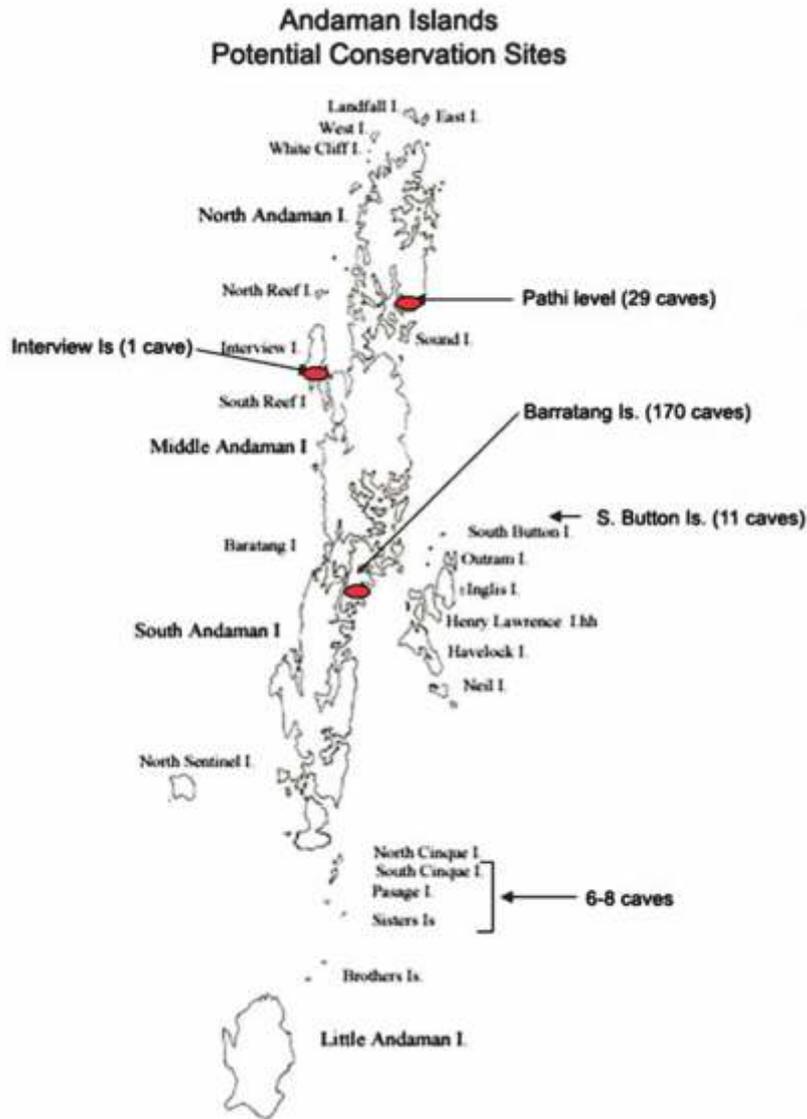
After installing the audio system in the houses to play back the Swiftlet calls, one adult Edible-nest Swiftlet was observed roosting in the dark zone of the ground floor chamber in the Swiftlet house at Tugapur. No signs of the swiftlets were seen in other three Swiftlet houses. During May 2012, only 33 eggs were transferred and hatching success was more than 80%.

Discussion

Steady population growth at two in-situ conservation sites (Chalis-ek and Baratang) is quite noticeable. whereas, after the successful breeding every year population decline at Interview Island is reported. The capture-recapture studies confirm presence of the old birds in the colony. Study on dispersal will help us to understand the breeding and natal dispersal of the species. The roosting pattern is now known to be related with the breeding stage of the colony rather than the lunar cycle. This may help us to understand

the populations in the unprotected caves through roost count method. Regular, scheduled playing back of the calls and transfer of Edible-nest Swiftlet eggs into the Glossy Swiftlet nests may result in settlement of the Edible-nest Swiftlet populations in the ex-situ Swiftlet houses.

LOCATIONS
OF THE
EDIBLE-NEST
SWIFTLET
PROTECTION
SITES IN
ANDAMAN
ISLANDS



STATUS, ECOLOGY AND CONSERVATION OF NARCONDAM HORNBILL *AECEROS NARCONDAMI* ON NARCONDAM ISLAND, INDIA

Background

Narcondam Hornbill *Aceros nacondami* is considered as the most endangered hornbill species in the world. The species is one of the globally threatened birds listed by BirdLife International and International Union Conservation Network. The species is also included in Scheduled I of the Wildlife (Protection) Act, 1972 in India. Narcondam Hornbill is endemic

to the tiny 6.82 sq. km. dormant volcanic Narcondam Island in Andaman Sea. Because of high endemism and low population, Narcondam Hornbill is of a high priority species for avian conservation in India. With several stresses, as the population trend of Narcondam Hornbill is believed to be in declining phase there is an urgency to understand ecological and evolutionary aspects of the species. Identifying this, the

Department of Environment and Forests,

Andaman and Nicobar Islands has suggested for the investigation about Narcondam Hornbill, especially, its present population and habitat requirements on the Island. Preliminary knowledge about the population status with its seasonal habitat requirements can help us to identify the factors regulating population of the Narcondam Hornbill and lead us towards assured survival of the species and its habitat through formulation and advocacy of required conservation measures.

<i>Principal Investigator</i>	: Manchi Shirish S
<i>Duration</i>	: 18 Months
<i>Date of Commencement</i>	: May 2011
<i>Expected date of Completion</i>	: October 2012 (extended up to October 2013)
<i>Budget</i>	: Rs. 6.07 lakhs
<i>Funding Source</i>	: Ministry of Environment and Forests, Govt. of India
<i>Status</i>	: On going

Objectives

- To investigate population status of the Narcondam Hornbill
- To study the nesting and foraging habitat requirements of the Narcondam Hornbill
- To study breeding and non-breeding biology of the Narcondam Hornbill
- To identify threats, formulate and advocate conservation measures

Methodology

Nest-site selection and preference is studied using nest tree-centered circular plots (15m radius) to compare with the circular plots at 75m from the nest tree. To study the nesting and foraging, 10X10m plots were laid randomly. Focal Animal Nest Sampling is used to study breeding biology of the species. The observations are being made between 04:30 – 17:30 hours once in a week to record associated behaviors and visits made by male to the nest and food items delivered. Focal Animal Sampling method is used to observe the foraging individuals / flocks along the line transect of various lengths. To supplement information on the diet of the nesting bird, the seeds and other remains in the middens are collected. Data regarding sex and age of an individual, group size, food item, food tree species, height of the tree, etc. are being collected.



Male Narcondam Hornbill feeding on the Ficus fruits

(Photo by: Dhritiman Mukherjee)

Open-width Line Transect is being used to estimate the population of the Narcondam Hornbill. Appropriate number of transects are laid and the observations are taken fortnightly.

To measure impact of goats on forest regeneration 1x1m sub plots were laid at four corners of each 10 x10m plots mentioned earlier. Discussions are underway with the police personnel to understand current level of hunting, fire wood collection, and other disturbances by human on the island.

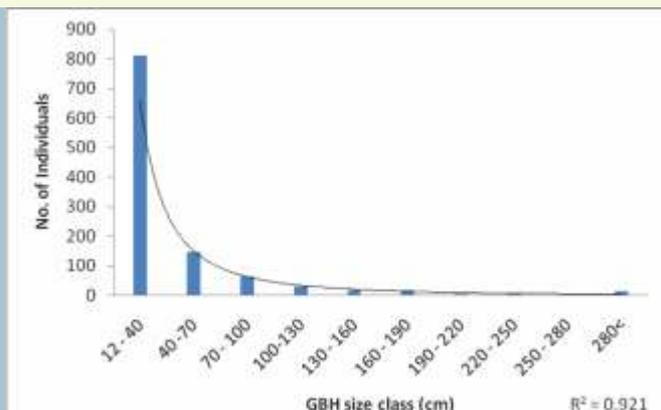
Results

The population structure of the entire tree community showed normal reverse 'J' shaped curve (Figure 1). Out of the six dominant species, three showed reverse 'J' shaped population structure. These three species growth did not exceed 100 cm in GBH (except two individuals). Another three species had high GBH values and show less number of individuals in the lowest GBH classes.

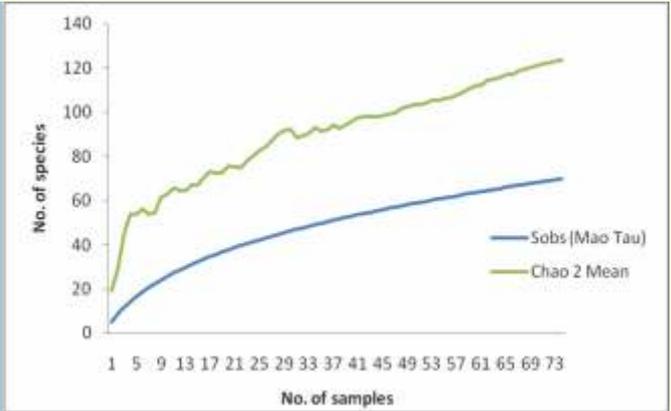
Seventy species were observed in Narcondam Island. As the observed pattern did not attain asymptote (Figure 2), further sampling is required to get a realistic estimate of the tree species diversity of the Island. The estimated stem density of the Narcondam Island was 598 stems / ha.

Narcondam Hornbills were observed feeding on fruits of 11 species of trees. During the sampling, 27 ± 11 individuals of Narcondam Hornbill were encountered, which was dominated by females. Greater proportion of birds belonged to less than five years of age.

THE POPULATION STRUCTURE OF THE TREE COMMUNITY ON THE NARCONDAM ISLAND



TREE SPECIES ACCUMULATION
CURVE OBSERVED IN THE
NARCONDAM ISLAND.



Major goal of the study is to understand status, biology and habitat requirements of endangered Narcondam Hornbill, confined to a small island, for immediate conservation action and to design further detailed studies to develop appropriate conservation measures/strategies for the species and its habitat on the Narcondam Island.

Data was collected between July and August 2012. As it was monsoon, limited data could be collected regarding nesting and foraging habitat available for the Narcondam Hornbill. In addition, data could be collected regarding threats to the species on the island. As data collection regarding other objectives is on going, the results for these objectives could not be presented.

Data collection regarding population of the species, breeding biology and nesting habitat and food and foraging habitat are on going. Total eight nests of the Narcondam Hornbill were located and required data collection is initiated at these nests. All the nests located were with two chicks. Further nest search is being continued. Data collection regarding breeding biology, population survey, nesting and foraging habitat and food and foraging continue as the project period is extended until October 2013.

Recommendations

It is recommended to have an arrangement made either by police or by the forest department to commute to and from the Narcondam Island and the nearest human habitation, as it will boost morale of the police personal working in the inaccessible area. Additional LPG should be provided to the police outpost to completely ban the firewood collection. Solar power system on the island should be repaired and used instead of the diesel generators to reduce disturbance to the nocturnal fauna on the island. There should be no more interference of any sort on the island as the habitat seems to be recovering. In case feral goats are encountered in future, police personals should be allowed to eliminate them from the island.



REASSESSMENT OF THE IMPACT OF NEST COLLECTION ON THE EDIBLE-NEST SWIFTLET IN THE ANDAMAN ISLANDS

Background

The Edible-nest Swiftlet *Aerodramus fuciphagus* builds nests exclusively of saliva, which has importance according to Chinese cuisine and pharmacy. Ranked amongst the world's most expensive animal products, excessive and uncontrolled nest collection has led to wide spread decline in population. However, when properly managed by following scientifically prescribed harvesting regimes, populations

of the Edible-nest Swiftlet have shown remarkable recoveries with growth. Swiftlets' nest harvesting is ethically acceptable, as it does not involve killing or constraining the birds in any way; that Swiftlet nest harvesting is a unique case that needs innovative conservation approaches.

Principal Investigator	: Manchi Shirish S
Duration	: One Year
Date of Commencement	: September 2011
Expected date of Completion	: August 2012 (extended up to May 2013)
Budget	: Rs. 2.00 lakhs
Funding Source	: Small Grant Program, WWF India
Status	: Ongoing

During 1998, of the 384 caves (260 inland caves and 124 coastal caves) across the Andaman and Nicobar Islands, 291 were occupied by the Edible-nest Swiftlet. A program to conserve the Edible-nest Swiftlet has been underway since 1999 by local forest department and SACON in the Andaman & Nicobar Islands. The survey aimed at identifying of the potential areas for expansion of the on-going conservation program, and understanding the rate of population loss across the Andaman Islands.

Objectives

- Estimate the breeding population of the Edible-nest Swiftlet throughout the Andaman Islands
- Assess the extent of the nest collection in Andaman Islands
- Identify the potential populations towards expansion of the on-going conservation program

Methodology

All the known caves were explored on eight islands of the North and Middle Andamans for estimating the population of the Edible-nest Swiftlet. Nests were counted to estimate the breeding population of the species. All the existing nests and used nests sites (marks left behind by the old nests) were counted to estimate the current and the previous populations breeding inside the caves. Data collected were compared with the previous survey (1997) to estimate the impact of the nest collection on the population of the Edible-nest Swiftlet between 1997 and 2010.

Results

Of the 325 caves surveyed during 1997, 249 caves were occupied by Edible-nest Swiftlet in the Andaman Islands. Of these 249 caves, 237 were revisited and two new caves were found to be used by the species during the present survey. Of the total 2448 breeding pairs observed during present population survey, 2111 were found in the 203 caves protected under the Edible-nest Swiftlet conservation program, 97 in 2 caves explored first time and 240 breeding pairs were found in 34 undefended caves. Present

investigation depicts that almost 41% of the Edible-nest Swiftlet population is declined from 1997 onwards and more than 70% of undefended/unprotected population is lost between 1997-98 and 2012-13. Edible-nest Swiftlet is found extinct from around 50% of caves in Andaman Islands.

Two new breeding colonies of the Edible-nest Swiftlet were explored during the recent survey: Colonies of 78 breeding pairs on the Landfall Island and 19 breeding pairs at Chalis-ek, North Andaman Island (Table I).

More than 99.8 % of the 2001 protected nests were found built completely whereas, of 337 unprotected nests only close to 39% of nests were found built completely, around 31% were half built and more than 15 % nests were in the foundation building stage (Figure 1).

During this survey 8 breeding and one roosting site of the Edible-nest Swiftlet were discovered in the man-made buildings in urban areas of the North, Middle and South Andaman and Havelock Island. In these eight breeding colonies, total 62 nests were found.

Table I. Nest count of the Edible-nest Swiftlet and the number of caves in different islands of North and middle Andaman Island

Sr. No.	Island Name	1997 survey		2012 survey	
		# Caves	# Nests	# Caves	# Nests
1	Interview	33	310	34	67
2	*Interview (Protected)	1	600	1	137
3	Point	2	0	2	0
4	Reef	5	8	5	0
5	White Cliff	4	0	4	0
6	Landfall	1	0	1	78
7	Chalis-ek, N. Andaman	3	19	5	32
8	**Chalis-ek, N. Andaman	30	922	30	1305
9	Ramnagar, N. Andaman	2	0	2	0
10	Cuthbert Bay, M. Andaman	3	0	3	0
11	Opp. Strait	1	0	1	0
12	***Rafters Creek, Baratang	170	1799	174	669
13	Henry Lawrence	20	51	20	2
14	Inglis	2	0	2	0
15	Outram	2	1	3	0
16	Neil	9	139	9	98
17	South Button	14	296	14	60
18	Middle Button	1	0	1	0
19	Chidiya Tapu, S. Andaman	1	0	1	0
	TOTAL	304	4146	312	2448

*Cave protected from 2000 onwards, **Caves protected from 2001 onwards,

***Caves protected from 2010 onwards, NS: Not Surveyed

Figure I : Stage fo nest constructions

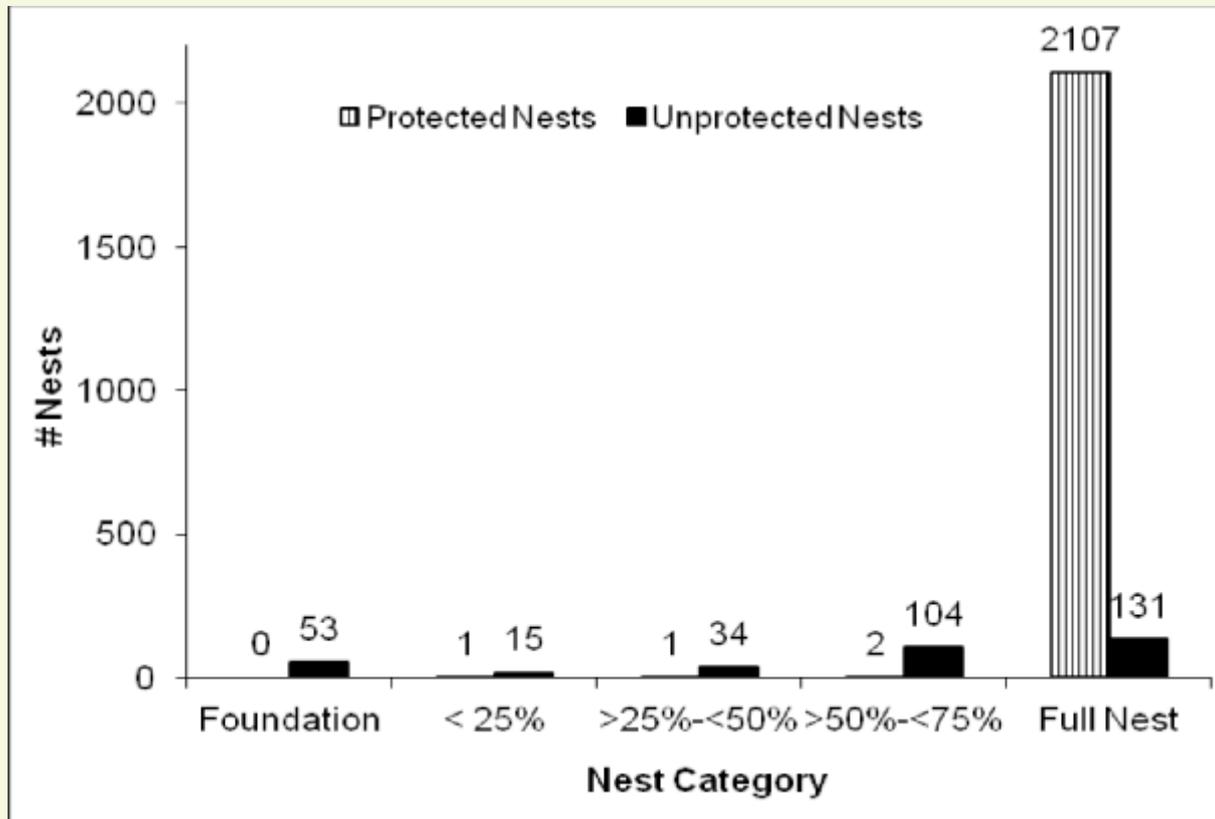


Figure I The graph shows the number of nests observed in different size categories during the survey, which depicts the results of an extent of the illegal nest collection in the unprotected caves and legal nest harvesting in the protected caves. (Here: Foundation = Saliva laid attached to rock; <25% = >Foundation < 25%; >25%-< 50% = nest built was > 25% but < 50%; >50%-< 75% = Nest built was > 50% but < 75%; Full Nest = nest built was > 75%-100%)

Discussion

Notable decline in populations and preliminary breeding stage of most of the nests of Edible-nest Swiftlet clearly show that the undefended population on the islands is continued to be under tremendous nest collection pressure. Among all the surveyed sites at present only South Button and Landfall islands have potential populations remaining which can be focused for expansion of the ongoing in-situ conservation of the Edible-nest Swiftlet. Both these islands are the rocks in the middle of the open sea, where it seem to be practically difficult to setup the protection camps there. As Landfall, the northern most island, and South Button Island in southern group of the Andaman, uninhabited, with no fresh water source on the island and also difficult to access in harsh climatic conditions, it may not be feasible to make people stay here for protection. Discovery of the urban populations is one of the most important outcomes of this survey. These successfully breeding colonies allow us to believe there may be more populations in the urban areas.



PATTERNS OF DISTRIBUTION OF SELECTED FAUNAL GROUPS IN THE AGASTHYAMALA HILLS, WESTERN GHATS, KERALA, INDIA

Background

Understanding the distribution patterns of biotic communities is important for planning conservation of biological diversity at local and regional levels, as global decline is being reported for several taxa. Apart from understating fundamentals of species distribution in large landscapes, the proposed study would provide some guidelines for prioritization of Protected Area delineation in the Western Ghats, One of the Global Biodiversity Hotspots. Though several studies are available on the distribution pattern of various taxa across the globe, research on this line is scanty in India. This research project intends to study systematically and find out distribution patterns of selected fauna (birds and reptiles) and factors governing the same along the elevation gradient (about 50 to 1850 m above sea level) in the Agasthyamala Hills, Western Ghats.

<i>Principal Investigator</i>	: S Bhupathy
<i>Co-Investigator</i>	: Lalitha Vijayan
<i>Research Fellows</i>	: Jins, J V and Madhumita Panigrahi
<i>Duration</i>	: Three years
<i>Date of Commencement</i>	: August 2011
<i>Date of Completion</i>	: August 2014
<i>Budget</i>	: Rs. 24.90 lakhs
<i>Funding Source</i>	: Department of Biotechnology, Govt. of India
<i>Status</i>	: On going

Objectives

- Determine the species richness and turnover patterns of reptiles and birds with altitude in Agasthyamala Range, Western Ghats, Kerala
- Understand both abiotic and biotic factors influencing such patterns
- Know the status of reptile and bird species found in the Agasthyamala Range, Kerala, and
- Apply distribution (Ecological Niche) models to find out the probable distribution limits of selected endemic species found in Agasthyamala Hills

Methods

Considering the requirement of maximizing species detection, the sampling methods have been designed. The study area was stratified at 100 m elevation. Fifteen bands are being surveyed for reptiles and birds using Time-constrained Visual Encounter and Variable-width Circular Plot respectively for data collection. The sampling effort was largely depending on area availability in each category.

Location details (lat-long) of each sighting of *Otocryptis beddomii* is being recorded using a GPS. Locations of a minimum of 1 km from each other were included in the analysis to avoid overlap. Uncorrelated environmental variables, consisting of six bioclimatic layers (max-mini temperatures, etc.), two topographical layers (aspects, elevation) and one vegetation layer (vegetation types) were used to predict the geographic distribution and area occupied by *Otocryptis beddomii* at two levels using MAXENT model; south of Palghat gap in the Western Ghats and within Agasthiyamalai Biosphere Reserve.

Results & Discussion

The data collection is in progress and the following are the salient findings during the reporting period.

- In all, 57 species of reptiles were observed in 15 elevation categories during the reporting period. Monotonic decline of reptile species richness with increasing elevation was observed
- In all, 157 species of birds belonging to 43 families were observed. Higher number of species were observed in lower and mid elevations and declined further
- The highest reptile species turnover among consecutive zones was between 1100-1200m and 1200-1300m zones (0.75). The complete species turnover (1) was observed in both 600-700m and 800-900m zones with all elevation zones above 1200m. Most of the higher elevation zones (> 1200m) had higher turnover (above 80%) with lower elevation zones
- The highest bird species turnover was seen between elevation 300m and 1500m, which is showing almost complete turnover. Consecutive elevation categories did not show any significant amount of species turnover except between 800 m and 900 m (0.846)
- As on date, 39 individuals of *Otocryptis beddomii* in 24 locations were observed. Among them, 15 locations were 1 km apart, and the same were included for analysis
- It is predicted that potential sites (probability > 0.7) for *Otocryptis beddomii* were found south of Periyar Tiger Reserve and highly suitable sites (>0.8) were predicted only south of the Senkottah Gap



A SURVEY FOR THE FISHING CAT (*PRIONAILURUS VIVERRINUS*) IN COASTAL KERALA, INDIA

Background

This project was an offshoot of a larger project on the fishing cat (*Prionailurus viverrinus*) that looked at genetic connectivity among identified populations in India, given its distribution is known to be very patchy.

Although the fishing cat has a wide distribution range within India, their presence in the Western Ghats and along the western coast was unclear with no authentic records of the species in this region. There is some confusion regarding a type specimen purportedly from the Malabar Coast and researchers believe that it could be just an assumption since the specimen was broadly assigned to India with no specific locality mentioned. Since mangroves and water bodies abound along coastal Kerala, there

have been speculations on the presence of the species due to habitat availability in this region. Yet, lack of current records led to inferences of the cat being extirpated from coastal Kerala in recent years. On the other hand, the absence of any authentic record for this medium sized cat could also be indicative of the western coast being out of its distribution range.

We conducted a survey along coastal Kerala to investigate the occurrence of the fishing cat. Due to paucity of resources, we limited the survey to a two and half month period in select sites, which had the highest probability of occurrence for the cat.

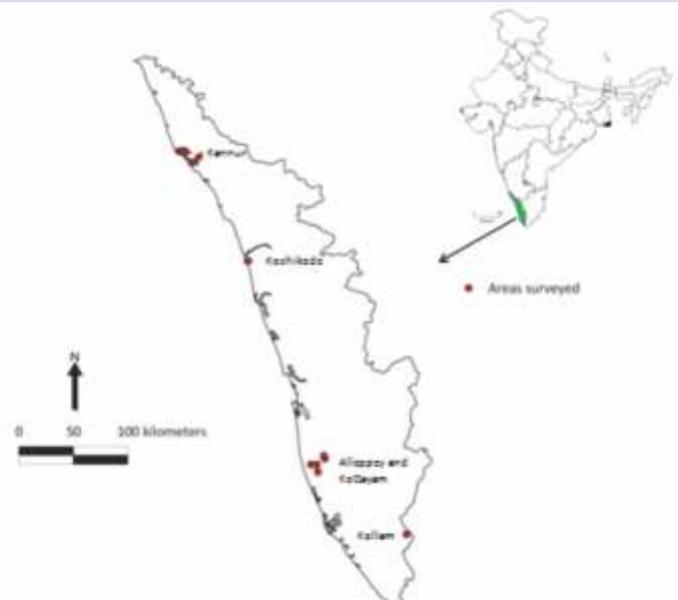
Objective

Survey the coastal parts of Kerala for the presence of the fishing cat, through an assessment of habitats and scat analysis using molecular techniques.

Methods

In a week long field survey (20th to 27th January 2013), we covered five districts shown in the map and in Table I.

<i>Investigators</i>	: Shomita Mukherjee & P V Karunakaran
<i>Collaborator</i>	: Ramana Athreya
<i>Collaborative agency</i>	: Indian Institute of Science Education and Research (IISER), Pune.
<i>Research personnel</i>	: Ranjini J
<i>Duration</i>	: Two and half months
<i>Date of commencement</i>	: January 2013
<i>Date of completion</i>	: March 2013
<i>Budget</i>	: Rs 1.00 lakh
<i>Funding source</i>	: Panthera Corporation, New York & IISER Pune
<i>Status</i>	: Completed



Locations surveyed for Fishing Cat in Kerala

Table I : Places surveyed for scat samples and habitat observations.

Density gradient Medium	Locality	Habitat type
Kannur	Ezhom, Pazhayangadi	Mangrove, aqua farms, paddy fields
	Chempallikunde	Aqua farm, abandoned paddy fields
	Ramapuram East and West	Reed beds, degraded mangrove
	Pappinissery, Chungam, Naniyur, Mayyil Panchayat, Koduvally, Thalassery	Relatively intact mangrove
Kozhikode	Kadalundi	Mangrove islands (degraded)
Kottayam	Neelamperoor	Paddy fields and reed beds
Alleppey	Kavalam	Tall grass, abandoned paddy fields
	Bootapandi Kayal	Temple pond
	Thankankary	Tall grass, abandoned paddy fields
	Judge 6000	Paddy fields and canals
Kollam	Ashramam	Highly disturbed mangrove

The survey was conducted with the help of the Forest Department and local naturalists who informed us of possible locations at every site. We visited potential mangrove patches and water bodies to assess the habitat as well as to collect scats. Locals were asked to describe the cats present in their area.

Scats were collected from the sites visited in zip-loc bags with details of geo-coordinates and date of collection, and transferred to the laboratory at IISER Pune for further analysis using molecular tools for species assignments. In the laboratory, DNA from scats was extracted using commercially available stool kits by QIAGEN (QIAamp) and a portion the 16srRNA gene of the mitochondrial DNA was amplified using felid specific primers. The products were then digested using enzymes Hae III, Ase I and Dpn I.

Results

We surveyed a variety of habitats in several districts including, mangroves, aquaculture farms, paddy fields, lakes (kayals), small wetlands and backwater canal systems. All sites visited were severely disturbed and patchy. The mangroves were in very poor condition and deeply fragmented. The water canal systems of Alleppey were devoid of any large fish and severely polluted. None of the locals could provide information on the fishing cat. No local name exists for the cat and descriptions provided by locals of cats present in the region matched those of jungle cat and house cat.

One tiny mangrove patch that was located opposite the Parassinikadavu temple in Kannur district was relatively undisturbed. A snake park located nearby supposedly housed a fishing cat caught in the mangrove patch in the 1990's. From accounts of the staff in the snake park, after the cat died in captivity, its skin was kept but it was destroyed in a fire in 1996. No photographic evidence of the cat or the skin was available and hence the record is unauthenticated.



Trash in mangroves from surrounding urban sprawls

Fifty-three scats were collected and 14 were identified as felids from DNA analysis. However, none of these were positive for fishing cat. Nevertheless, six jungle cats and two house cats were identified from scats. Four scats were too degraded to provide any useful information.

Discussion

Arguments for recent extirpation of the fishing cat from coastal Kerala, hinge on our discussion with locals, the extremely poor condition of the coastal habitat as well as negative results from scat analysis.

Of particular concern was the state of the fragmented mangrove patches that had a huge amount of plastic waste from urban sprawls. This was also the case with inland canals and no large fish was seen in these.

Additionally, we also surmise that they never existed in this region and we provide two reasons:

- There are no local names for the species unlike in other regions where they occur in human dominated landscapes (e.g. Eastern India). The cat is fairly large in size (12-15kg body mass) and it is unlikely that it would have gone unnoticed in a human dominated landscape such as the coasts
- The higher salinity on the Western coast with no large rivers to dilute the salinity as in the eastern part of India (Sundarbans and Coringa both have large rivers pouring into the coastal belt). High salinity perhaps makes this unsuitable for the fishing cat. This can be tested using niche model analysis with salinity gradients and known, global fishing cat locations

Their presence in the Western Ghats however, needs to be examined through longer, detailed surveys.

SOCIAL ORGANIZATION, BEHAVIOUR AND PHYLOGEOGRAPHY OF *MACACA FASCICULARIS UMBROSA* ON THE NICOBAR ISLANDS, INDIA

Background

In India, data on the unique endemic subspecies, *Macaca fascicularis umbrosa*, is limited only to a status report from a short survey. This subspecies is endemic to three islands viz. Great Nicobar, Little Nicobar, Katchal. Nicobar Islands were one

of the worst hit areas during the December 2004 Tsunami. Large parts of the habitat of the macaque were affected. Further, the inhabited islands have been isolated since long and this could potentially result in inbreeding within, and genetic isolation among populations. The consequence of this would be high genetic distance among, populations resulting in strong genetic structure. Phylogeography utilizes standing patterns of genetic variation to

explain historical events such as migrations and demography over space and time. We propose to document and study the phylogeography, social organisation and behavior of *Macaca fascicularis umbrosa*

Principal Investigator	: Honnavalli N. Kumara
Co-Investigators	: Mewa Singh and Shomita Mukherjee
Collaborative agencies	: CES, Bangalore
Research Personnel	: Arijit Pal, Partha Sarathi Misra and Avadhoot D. Velankar
Duration	: Three years
Date of Commencement	: July 2012
Expected date of Completion	: July 2015
Budget	: Rs. 38.54 lakhs
Funding source	: Science and Engineering Research Board of DST
Status	: Ongoing

in the Nicobar Islands, which would help in understanding the ecology and evolutionary history of this species.

Objectives

- To assess the status of populations of the long tailed macaque on the Nicobar Islands
- To study the social organization and time-activity budget of long-tailed macaques on the Nicobar Islands in the post-Tsunami scenario and correlate this to objective
- To study the phylogeography of the long-tailed macaques on the Nicobar Islands

Methods

Social organisation: All the three Islands will be visited, and location, group size and age-sex will be recorded for all the macaque groups sighted. **Phylogeography and evolution:** Samples for molecular work will be non-invasively collected fecal samples. Samples will be collected in vials containing alcohol for extraction of DNA and further analysis. **Behaviour:** Scan sampling will be done for data on activity budgets. The focal group will be followed from 0700 to 1800 hrs. While following the focal group a handheld GPS unit will be used to record the geo-coordinates of the group at every 30 min to assess the movement pattern and for plotting home ranges. Any interaction with other groups will be recorded as anecdotal. **Focal animal sampling:** Individual identification of all the group members will be made, and focal animal sampling will be used to understand the behaviour pattern and individual interactions.

Results

Study has been initiated after recruiting the research personnel and procuring the required permission from the forest department and Commissioner Office of Port Blair.



A SURVEY OF SLENDER LORIS IN PARTS OF KERALA AND TAMIL NADU, INDIA

Background

The Slender Loris, *Loris lydekkerianus* is one of the two nocturnal primates found in India. Two subspecies are recognized so far – the Mysore slender loris, *Loris lydekkerianus lydekkerianus* and the Malabar slender loris, *Loris lydekkerianus malabaricus* inhabiting the dry and wet forest types of the Eastern and Western Ghats respectively. Although the distribution and abundance of the species is known for the state of Karnataka and some parts of Tamil Nadu, Kerala and Andhra Pradesh, the full distributional extent of the species in southern India remain largely unknown. Though thought to be present in larger abundance in the eastern part of Tamil Nadu, its full distribution extent and conservation status is unknown. Moreover, none of the remaining forests in Eastern Ghats of Tamil Nadu is having a protected area status. Therefore, understanding the distribution pattern of the lorises and the quality of the remaining forests will help in conservation prioritization and planning for conservation in the crucial areas.

<i>Principal Investigator</i>	: Honnavalli N. Kumara
<i>Co-Investigator</i>	: R. Sasi
<i>Project Period</i>	: 20 months
<i>Date of Commencement</i>	: February 2012
<i>Expected date of Completion</i>	: October 2013
<i>Budget</i>	: Rs. 1.97 lakhs
<i>Funding source</i>	: Primate Conservation Inc.
<i>Status</i>	: Ongoing

Objectives

- To survey Slender Loris in southern Kerala and northern Tamil Nadu
- To assess the abundance of slender loris in forest units
- To assess the habitat parameters and threats
- To spatially characterize and configure the landscape of suitable habitats in GIS for conservation prioritization

Methods

Surveys were carried out at forest range level in Kerala. Two techniques were used to confirm the presence of loris in the area – (a) field sightings of the species during night transects, and (b) information from forest department personnel and local villagers. Night transects will be repeated in areas where initial transects fail to locate lorises, if local information indicates the presence of the species. Apart from forests, slender lorises also inhabit adjacent plantations and orchards. Hence, these habitats in the fringes will also be surveyed for the presence of lorises.

Results

In total, 23 forest ranges in southern Kerala were surveyed. Forty-seven lorises were sighted during the 641 km walk / vehicular transects. The encounter rate highly varied between the ranges and the highest was recorded at Naduvathumuzhy range (0.50/km) of Konni forest division, which was followed by Palode (0.21 ± 0.24) and Paruthipally (0.21 ± 0.29) ranges in Thiruvananthapuram forest division. The overall encounter rate was 0.07 (± 0.13).

In Tamil Nadu, we are yet to get the permission from the forest department (Tamil Nadu) to complete the proposed survey.

Discussion and Recommendations

The distribution of the nocturnal primate of South India, *Loris lydekkerianus* is known only from limited areas in its entire range. Two sub species are known for the Peninsular India, and their distributions are known to overlap each other. The present study will fill the gap in information on the distribution pattern and conservation of the two sub species of slender lorises. This information is crucial in planning protected area network with a focus to conserve the slender lorises in the Eastern and Western Ghats of southern India.

EVALUATING THE STATUS OF NTFP TREES AND DEVELOPMENT OF A MODEL FOR SUSTAINABLE HARVEST OF *GARCINIA GUMMI-GUTTA* IN AGHANASHINI –LION-TAILED MACAQUE CONSERVATION RESERVE, WESTERN GHATS, INDIA

Background

Forests of Sirsi-Honnavaara, over the last decade, has seen a rapid decline in the vegetation cover of estimated yearly loss of 1.9%, in which largest population of Lion-tailed Macaque (LTM) was first

identified in 2002 and reconfirmed and the boundaries marked to declare as a protected area in 2008. A result of this is the Aghanashini Lion-tailed Macaque Conservation Reserve (ACR). Out of the 13 Non-timber Forest Produce (NTFP) collected by people from ACR, nine of them are food of LTM of which *Garcinia gummi-gutta* (Uppage) is the most widely extracted NTFP by all sections of the society. Uppage is the most important food item in the wet season for the LTM as it constituted 16.41% and contributes 7.14% in its

overall diet. These findings were of good interests to the forest managers and they were keen on banning extractions of NTFP. An assessment of NTFP species availability in the region, a study to develop a model for sustainable harvest of *uppage* and its impact on stand structure, regeneration, and its management for the forest managers.

Objectives

- To know the distribution and abundance of NTFP tree species in ACR
- To develop a model for sustainable harvest of *Garcinia gummi-gutta*
- To evaluate the impact of sustainable harvest on stand structure and regeneration of *Garcinia gummi-gutta*

Principal Investigator	: Honnavalli N. Kumara
Research Personnel	: K. Santhosh
Project Period	: 18 months
Date of Commencement	: April 2012
Expected date of Completion	: September 2013
Budget	: Rs. 8.85 lakhs
Funding source	: Rufford Small Grants
Status	: Ongoing

Methods

Assessment of the status of NTFP will be done by gridding the whole area and assessing its abundance in each of 10 km² grids. Participatory methods were developed to ensure the involvement of local stakeholders for sustainable resource sharing.

Results

Stand structure of Woody plant species

Hosthota area :

In total 1503 woody plants belonging to 57 genera and 71 species spread over 32 families were recorded from 132 circular plots (10m radius) in Hosthota area. Among these *Knema attenuata* was represented by maximum number of individuals (n=238) followed by *Diospyros sylvatica* (n=185), *Hopea ponga* (n=158) and *Holigarna arnottiana* (n=111). The highest Important Value Index (IVI) was recorded for *Knema attenuata* (28.6) followed by *Diospyros sylvatica* (23.94), *Hopea ponga* (19.76) and *Olea dioica* (14.21).

Chiksuli Area :

1383 woody plant belonging to 73 species, 54 genera spread over 31 families were recorded from 128 circular plots (10 m radius) in the study site of Chiksuli of Group 2 range. Among them *Olea dioica* was represented by maximum number of individuals (n=128) followed by *Knema attenuata* (n=100), *Aglaia roxburghiana* (n=92) and *Garcenia talbotti* (n=89). The highest Important Value Index (IVI) was recorded for *Olea dioica* (17.89) followed by *Knema attenuata* (15.61), *Aglaia roxburghiana* (14.41) and *Garcenia talbotti* (13.00).

NTFP trees :

Garcenia gummi-gutta showed the highest density in Hosthota (14.2) followed by Chiksuli (11.2) and Devgaar (13.1). *Myristica dactyloides* showed highest density in Devgaar (13.1) followed by Chiksuli (4.2) and Kodgi (2.6). Hosthota showed highest density of *Mangifera indica* (2.8) while the density of *Myristica malabarica* is being high in Devgaar (2.2) and *Garcenia morella* being high in Hosthota (21.0). Densities of *Piper nigrum*, *Entada scandens*, and *Canarium strictum* remained negligible in all the areas while Kodgi showed comparatively higher density of *Artocarpus lakoocha* (0.6).

Discussion

The population of LTM in Sirsi-Honnava is the largest one in its distribution range. In the area, many low income class people leading livelihood using forest products of which many are food trees of LTM. The status of NTFP species is unknown of which *Garcinia* an understory tree valued for its fruit as food for the LTM and important NTFP for the local people. An evaluation of NTFP abundance with a study to develop a model for sustainable harvest of *Garcinia* having minimal effect on forest and LTM and its impact on stand structure and regeneration is vital.

ESTIMATION OF ABUNDANCE OF FERAL ELEPHANTS IN INTERVIEW ISLAND SANCTUARY, ANDAMAN AND NICOBAR ISLANDS, INDIA

Background

Many tropical islands are rich in endemism and Andaman and Nicobar Islands are such a group of islands with high biodiversity and endemism. However, many domesticated animals were introduced to these islands in the last century viz. goat, cat, dog, chital and elephant. Over the time, many of these animals have become feral in these islands. The elephants were brought from the mainland in the early 1960s for timber

operations and abandoned, during 1962. The Interview Island was declared as a sanctuary in 1985 mainly to protect the feral population of elephants. When the elephants were released, they were 40 in number. During 1994, estimated number of elephants in the islands was 70 using dung-count methods. The numbers were supposed to have increased from 40, but in a recent study during 2001, the number was estimated between 30 and 35. However, the status of elephant population in the Interview Island Sanctuary was not known,

<i>Principal Investigator</i>	: <i>Honnavalli N. Kumara</i>
<i>Co-investigator</i>	: <i>Manchi Shirish S</i>
<i>Project Period</i>	: <i>4 months</i>
<i>Date of commencement</i>	: <i>April 2012</i>
<i>Expected date of completion</i>	: <i>August 2012</i>
<i>Budget</i>	: <i>1.72 lakh</i>
<i>Funding source</i>	: <i>Andaman and Nicobar Forest Department</i>
<i>Status</i>	: <i>Completed</i>

thus we undertook a survey to estimate the abundance of surviving feral elephants in the Interview Island Sanctuary.

Objectives

- To estimate the abundance of feral elephants in the Interview Island Sanctuary
- To document the herd size and demography of feral elephants in the Interview Island Sanctuary

Methods

The field survey was carried out between April and July 2012. We used dung count method, and tracking and photo trapping for the identity of individuals and herd to estimate the elephant abundance in the sanctuary.

Results

A total of 7.79 km of strip with a width of 20 m and 8.3 km of strip with 13 m was covered for dung count. The total area sampled was 0.2637 km², in which 36 dung piles were recorded, which provide a density of 136.52 dung piles per km². We used dung density to estimate the density of elephants by using defecation rate and dung decay rate, which was estimated for wild elephants in the Western Ghats and Interview Island respectively. That would mean 0.109 elephants per km². We observed the elephants using adjoining mangrove forests, uplifted area due to Tsunami, which has been in the transition of vegetation success, and part of the creek. However, some areas with thorny scrub without much vegetation, rocky plates and mangrove forests have not been used by elephants that were considered as non-suitable habitat, thus we considered about 100 km² as a suitable habitat available for the elephants in the sanctuary. Therefore, the estimated number of elephants (minimum population size) for the sanctuary is 10.9 individuals. We also observed group of dung piles deposited at same time with varying size including young

calf and juvenile. This confirms the existence of at least one herd of elephants with a minimum of five individuals. Thus, the minimum population size of feral elephant in the Interview Island Sanctuary would be 11.

Discussion

The earlier estimation was based on the dung density, defecation and decay rate of the dung. The defecation rate was calculated using domestic elephants in the main land, where they are fed on soft and boiled food, which will have greater impact on the defecation rate, thus we used the defecation rate calculated for the forest elephant in the mainland. However, we used the decay rate estimated in Interview Island. The present estimate of low abundance raises question on the earlier estimates. If the estimation during 1993-94 is precise, then, though it is difficult to conclude and find the reasons for the decline of elephants, it is apparent that the size of feral elephant population in the Interview Island has declined sharply. The evidences that we have recovered on skeletal remains of elephant's supports the large number of deaths as one of the driven reason for the decline in the population size, however, the reason for the death may be compound effect of lack of food resources and hunting by people.



ECOLOGICAL INVESTIGATION OF WOODY VEGETATION AND NEST TREE USE BY BIRDS IN THE RIVERINE FORESTS OF ATHIKKADAVU VALLEY, WESTERN GHATS

Background

Two important tree strata namely bole and canopy are heavily used by birds for nesting. While the cavity nesters such as parakeets, owls, barbets, hornbills, woodpeckers, and mynas use the cavities of live and dead trees, stick-nesting raptors such as kites, eagles, vultures and owls use the tree canopy. Cavity nesting birds prefer diseased, dying or dead trees because it is easier to find or excavate cavities in such

trees. In India, more than 100 species of tree-cavity nesting birds have been identified, but very little information is available about their breeding habits. As the forest department does not give adequate attention to the snags, the birds are left with fewer places to nest. Riparian forests are exceptionally rich in woodpeckers, parakeets, tits and owls and protecting the trees favoured by birds, attract a variety of birds. Anthropogenic interventions such as tree felling, non-timber forest produce collection, agricultural activities alongside the

forests threaten birds that nest in cavities of tree trunks and canopies. Hence, it is felt that a study on tree diversity and its use by birds in the riverine forests of an important river system-the Bhavani a tributary of Cauvery would be useful for protecting the biodiversity.

Objectives

- Quantify the woody vegetation and estimate their abundance in the riverine forests of the Athikkadavu Valley of the river Bhavani, Western Ghats
- Identify the nest trees used by cavity-nesting birds and assess the characteristics of nest trees
- Find out the nest trees used by stick-nesters, especially raptors and assess the nest tree characteristics
- Assess the threats to the nest trees and suggest conservation measures

Methodology

Quantification of vegetation: Woody vegetation along riverbanks was enumerated by making repeated walks along riverbanks and recording the species encountered. A preliminary list was prepared. Subsequently, woody vegetation was quantified by using belt-transect method. All the stems measuring >20 cm GBH (Girth at Breast Height) were enumerated. Snags were also counted. Two belt transects, totaling 2 ha in area were sampled.

Observations on cavity-nesters and nest tree and cavity characteristics: Nest trees were located by making repeated walks along riverbanks. The plant species on which nests are placed are identified and recorded. Data on nest characteristics and nest-sites are collected. Nest tree parameters such as height of the tree, height of the nest location, placement and orientation of the nest and cavity dimensions were recorded.

Principal Investigator	: P. Balasubramanian
Research Personnel	: P. Manikandan
Duration	: Three years
Date of Commencement	: April 2012
Date of Completion	: March 2015
Budget	: Rs 10.72- lakhs
Funding Source	: MoEF, Gol
Status	: Ongoing

Observations on stick-nesters, nest trees, and canopy features: Stick-nests of raptors were located by making repeated walks along riverbanks. Trees species, its features, including the canopy characteristics and nest location, etc were observed and recorded.

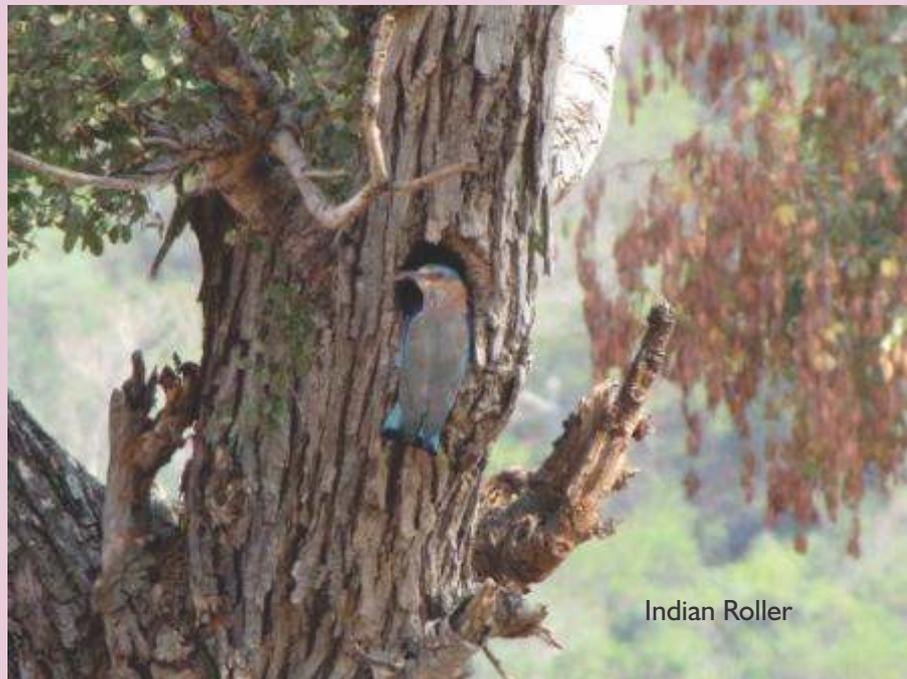
Threat assessment to trees: Potential human disturbances include cutting, lopping, and Non-Timber Forest Produce collection. While sampling the woody vegetation, human disturbances such as number of branches, stems cut and trees felled etc were noted. Based on the disturbances, tree species were grouped into (i) highly exploited (ii) Moderately exploited and (iii) mildly used.

Results

Ninety-five woody plant species belonging to 36 families were enumerated. Moraceae constituted the largest family with 11 species. Ebenaceae and Fabaceae are represented with five species each. At the generic level, Ficus has the highest species (8). Quantitative data on vegetation is being analyzed.

One hundred and thirty bird species belonging to 38 families were recorded. Out of 38 families, Cuculidae constituted the largest family with 11 (8.5%) species followed by Corvidae 10 (7.7%). Muscicapidae and Accipitridae represented by eight (6.2%) species each.

A total of 31 cavity nesting birds have been recorded so far. Major proportion of cavity nesting birds included woodpeckers, owls and mynas (16.13% each) followed by parakeets (12.90%), hornbills and barbets represented by 9.68% each. Nest tree searches were done along riverbanks for finding out the presence of tree cavities in tree trunks. Twenty-three cavity bearing tree species belonging to 18 families were recorded in the study area. Sixty-six active nest holes were used by different birds in the riverine forests. Out of the 66 active tree holes, highest number was used by Common Myna (14; 21.21%) followed by Jungle Myna (9; 13.64%) and Blue-winged Parakeet and Brown-headed Barbet represented by seven nests each (10.61%). Majority of the hole nests were found in *Mangifera indica* (14.06%) followed by *Ceiba pentandra* (10.94%), *Ficus benghalensis* and *Melia dubia* (7.81% each).



Indian Roller

Seven species of raptors belonging to Accipitridae were recorded in the study area. These included Brahminy Kite, Black Kite, Jerdon's Baza, Greater Grey-headed Fish Eagle, Crested Serpent-eagle, Black Eagle and Bonelli's Eagle. Grey-headed Fish Eagle used three nest tree species viz. *Mangifera indica*, *Calophyllum apetalum* and *Terminalia bellerica*. Jerdon's Baza's nests were located on two tree species namely *Hardwickia binata* and *Albizia lebbek* and Bonelli's Eagle nest found on *Terminalia arjuna*.

AVIAN FRUGIVORY AND SEED DISPERSAL OF ENDEMIC TREE SPECIES IN *THAI SHOLA* FOREST OF NILGIRI HILLS, WESTERN GHATS

Background

The mountain grassland and adjacent tropical evergreen forests, locally called as shola forests of the Western Ghats form a distinctive vegetation mosaic. These forests were found extensively in the higher elevations of the Nilgiris and Palani hills of southern India, but due to agricultural expansion, conversion to

Principal Investigator	: P. Balasubramanian
Research Personnel	: C. Anbarasu
Duration	: 6 months
Date of Commencement	: April 2012
Date of Completion	: October 2012
Budget	: Rs 1.00 lakh
Funding Source	: Tamil Nadu Forest Department
Status	: Completed

plantations, livestock grazing pressure and development, a high proportion of this forest type has been destroyed. It has been estimated that half of the shola forests in the Nilgiris have been destroyed since 1849. As a part of habitat restoration measures, the Tamil Nadu Forest Department has undertaken an afforestation initiative in the Nilgiris. In order to identify suitable native bird-attracting species for afforestation, the forest department entrusted a project to SACON.

Objectives

- Assess the role of avian frugivores in seed dispersal of endemic tree species of *Thai shola* forest
- Find out appropriate native bird-dispersed tree species for *shola* forest afforestation

Methodology

Phenology: Phenological observation was carried out on 200 tagged trees belonging to 20 species. Ten individuals per species were marked and observed once in a month. During the phenology phase, flowering and fruiting phase were recorded. Percentage of occurrence of flowers and fruits in the canopy were noted.

Vegetation Sampling: Vegetation sampling was done at three sites of *Thai shola*. Quadrat method was used for sampling. Ten quadrats of 50x20 m size were laid in each site, covering 3 hectares. In each of the quadrat, number of individuals of trees and girth at breast height (GBH) were noted. The data was analyzed to obtain quantitative structure and composition of the plant communities in the study area.

Fruit foraging by frugivorous birds : Data on bird foraging was recorded by observing activities of birds foraging on fruit bearing plants. The fruit bearing plants with good visibility for the observer was selected for extended bird feeding watches. Observations were carried out in the morning from 6 - 9 am and in the evening from 3-6 pm. The extended feeding observation were made by using binoculars. During the extended observation, we recorded the frequency of bird foraging visits. Birds that visited to eat the fruits alone were recorded. In addition, birds' fruit handling method, viz., whether swallowed wholly or eaten in piecemeal, etc were noted.



Oriental white eye

Results

Occurrence of fruiting seasonality was noticed in the *shola* forest. While peak fruiting was observed during south-west monsoon, a trough in activity was noticed during summer. 645 individuals of trees belonging to 48 species were recorded in the site 1, whereas in the site 2, 862 individuals belonging to 67 species were recorded. Site 3 recorded 1058 individuals belonging to 53 species. Predominant tree species of Thai *shola* include *Syzygium montanum*, *Elaeocarpus recurvatus* and *Cinnamomum sulphuratum*.

Twelve endemic fleshy-fruited tree species were observed for frugivory studies in the Thai *shola* forest. In total, 24 species of birds belonging to 11 families were recorded to eat fruits. Maximum number of avian visits was made by members of Pycnonotidae (32.99%) followed by Muscicapidae (30.96%) and Columbidae (18.52%). 1928 birds made fruit foraging visits. Red-whiskered Bulbul (18.62%) and Nilgiri Laughingthrush (15.25%) constituted the predominant avian visitors to fruits. Red-whiskered Bulbul foraged 12 fruit species followed by Nilgiri laughingthrush (10 species) and these two species appear to be the principal seed dispersers in the *shola* forest.



Red- whiskered Bulbul

In total, eight plant families were utilized by avian frugivores in the Thai *shola* forest. Maximum number of avian frugivores visited Lauraceae (30.24%) followed by Myrtaceae (14.21%). Among the eight plant families studied, Myrtaceae supported highest number of species (17) followed by Symplocaceae (11 species) and Lauraceae (10 species).

Discussion

The present study indicates that Bulbul, Nilgiri laughingthrush and pigeon are the major frugivores and seed dispersers in the Thai *shola* forest. Our earlier study in two other *shola* forests, Longwood and Epanadu of the Nilgiris also revealed the predominant role of these groups of birds in frugivory and seed dispersal of trees.

This study clearly indicates that Sapotaceae, Lauraceae, and Myrtaceae are important food plants of fruit eating birds in the Thai *shola* forests.

The vegetation study indicates that Lauraceae and Myrtaceae are the dominant tree species in the Thai *shola* forest. Similarly, Lauraceae is found to be the biggest family in four other *shola* patches of Nilgiris (Mohandas et al 2009) and Pulney hills (Davidar et al. 2007). Hence, conservation of Lauraceae trees attains importance.

Recommendations

As endemic bird species such as Nilgiri laughingthrush, Nilgiri Wood-pigeon and Grey-headed Bulbul were found to favour endemic fruit species of Lauraceae and Myrtaceae, a list of bird-dispersed endemic tree species with details on their abundance, fruiting season, avian seed dispersers and micro-habitat has been provided to the forest department for inclusion in *shola* afforestation program.

MONITORING OF PESTICIDE RESIDUES IN SELECT COMPONENTS OF AN AGRO-ECOSYSTEM ADOPTING ORGANIC AND CHEMICAL FARMING IN PADAYETTI VILLAGE, PALAKKAD DISTRICT, KERALA

Background

Challenged by many environmental concerns, there have been attempts world over, to develop alternate methods of farming which are environment-friendly and economically viable. It may be noted that the annual consumption of pesticides mainly for agriculture in India has crossed 50,583 metric tons (MT) from

a mere 5,000 MT during 1960s. Several studies have shown that pesticides could cause a plethora of health problems. At this juncture, Kerala State Biodiversity Board through Directorate of Environment and Climate Change launched a demonstration project known as “Granary of Kerala” in Palakkad district in 2009 to conserve biodiversity associated with agro-ecosystems. As part of this mission, SACON was entrusted with an assignment to monitor the residues of pesticides in organic and chemical farms in Padayetti village.

<i>Project Investigator</i>	: S. Muralidharan
<i>Research Personnel</i>	: K. Ganesan (until 15th June 2012) S. Suresh Marimuthu (25th Sep - 25th Dec 2012)
<i>Duration</i>	: Three Years
<i>Date of Commencement</i>	: May 2009
<i>Date of Completion</i>	: December 2012
<i>Budget</i>	: Rs 15.45 lakhs
<i>Funding Source</i>	: Directorate of Environment and Climate Change, Government of Kerala
<i>Status</i>	: Completed

Objective

- Monitor pesticide residues in select components of an agro-ecosystem adopting organic and chemical farming

Methods

- Samples of components, namely sediment, crab, snail, fish, frog, paddy, fodder and cow-milk were collected from organic and chemical paddy agro-ecosystem on seasonal basis and processed for multi residue estimation. Qualitative and quantitative analyses of organochlorines (OCs), organophosphates (OPs), synthetic pyrethroids (SPs) and carbamates (Cbs) were performed with GC-MS at Agilent Technology’s laboratory, Bangalore



Application of neem based pesticide by an organic farmer

Results

Pesticide residues in different components of the agro-ecosystem in Padayetti village:

a) Residues of Organochlorine pesticides

Total OC residues were detected in five out of 30 pooled samples (16.67 %) analysed with the highest (30.90 ng/g) in sediments of chemical farms collected during Khariff season (2009-10) and lowest (2.34 ng/g) during summer season (2010-11). Among the OC residues detected in different biotic components, -HCH was higher in the tissues of frog *Fejervarya limnocharis* (81.14 ng/g; 2009-10 summer season), followed by snail *Pila globosa* (80.90 ng/g; 2009-10 Khariff season) and crab *Geothelphusa dehaani* (72.30 ng/g; 2011-12 summer season) collected from chemical farm than organic farm. Presence of trace amounts of -DDT, Dieldrin and Heptachlor in few samples of crab, snail and frogs collected from both organic and chemical farms might indicate the past use in this region. However the residues of -HCH in crabs were significantly varied between the seasons (ANOVA F = 37.07; P < 0.05). Similarly the residues of same compounds in snails significantly varied between the seasons and years (ANOVA F = 8.30; P < 0.05). This has led to the significant variation of Σ OC residues in snail samples collected during different years (ANOVA F = 8.04 P < 0.05), while levels of other OC pesticides such as Endosulfan, Aldrin, Chlordane and Mirex were found to be below detection limit (BDL) in all the components studied from both the farms.

b) Residues of Organophosphate pesticides

Among a set of commonly used OP compounds analysed, residues of Chlorpyrifos (14.72 ng/g; 2009-10 Rabbi season) and Triazophos (17.71 ng/g; 2009-10 summer season) were detected at higher levels in sediments from chemical



Application of Quinalphos (Ekalux 25% EC), an OP pesticide to control stem borers in paddy

farms, while in organic farm, the levels of all the OPs were BDL. In frogs collected from chemical farms concentrations of Quinalphos and Phorate were in the range of BDL- 7.19 and BDL- 3.35 ng/g respectively, while in frogs from organic farms, the concentrations of Quinalphos and Phorate were in the range of BDL- 3.89 and BDL- 2.78 ng/g respectively. The levels of Pirimiphos Ethyl and Ethion were BDL in all the components studied. Malathion (BDL- 5.38 ng/g in Ishwaryam variety) and Quinalphos (12.27 ng/g; Jothimatta variety) were detected only in paddy straw collected from chemical farms during Rabbi and Khariff seasons (2009-10). Among all the OP compounds, Methyl Parathion (30.09 ng/g) was detected the maximum in milk samples collected from cows which were fed with feeds available in the market and

fodder grown in chemical farms than in milk collected from cows fed with only feeds grown in organic (22.64 ng/g) farms. The statistical analyses of the OP residues in various components showed that Chlorpyrifos residues in crabs varied significantly between seasons (ANOVA $F = 18.81$; $P < 0.05$) as well as between organic and chemical farms (ANOVA $F = 9.47$; $P < 0.05$). Similarly the Σ OP residues in crabs also varied significantly between the years (ANOVA $F = 9.51$; $P < 0.05$) as well as between the seasons (ANOVA $F = 15.18$; $P < 0.05$). Quinalphos residues in fodder also varied significantly between the farms as well as seasons (ANOVA $F = 27.60$; $P < 0.05$).

c) Residues of Synthetic pyrethroid pesticides

Two isomers of Fenvalerate, namely Fenvalerate I (28.11 ng/g) and II (34.70 ng/g) were the only pyrethroids detected in sediments collected from chemical farms during 2011-12 Rabbi season, while it was BDL in organic farms. Among the other components, paddy straw (Jothimatta: 6743.02 ng/g; 2009-10 Rabbi Season), crab *Geothelphusa dehaani* (98.70 ng/g; summer 2011-12), frog *F. limnocharis* (71.38 ng/g; 2009-10 Rabbi season) and snail *Pila globosa* (20.33 ng/g; 2009-'10 Khariff season) collected from chemical farms had recorded high concentrations of Σ Fenvalerate residues. Residues of Fenvalerate II detected in crabs alone were significantly different between the seasons (ANOVA $F = 229.80$; $P < 0.05$). Further, these residues were not detected in any of the organic farm fodder, crabs, and snails. Out of 109 frogs collected, seven were found to have deformities (6.42%). Interestingly, all these deformed frogs were collected from chemical farms. The levels of synthetic pyrethroid, Fenvalerate II were observed to be 42.15 ng/g and 26.91 ng/g in deformed *Hoplobatrachus crassus* and *Fejervarya limnocharis* respectively, whereas these pesticides were BDL in normal frogs analysed from both organic and chemical farms. Levels of Permethrin were BDL in all the components in both organic and chemical farms.

d) Residues of Carbamate pesticides

Commonly used carbamate pesticides such as Carbaryl and Carbofuran were analysed. Among all the components collected during the years, one of the dead crabs collected from the chemical farms recorded 3501.91 ng/g of Carbaryl (Rabbi 2011-12). Trace amount of the Carbofuran was detected in two samples of cow milk (5.23 ng/g: Summer Rabbi 2009-10) and one of the frogs *F. limnocharis* (2.09 ng/g) collected from chemical farm during Khariff 2011-12. In other components, these pesticides were found at BDL in both the farms.

Discussion

Technical HCH is a broad-spectrum OC insecticide that was available for decades and used throughout the world including in the present study area for agricultural and non-agricultural purposes because of its effectiveness and low cost. The isomeric forms of HCH are toxic and recalcitrants. They exhibit both acute and chronic toxicity, particularly γ -isomer acts as environmental estrogen. Use of HCH continued unabated until it was banned in 1997 in India, but restricted use was allowed for lindane (99% γ -HCH) until 2011. Presence of DDT compounds in agricultural components of Padayetti village indicates that the availability or use of DDT in the area might have been very limited. However, considering the facts that the DDT has a half-life of 10-20 years, it degrades to DDE and DDD and possibility of fresh inputs of DDT into environment through the usage for public health needs, it becomes even more imperative to monitor the environmental fate of this legendary chemical. Endosulfan is an off-patent OC insecticide and acaricide that is being phased out globally. Endosulfan became a highly controversial agrochemical due to its acute toxicity, potential for bioaccumulation, and role as an endocrine disruptor. Because of its threats to human health and the environment, a global ban on the manufacture and use of endosulfan was negotiated under Stockholm Convention in April 2011. Although the Supreme Court of India has banned manufacture, sale

and use of endosulfan in the country, it is necessary to keep track of this chemical's fate in the environment.

Recommendations

- Some of the currently used pesticides such as OPs, SPs, and Cbs are highly toxic across the food chain including man. These classes of pesticides have relatively short half-lives in tissues, but nonetheless can still evoke toxicity. Hence, regulatory agencies in India should consider imposing restrictions on the use of these pesticides
- In India although submission of toxicity data on birds and mammals are necessary for registration of a new molecule, for amphibians to-date, no reference is made in the registration process. Our results indicate that existing risk assessment procedures for pesticide formulation need to be strengthened to protect also the amphibians
- We hope that our work will encourage further investigations on the role of agrochemicals on frog declines, given that to-date there has been relatively very little research on contaminants in India
- Farmers have to be provided with safe alternatives to handle pests without compromising on productivity. Agricultural subsidy offered to farmers towards preserving biodiversity and promoting organic farming need to be more flexible to fit different levels of farmers
- Production of organic fertilizers (neem and castor oil cakes), biopesticides, bionutrients and green manures should meet the demands

MONITORING AND SURVEILLANCE OF ENVIRONMENTAL CONTAMINANTS IN BIRDS IN INDIA

Background

Causality of birds due to pesticide poisoning has become rampant across the agricultural landscapes in the country. What is publicized and how much of it goes into official records is a minuscule percentage of the reality. In this direction, a study was initiated and the same is in its third year.

Objectives

- Monitor residue levels of persistent chemicals in birds and generate a database
- Identify chemicals responsible for mass mortality of birds across the country
- Assess the effectiveness of guidelines on usage of major chemical pesticides in the country

<i>Principal Investigator</i>	: S. Muralidharan
<i>Research Personnel</i>	: K. Ganesan, K. Nambirajan, V. Kirubhanandhini
<i>Project Period</i>	: Three Years
<i>Date of Commencement</i>	: March 2010
<i>Date of completion</i>	: March 2013
<i>Budget</i>	: Rs 48.36 lakhs
<i>Funding Source</i>	: MoEF, Govt. of India
<i>Status</i>	: Extension is requested

Methods

Efforts were made to collect dead birds from all over India. Opportunistic sampling strategy and organized field visits were followed to collect samples. Multi residue method was used for extraction of pesticides, and residues were measured in GC-ECD and GC-MS. For metal analysis, Microwave Digestion System was used for digestion of samples and AAS with graphite furnace was used for estimation. Residues of Diclofenac and cholinesterase activities were estimated using HPLC equipped with UV detector and UV/Vis Spectrophotometer respectively.

Results and discussion

During 2012-13, 172 individuals comprising 56 species of birds were collected dead from different states in India. Notable species were Demoiselle Crane, Painted Stork, White-backed Vulture, Long-billed Vulture, Spot-billed Pelican, Common Coot, Eurasian Eagle Owl, Marsh Sand Piper, White-necked Stork, Slaty-legged Crake, Red-crested Pochard, and Common Moorhen. Forty-seven blood plasma samples from 16 species of live birds and 73 brain samples from 19 species of dead birds collected from Ahemadabad were analysed for cholinesterase activity.

Incidences of poisoning in birds in India

a. Mortality of Peafowl

“Fifty peafowl poisoned to death” was the shocking Newspaper report on 7 August 2012 from Anaikaradu Forest range near Keveriammapatti, Dindigul Dt. Tamil Nadu. On survey it was learnt that farmers had laced millet with Thimet 20G (Phorate) and Furadan 2G (Carbofuran), and spread across the field to get rid of rodents. A flock of Peafowl (15 Nos.) which fed on those treated seeds died. Post-mortem report of the dead birds and circumstantial evidences were supportive of poisoning.

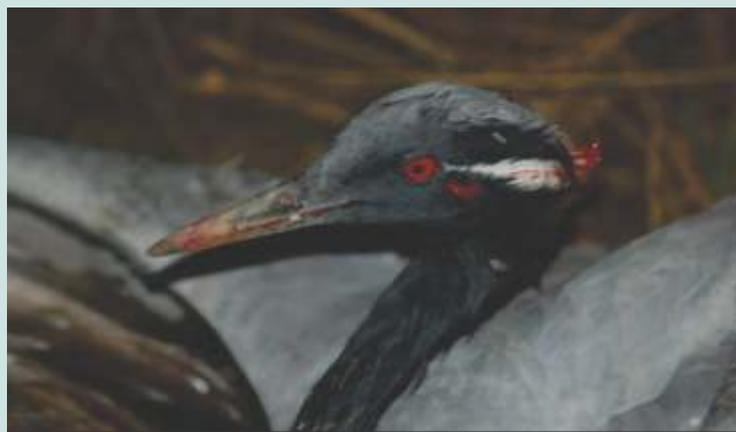


Peafowl poisoned to death: Keveriammapatti, Dindigul Dt. Tamil Nadu

Photo: The Hindu

b. Mortality of Demoiselle Crane : Phorate and suspected rodenticide poisoning

This time again, it was the media which made people to know about the mass death of D. Cranes in Amreli and Surendranagar district in Gujarat during early December 2012. Sadly, mortality of D. Cranes continued in Victor Dam near Rajula, Mansarovar Lake near Sayla, Kodinar and Kutch for about two weeks. Field survey was carried out by SACON to ascertain the reason. Kathiyavadar, Victor, Thalavu



Bleeding Demoiselle Crane a typical symptom of rodenticide poisoning? in Kathiyavadar dam, Rajula, Gujarat

Photo: S Suresh Marimuthu

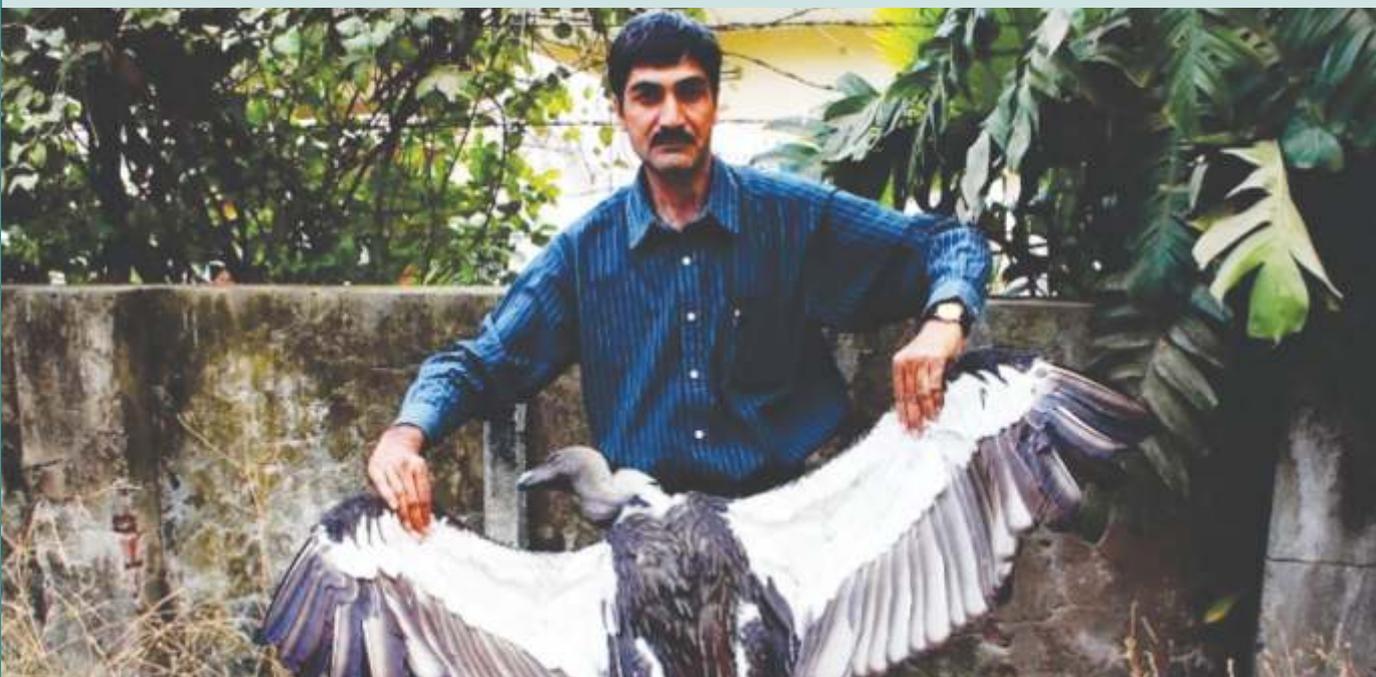
are the dams near Rajula where large flocks of D. Cranes with many sick birds were noticed congregating. Feral dogs and Marsh Harriers preyed upon dying and moribund D. Cranes. Birds with inability to fly, tottered walk, shallow breathing and bleeding on the head and beak were noticed. These symptoms are typical of rodenticide poisoning. Samples were screened for various chemical contaminants in the laboratory and residues of phorate in tissues of dead birds confirmed the poisoning. Phorate is an organophosphorus (OP) pesticide, extremely toxic to mammals and other non-target organisms including birds (WHO/FAO factsheet 1988). Granular formulations of phorate is available in the trade names of Jackpot, Thimate, Foril, Dahn 10G and phoradox (Central insecticide board of India, 2013). It is moderately persistent in the soil with a half-life up to 173 days depending on the environmental conditions.

Other incidences of poisoning or suspected cases of poisoning in birds in India

Around 150 House Swift were reported dead in Madurai (Tamil Nadu) during April 2012. Analysis confirmed that DDE was responsible for the death. Samples of birds, namely Red-crested Pochard and Common Moorhen received from Sitarganj Forest Range, Uttarakhand had high levels of chlorpyrifos suggestive of poisoning. We have also confirmed reports on the death of Great Cormorants and Greater Pelicans (around 50 Nos) in Kaziranga National Park Assam, Peafowl in Rajasthan (12 Nos), Madhya Pradesh (7 Nos) and Maharashtra (13 Nos) and Tamil Nadu (33 Nos), Blue Rock Pigeons in Pune (38 Nos) and Ahmedabad (>50 Nos), Cattle Egrets in Amreli Dt of Gujarat and Crows in Vellalore dumping yard at Coimbatore. While circumstantial evidences were pointing towards chemical poisoning, samples of tissues could not be obtained for analysis.

Organochlorine pesticide residues in dead birds collected from Tamil Nadu and Kerala

Totally 18 and 22 individuals belonging to eleven and nine species of birds found dead in Mayiladuthurai (TN) and Palakkad (Kerala) respectively were analysed for pesticide residues in various tissues, namely muscle, liver, kidney, brain, and gut content. Gut content of Indian Treepie collected from Mayiladuthurai and liver of Blue-faced Malkoha collected from agro-ecosystems of Palakkad detected fairly high concentration of p,p'-DDE and -HCH, respectively. However, the residue levels in all these birds did not indicate poisoning.



Moribund Oriental White-backed Vulture, at Jivdaya Charitable Trust, Ahmedabad

Photo: Aditya Roy

Diclofenac residues in Vultures received from Assam and Gujarat

During 2012-13, samples of 24 vultures comprising four species, namely Oriental White-backed Vulture, Long-billed Vulture, Slender-billed Vulture and Himalayan Griffon from Gujarat (20 Nos) and Assam (5 Nos) were analysed for residues of diclofenac. Levels ranged between 162.90 ng/g in Oriental White-backed Vulture collected from Kadi district of Gujarat and 497.26 ng/g in the same species collected from Ahmedabad. It may be noted that the concentration associated with the toxicity of diclofenac ranged from 250 to 1000 ng/g. Further, in one of the Oriental White-backed Vulture, which was found to have visceral gout during postmortem examination, the liver tissue had 891.85 ng/g of diclofenac. Although use of diclofenac for treating cattle was banned in India in 2006, it is evident that the drug is still being illegally used.

Levels of heavy metals in birds

Levels of Cu, Pb, Cr, Cd, Ni and Zn in Sarus Crane and Black Kite collected from Gujarat were analysed. Muscle tissues of Black Kite had higher concentration (3.01 $\mu\text{g/g}$) of chromium than Sarus Crane (2.15 $\mu\text{g/g}$). The maximum level of lead was (1.74 $\mu\text{g/g}$) in the heart of Sarus Crane. Samples of rest of the species collected from seven other states of India are being analysed.

Cholinesterase activity in blood plasma and brain tissues of birds

a) Acetyl cholinesterase activity

AChE activity in plasma ranged between 0.10 mol/ min/ ml in Blue Rock Pigeon and 4.15 mol/ min/ ml in the Common Moorhen. The highest levels of mean brain AChE activity was observed in Eurasian Collared Dove (43.40 $\mu\text{moles/min/g}$) and lowest activity was in Black Ibis (6.80 \pm 0.82 $\mu\text{moles/min/g}$). The variation in plasma and brain AChE activity among the species studied was significant ($P < 0.05$).

b) Butyrylcholinesterase activity

Mean plasma BChE activity was found to be the highest in Black Ibis 1.58 mol/min/ml and lowest in Oriental Honey Buzzard 0.92 mol/min/ml. The variation in brain BChE activity among the species studied was not significant ($P > 0.05$).

c) Carboxyl esterase activity

Carboxyl esterase activity was the highest (0.06 mol/min/ml) in Blue Rock Pigeon and lowest (0.01 mol/min/ml) in Long-Billed Vulture. Plasma carboxyl esterase activity was inversely related to the body size of the bird. Data gathered in this study is also in support of the same. Variation in activity among the species was highly significant ($P < 0.05$). It may be noted the activity levels of these esterases help in understanding the degree of exposure to pesticides. The project is in its final year. Analysis for metals and pesticides in birds collected so far being continued.

It is adequately evident that birds do suffer across the country due to contaminants particularly pesticides. Our effort towards addressing the issue has been an ongoing exercise.



MONITORING THE IMPACTS OF JANGI WIND POWER FARM (91.8 MW) WITH SPECIAL REFERENCE TO BIRDS AND BATS

Background

The study is aimed at monitoring and assessing the impact of wind turbines on birds and bats at the Jangi wind power farm. Information on impact of wind power facilities on avifauna or bats is scarce in India. However, it is reported to be of serious risk in other countries such as USA, UK and New Zealand.

Objectives

- Documentation of bird and bat populations in and around the project sites
- Identification of roosting sites of bats and population estimations
- Developing an effective monitoring protocol for bats and birds
- Recording the seasonal patterns in the migratory bird population and assess the importance of the area in terms of migratory route for birds
- Documentation of flight behaviour of birds in study area
- Evaluate the impact of the project on raptor roosting sites

<i>Principal Investigator</i>	: Arun P R
<i>Research Staff</i>	: Samsoor Ali and Ramesh Kumar
<i>Project Period</i>	: Three years
<i>Date of Commencement</i>	: May 2011
<i>Expected date of completion</i>	: April 2014
<i>Budget</i>	: Rs 58.328 lakhs
<i>Funding source</i>	: M/s Genting Energy
<i>Status</i>	: Ongoing

Methodology

A total of 70 points (50m radius) and three line transects (3km length and 100m width) were sampled repeatedly from July 2012 to March 2013 in and around the wind farm in order to study the avian community (especially passerines) of the area. A total of 10 points (500-800m radius around wind farm) were also sampled in order to record the raptor activities and flight activity of birds in the wind farm. Total count method was used to count water birds in man made ponds, lakes and other water bodies in and around the wind farms. Surveys were

done regularly to record the nesting and roosting-sites of birds and bats in the study area. Three transects of 1 km length were surveyed in order to record the nocturnal bat activities with the help of ultrasonic bat call detector (BATBOX III D). To record the mortality of birds and bats at turbine sites, searches for fatalities were conducted at 51 turbines. Each turbine was searched via slow walking of spiral circles outwards from the base of the turbine (generally 100 m radius).



Flamingos near wind turbines

Results

Totally 166 species of birds belonging to 44 families were recorded during the study period which included three vulnerable and eight near threatened species. Among the 166 species, 16 diurnal raptor species and two nocturnal raptor species were recorded. In all, 61 species belonging to 15 families were winter migratory to the study area. Nine species of birds were found nesting in the study area. Nesting of Black Ibis and House Crow on power transmission line towers were also recorded. Eleven species of birds and one species of bat (*Pteropus giganteus*) were found roosting on trees in and around the wind farm. Four rounds of nocturnal bat survey revealed there are activities of insectivorous bats present in both turbine and adjacent areas. 85 bat echolocation calls (bat passes) were recorded in all three transects during four rounds of survey. Out of 166 species of birds recorded in the study area, 54 species belonging to 16 families, mostly raptor were found flying in the risk zone of the turbine (i.e. between 45m and 150m from the ground).

Fifteen bird fatalities (three unidentified species) were recorded under the wind turbines. Of these, three individuals each of Blue Rock Pigeon (*Columba livia*), House Crow (*Corvus splendens*) and Indian Peafowl (*Pavo cristatus*) were recorded. The dead birds were found usually close to the base of turbine, the distance ranged from 2m to 150m with an average of 44m from the base of turbine. During the survey, two carcasses of the Greater Mouse-tailed Bat (*Rhinopoma microphyllum*) under two different turbine sites were recorded.



Discussion

The study area supports rich and diverse avifauna that include both resident and migratory species as well as several species of conservation importance. The bird abundance varied markedly between seasons, abundance of birds were higher in migratory season than the non-migratory season. It is frequently assumed that collision mortality should increase with bird abundance because more birds are 'available' to collide. The present study adds to mounting evidence to this assumption as all the dead birds in the study were found in the migratory season when the bird abundance was high. Among 54 bird species recorded in risk zone, soaring birds were the most dominant species, which is alarming as the high risk of collision reported (from other countries) for raptors than other groups of birds. Moreover, the seasonal variation

in raptor species richness is also high in winter season, which leads to more collision risk of raptors. The nesting of House Crow and Black Ibis were found on transmission pylons. The lack of tall trees in the area may be the reason for these unusual nests. As the Genting Energy wind turbine towers are of tubular type there is no chance of nesting on the tower. The present study also reported that bats can be affected by the wind turbines. The estimated mortality rate by turbines during the present study was 0.02 birds/turbine/ year, which is low as compared to studies in other parts of the world. As the findings from the present study is incomplete, completion of this study would throw more light into our present understanding of wind power generation and associated impacts on avifauna and bats and the possibilities to mitigate the effects.

CUMULATIVE ENVIRONMENTAL IMPACT ASSESSMENT OF HYDRO ELECTRIC PROJECTS OF SUTLEJ RIVER BASIN IN HIMACHAL PRADESH-FAUNAL ASPECTS

Background

The River Sutlej, one of the key river basins featuring in the hydro development plan of the state of Himachal Pradesh, rises in the Tibetan Plateau, Rakastal-Mansarovar Lake. The Governments of India and Himachal Pradesh are working to exploit the full hydro-potential of the river basin through both private and public developers. The state holds the major projects like Nathpa-Jakhri (1500MW), Karcham-Wangtoo (1000MW) and many other small and medium hydroelectric projects.

<i>Principal Investigator</i>	: P R Arun
<i>Collaborating Agencies</i>	: ICFRE, AHEC, DCFR & FRI
<i>Research Personnel</i>	: Murugesan M., Ramesh C., Shanthakumar S.B. & Sony R.K.
<i>Project Period</i>	: One year
<i>Date of Commencement</i>	: July 2011
<i>Expected date of completion</i>	: Aug 2013
<i>Budget</i>	: Rs 55.56 lakhs
<i>Funding source</i>	: Govt. of HP through ICFRE
<i>Status</i>	: Ongoing

Starting from Kinnaur district to Bilaspur district, the river has been used for construction of more than 35 hydroelectric projects. These projects are mainly supplying power to Himachal Pradesh and other North Indian states. It has enabled to overcome power shortages in the region. The resources used for construction of dam and activities involved for generating the power could cause disaster to the environment. It also led to deleterious effect on fauna and flora, drying up of the riverbed and natural water springs, changed climatic conditions that would affect the livelihood activities. Hence, the Department of Energy, Government of Himachal Pradesh and Ministry of Environment & Forests, Government of India, had assigned the task of Cumulative Environment Impact Assessment in Sutlej basin to Indian Council of Forestry Research & Education (ICFRE), Dehradun. ICFRE is taking up this study in collaboration with other three partner institutions. Among them, Salim Ali Centre for Ornithology and Natural History (SACON) has taken up the study on terrestrial fauna including avifauna.

Objectives

- Inventory of avifauna and other terrestrial fauna from primary and secondary sources
- Evaluation of conservation importance of species (RET, endemics etc)
- Identification of existing protected areas

- Identify barriers and corridors for wild animals
- Determine the threats to wildlife
- Identification of ecologically sensitive areas
- Assess the cumulative impact of hydropower projects on fauna along the Satluj River. Prepare a suitable Environmental Management Plan (EMP) and mitigation measures to reduce these impacts on fauna and rivers
- Examine faunal Impacts of Baspa and Nathpa Jakhri projects as case study



Egyptian Vulture-an endangered species

Kashmir Rock Agama- A local common species

Methodology

Extensive field surveys were conducted from June 2012, covering the entire Sutlej river basin within the Himachal Pradesh from Koldam (500m) to Kunzam (4600m) covering 554 sampling points. Importance were given to those areas where maximum vegetation and agricultural fields were found while selecting the sampling points in the catchment area. Minimum sampling points were taken in high altitude areas due to proportionately lesser area availability and lack of vegetation and the harsh terrain.

The present study focused on five major faunal groups viz. i) insects (particularly butterflies), ii) amphibians, iii) reptiles, iv) birds and v) mammals and documented by both direct and indirect methods. Time constrained point counts, transect walks, and opportunistic observations were mainly used for documenting the overall faunal elements. Transects varying from 500 m to 1 km were used depending on the terrain and area availability.

Results

The present study results in the identification and documentation of 62 species of butterflies, 13 species of amphibians, 20 species of reptiles, 368 species of birds and 64 species of mammals. Among the 62 species of butterflies, Danaid Eggfly protected under both Schedules I & II and Green Sapphire under Schedule II. Only one species of amphibian i.e. Paa Frog protected under “vulnerable” category as per IUCN. Of the 20 species of reptiles, only one species i.e. Indian Monitor Lizard protected under Schedule I of Wildlife (Protection) Act, 1972. Species like Checkered Keelback, Spectacled Cobra and Indian Rat Snake are coming under Schedule II and species such as Banded Kukri Snake, Common Krait, Himalayan Keelback and Himalayan Pit Viper are coming under Schedule IV. Among the 368 species of birds, 18 species are included in various IUCN red-listed categories. Four species namely, Himalayan Quail, Indian White-backed Vulture, Long-billed Vulture and Red-headed Vulture are protected under “critically endangered” category. Egyptian Vulture is the only species, which is coming under the category “endangered”. Black Partridge, Cheer Pheasant, Great Slaty Woodpecker, Pallas’s Fish Eagle, Western Tragopan,

Yellow-throated Bulbul and Wood Snipe are falling under the “vulnerable” category. Five “near threatened” bird species such as European Roller, Lesser Grey-headed Fish Eagle, Red Backed Thrush, Tytler’s Leaf-Warbler and Pallid Harrier also recorded from the study. Apart from these, only one species, Large-billed Reed-warbler is coming under the category “data deficient. Of the 368 species of birds recorded, Peregrine Falcon, Common Hill Myna, Bearded Vulture Indian White-backed Vulture, Long-billed Vulture, Himalayan Monal, Kaleej Pheasant, Himalayan Quail, Indian Peafowl, Tibetan Snowcock and Western Tragopan are protected under Schedule I of the Indina Wildlife (Protection) Act (1972) and rest of the species are included under Schedule IV.



A view of Kol dam project (under construction)

Among the 64 species of mammals, 21 species are protected under the various categories of IUCN, 2012. Only one species i.e., Markhor is protected under “critically endangered” category. Three species namely Tibetan Wolf, Snow Leopard and Tibetan Antelope are included in the endangered category. Species such as Asian Black Bear, Himalayan Brown Bear, Ladakh Urial, Musk Deer, Red Fox, Sambar Deer, Sumatran Serow and Wild Yak are included in the vulnerable category. Nine species viz., Common Leopard, Common Otter, Himalayan Goral, Himalayan Tahr, Large Indian Civet, Pallas's Cat, Himalayan Serow, Tibetan Gazelle and Wild Sheep are included under near threatened category.

Of the 64 species of mammals, 45 species are protected under various schedules of Indian Wildlife (Protection) Act (1972). Of the 45 species, 22 species are protected under Schedule I category, 18 species are coming under Schedule II and five species are under Schedule III.

Discussion

Adverse ecological impacts are unwelcome by-products of any development process. However, scientific studies can help in planning and managing development to minimize these impacts to the possible bare minimum levels. Dumping of soil muck is a common practice during the construction phase of hydroelectric projects. From the faunal point of view, in the study area, 42 birds, 1 mammal, 3 reptiles and 8 amphibians were found associated with the fast flowing river stretches for their ecological requirements.

Because of the proposed HEPs along the Sutlej River system, the reduction in the flow of water through natural river channels will be decreasing drastically affecting the associated ecology and biodiversity. While the deep puddles and sub surface flows of Potamon reaches may still be sustained, the Rhithron zones will be the most affected and would become narrower and shallower with slower and less oxygenated waters. Reduction of flow coupled with increase in turbidity especially in the tributaries will significantly reduce the habitat quality and resource base for endemic and stream dependent species that require these specialized conditions. The changes in the natural seasonal, cyclic successions of varying water levels also has significant implications on the aquatic and semi aquatic diversity.

CUMULATIVE IMPACT ASSESSMENT STUDY OF HYDRO POWER PROJECTS ON RIVER YAMUNA, TONS AND TRIBUTARIES- FAUNAL ASPECTS

Background

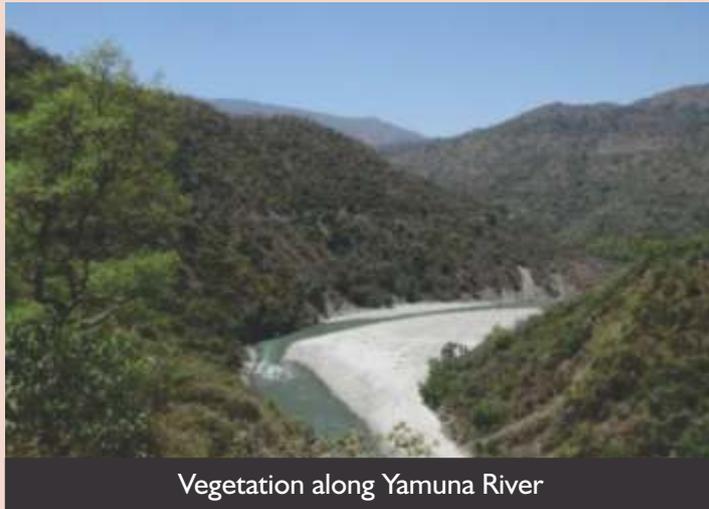
The High Court of Uttarakhand at Nainital vide its order dated 15 July 2011 has asked Government of Uttarakhand to conduct cumulative impact study of hydropower projects on river Yamuna Tons and its tributaries in Uttarakhand. Accordingly, the study has been assigned to Indian Council of Forestry Research and Education (ICFRE), in collaboration with other partner institutes, by Uttarakhand Govt. through Uttarakhand Jal Vidhyut Nigam Limited. ICFRE, would conduct the study in association with three partner institutions viz. i) Alternate Hydro Energy Centre of the Indian Institute of Technology, Roorkee, ii) Sálim Ali Centre for Ornithology and Natural History, Coimbatore, and iii) Directorate of Cold Water Fisheries Research, Bhimtal.

The river Yamuna originates from the Yamunotri Glacier point near Bandar Punch in the Mussourie range of the lower Himalayas at an elevation of about 3000 m above mean sea level in the district of Uttarkashi (Uttarakhand). It travels a total length of 1,376 km and merges with the river Ganga at Triveni Sangam in Allahabad. Yamuna and its tributary Tons are identified as a major source for generating hydroelectric power. The total potential for hydropower development in the entire Yamuna basin is about 1300 MW. Few hydroelectric projects schemes have already been developed by Uttarakhand Jal Vidhyut Nigam Limited. Only one third of the estimated potential is utilised presently. There are few new schemes, which are at various stages of construction.

Objectives

- Assess the cumulative impact of hydropower projects along the Yamuna and Tons river systems on fauna
- Prepare an inventory of avi fauna, and other animals and evaluate their conservation status.
- Identify threats to wildlife in the region

<i>Principal Investigator</i>	: P R Arun
<i>Collaborating Agencies</i>	: ICFRE, AHEC, DCFR & FRI
<i>Research Staff</i>	: Srinivas, G
<i>Project Period</i>	: One and Half years
<i>Date of Commencement</i>	: January 2013
<i>Expected date of completion</i>	: June 2014
<i>Budget</i>	: Rs 43.23 lakhs
<i>Funding source</i>	: Uttarakhand Jal Vidhyut Nigam Ltd
<i>Status</i>	: Ongoing



Vegetation along Yamuna River

Methodology

The present study was envisaged to generate relevant faunal information from the basin as a part of the Cumulative Impact Assessment of the basin. The study primarily involved systematic faunal sampling across gradients of altitude, vegetation and human disturbance in the Yamuna and Tons basins. The study would focus on the hydroelectric project sites that are operational, as well as those under various stages of development. Transects of 500 m to 1 km were used for sampling as per the terrain conditions. Impact assessment using the before-after-control-impact models will be used to evaluate the impact of hydro power projects.

Stratified random sampling protocol was used for data collection. The entire area was gridded into 5x 5 km grids using a GIS platform and the sampling has been designed to ensure a minimum representation of 25% of these grids. The grids were selected from each altitudinal and project impact zones ensuring adequate and proportionate representation of various strata. The sampling was carried out seasonally. Apart from this primary data, available secondary information on fauna was also compiled.

During this survey, the team visited various existing and proposed hydroelectric project sites ; Burnighat, Yamuna bridge, Barkot, Janakichatti, Hanumanchatti, Phoolchatti, Purola, Gadugad, Netwad, Jakhol, Sankari, Mori, Subin, Dhola, Isthraghad, Imri, Samrod, Hanol, Tiuni, Kausu, Pilasu, Anthroli, Gumma, Ichadi, Kotti, Chibru, Khodri, Dakpathar, Assan dam and Kolgharghat. An initial rapid reconnaissance survey of various faunal groups was also carried out all along the river basin areas during this survey.

Results

Faunal records during the field surveys included two amphibians (Common Indian Toad *Duttaphrynus melanostictus* and Marbled Toad *D. stomaticus*), one Agamid species, (West Himalayan Rock Agama, *Laudakia tuberculata*) 74 species of birds (38 families) and four species of mammals ; among the birds, one endangered species (Egyptian Vulture *Neophron percnopterus*) and one near threatened species (River Lapwing, *Vanellus duvaucelii*) have been recorded.

Discussion

Hydroelectric projects obstruct the natural course of river and are a cause for serious concern during floods and disasters. The proposed hydroelectric projects in the basin would add additional pressure on to this already stressed and complex system.



Himalayan Bulbul



A view of the Gangani Project site

STUDY ON IMPACT OF CONSTRUCTION OF HIGH RISE TOWERS ON MIGRATION OF FAUNA INCLUDING AVIFAUNA - BENGAL NRI TOWNSHIP PROJECT (URBANA), ANANDAPUR

Background

The Bengal NRI Complex Limited of Kolkata, approached SACON to undertake a study on the specific aspect of the impact of high-rise residential towers (URBANA Towers) on the migration of fauna, especially avifauna. The Environmental Impact Assessment (EIA) Study on the project was already under way. As the East Kolkata Wetlands (EKW) is located towards eastern side, bordering the site, it was desired that the potential impact of these towers on the migration of avifauna be conducted by SACON covering the important migratory season of birds. Accordingly, a rapid one-season study was conducted by SACON.

<i>Principal Investigator</i>	: P R Arun
<i>Co-investigator</i>	: Rajah Jayapal
<i>Research personnel</i>	: M Murugesan
<i>Project Period</i>	: 4 months
<i>Date of Commencement</i>	: October 2012
<i>Date of completion</i>	: February 2013
<i>Budget</i>	: Rs 6.53 lakhs
<i>Funding source</i>	: Bengal NRI Complex Ltd.
<i>Status</i>	: Completed

Objectives

The study proposed to address the issue of the impacts of Urbana project of Bengal NRI Complex Ltd. near East Kolkata wetlands on the migratory fauna especially avifauna

Methodology

The general methodology comprises two approaches: the field survey to collect primary data on bird populations and species diversity in East Kolkata wetlands along with a general appraisal of the habitat quality of the wetlands. The survey was also meant to inspect the upcoming artificial structures including tall buildings. Secondly, extensive literature survey was done to gather information on the past status of birdlife of the wetlands and to gain insights into the changing trends in wetland use patterns and concomitant changes in bird diversity. Focus was given particularly on migratory birds of the region, which chiefly wintered in the suburban wetlands and some of which might use these wetlands as stopover sites along their migratory routes.

The field survey was undertaken in two phases: the first visit was during 19-23 November 2012 followed by



Aquatic weeds invading EKW

another during 22-25 January 2013. A circular area of 10 km radius around the Urbana project site was the focus of our intensive bird survey, though wetlands beyond this circle were also covered as part of the survey. Thus, as bound by Anandapur - Mundapara - Dhapa - Kolkata Leather Complex - Sonarpur - Narendrapur - Mukundapur - Anandapur formed the intensive survey area. In addition, we also surveyed wetlands of Nalban Fishery Farm (of West Bengal State Fisheries Development Corporation), located close to Salt Lake City c.a-10 km northwest of EKW ; this wetland complex, though heavily used for fishing, is known to harbour good population of migratory ducks. Though Nalban forms the northern boundary and often considered as part of the present landscape of EKW, we surveyed Nalban complex avifauna separately as it is quite distinct from other parts of EKW in terms of human disturbance, management regime, and geolocation settings. Santragachi jheel in Howrah, about 18 km northwest of the Urbana project site was also covered during the present survey, as this wetland was popular for its exceptional number of waterbirds and could possibly represent the original birdlife of EKW before urbanization and associated human disturbances including intensive fish-farming and agriculture activities altered this natural landscape.

Data on bird species inventories from EKW were compared and contrasted with that from Nalban and Santragachi wetlands to assess the status of birdlife of the former. The primary aim of the survey was to record all the birds both resident and migratory found in the region; since it was not possible to undertake any population census of birds within this short span of time, it was decided to go in for systematic species inventory data through repeated samples.

The field surveys were typically conducted using extensive road network that marked the East Kolkata Wetlands. A separate species inventory was maintained for each session that lasted from morning to evening. Surveys were repeated for days ranging from two to four, depending on the total area of the wetland complex.

We used species accumulation curve, a measure of the rate at which new bird species are added to the avifauna, to assess the current bird diversity of East Kolkata Wetlands and since the sampling effort was not standardized, we then used rarefaction curves using species richness values estimated through re-sampling ($n = 1000$ bootstrapped randomizations). The rarefaction curves were used to compare the bird diversity of all the three wetland complexes surveyed.

Results

Results indicated the relatively poor birdlife around the area and identified relevant potential impact sources during the project implementation. Our observations during the present study supported by relevant literature surveys and discussions with local people revealed that the EKW harbors a poor bird fauna both in terms of diversity and abundance compared to wetlands of comparable dimensions. There are extensive pisciculture activities going on in these wetlands and as a result, the piscivorous birds such as Cormorants are attracted to this area. It has resulted in severe competition between fish farmers and birds for the fish resource. As a result, the fish farms have adopted ingenious methods to keep the birds away. The fine mesh layers over most of the fish farms prevent any bird from landing in these wetland areas. In addition, there are physical interruptions strategically placed in these wetlands to deter the birds from using these wetlands. However, these deterrents along with other environmental factors appear to have caused the birds to desert this area for better pastures and consequently affected severe decline in the bird diversity of the area.



A view of East Kolkata wetlands

Discussion and Recommendations

Given the present status of the EKW in terms of pollution load, water quality and disturbance levels from urbanization and aquaculture; there is little potential for these wetlands as a safe or healthy habitat for migratory birds. Results of the present rapid study clearly indicated that, the vast expanse of EKW harbour very poor avifaunal diversity, especially for migratory birds. As a result, there is no potential mass movement of migratory avifauna in or across this area at an elevational profile within the range of proposed towers (~ 200m from ground level). However, going by the precautionary principle considering the reports from elsewhere, the following recommendations are made for further minimizing any unforeseen risk for birds that might arise in future.

- Minimize the use of reflective and transparent glass on the exteriors of the towers
- Raising tall green vegetation directly against reflective glass panels to be avoided
- The night lightings on the towers may be minimized and the use of exterior floodlighting especially during the spring and autumn migratory seasons (from September to November and from April to June) to be avoided
- Shields may be installed on night light sources (except those necessary for air traffic safety) to direct the light downward

As a positive gesture towards the environment, the project proponents may develop a programme to document and monitor bird movements and collisions, through bird population studies around the site involving relevant experts for enhancing our knowledge on the impacts of tall buildings on birds as well as to minimize response time in case of any unforeseen future exigencies.

REVIEW OF STATE OF ENVIRONMENT IN KEOLADEO NATIONAL PARK, BHARATPUR, RAJASTHAN AND ITS CATCHMENT AREA: A HISTORICAL ANALYSIS

Background

Keoladeo National Park (KNP) at Bharatpur, Rajasthan is one of the early Ramsar sites of India, which has been thoroughly and scientifically explored. There have been several attempts to understand its ecological functioning and threats to the ecosystem, which would help the management authorities to prioritize their management interventions. However, in the recent past, there have been periodic drought and lack of water availability that drives the winter avian visitors off the park and are bound to find

abode in other smaller wetlands. Any effort to identify the threats and prioritize research matrix and management intervention in the Park would necessitate having a relook at the past scientific investigations on KNP and its surrounding area, including the wetlands in the area. It requires revisiting all the completed scientific investigations and compiling the existing information on ecology of KNP and its surroundings. It would facilitate the forest department in general

and Park management in particular to expedite conservation efforts for maintaining this unique ecosystem. In view of the above, a review of the present scenario was attempted by revisiting all the completed investigations on ecological variables of KNP, which would facilitate preparing a regional scale comprehensive management action plan and strategy for environmental management.

<i>Principal Investigator</i>	: B. Anjan Kumar Prusty
<i>Research Personnel</i>	: Mohd. Zeeshan and Natasha Shrivastava
<i>Duration</i>	: Nine months
<i>Date of commencement</i>	: December 2011
<i>Date of completion</i>	: August 2012
<i>Budget</i>	: Rs. 4.94- lakhs
<i>Funding source</i>	: SER Division, Planning Commission, Govt. of India, New Delhi
<i>Status</i>	: Completed

Objectives

- Review of state of environment in KNP and its catchment area
- Historical analysis of the information based on the completed scientific investigations and reports

Methodology

The proposed study included (a) reviewing the present scenario in and around the KNP, (b) revisiting the completed scientific investigation on KNP and its catchment, (c) collecting and collating the findings of published and unpublished documents, and analyzing the data for examining the decadal changes in several ecological variables. Efforts were made to collect the available information from several sources such as i) Newspaper reports/articles, ii) Research articles published in scientific journals, iii) Research reports and dissertations from academic and research institutions, iv) Records from various line departments of respective states, such as department of forest and wildlife, agriculture, irrigation, rural development, v) Information available online. Information on hydro-meteorological variables over last 30-50 years was collected from Rajasthan state groundwater board and state irrigation department. The collected information were divided on a temporal scale for better interpretation and subjected to appropriate statistical tools for improved understanding. We also had series of discussions with stakeholders to gain basic understanding about their perception and opinion of about ground scenario and changes over time and customized questionnaire survey was carried out for this purpose.

Results

The present compilation made a bibliography which contains 418 reports (both published and unpublished), research articles, conference proceedings, dissertations and theses, and books and booklets. This also helped us to estimate the number of species reported from KNP until date. During the compilation, 23 key players were identified which could play a role in the ecosystem management of KNP and its surrounding areas. Of the various major taxa covered, the estimated number of plant species reported from KNP was 404, for birds it was 380, and ichthyofauna 68 species. Comprehensive list of other groups (benthic organisms, herpetofauna) were also listed out. A matrix was prepared for water management owing to the potential of various sources to make water available to KNP. The possible usage of treated waste water could also be deliberated as part of the water management practices. The present

compilation also helped us to make a deliberation on ecological causalities around KNP in terms of mass bird mortality and possible causes. With the experience of the primary field survey, a customized questionnaire was made during March-June 2012 and reported. This survey reflected on a shift in primary source of resources and dependency of surrounding villages around KNP.

Discussion

The present attempt, though an eye-opener for the future researchers, made a compilation of all the possible published studies on various environmental issues on KNP, viz., birds, reptiles, fishes, insects, vegetation, invasive species, mammals, hydrology, social issues, impact of grazing, feral cattle, and pollution and contamination. Findings of these studies have helped the management to undertake certain appropriate conservation interventions such as acquiring required water from the Ajan dam, control of feral cattle, and creation of boundary wall around the Park. This compilation helped us in identifying research gaps and priority areas that need to be studied to help maintaining the ecological integrity of KNP, its surrounding ecosystems, and catchment areas. The research matrix as prepared by earlier researchers was referred during the present exercise, and accordingly, the research areas are divided in two major heads: i) those required to be undertaken for the first time (in total 11 aspects), and ii) those require a revisit and comparison with earlier reported findings (in total 15 aspects).

Recommendations

The major gaps that need to be filled are on various aspects, viz., seed-bank for KNP; health of satellite wetlands around KNP; flow regime and environmental flow; nutrient and contaminant budgeting in the upstream areas of KNP; assessment of quality of inflow water from alternate sources; investigate the co-existence and resources partitioning of major herbivores; examine the changes in vegetation pattern and soil quality due to ongoing invasive species eradication programme; investigate the role of KNP in carbon sequestration; cumulative impact assessment on landuse changes, intensification of agriculture, hydrology and water regime, infrastructure development, ground water extraction, increase in visitors, etc.; identification of indicator species and its ecology; assessing ecosystem services of KNP and its economic evaluation; and creation of research database and analysis on research-management interface. Socio-economic assessments and economic evaluation need to be undertaken for the surrounding areas of KNP.

ASSESSMENT OF THE IMPACT OF AGROCHEMICALS ON AVIFAUNA IN THE CATCHMENT OF KEOLADEO NATIONAL PARK, RAJASTHAN

Background

Keoladeo National Park (KNP) at Bharatpur is unique having multiple habitats with congregation of thousands of birds on the onset of monsoon. Drastic changes in the ecology of KNP are driven by both natural and anthropogenic factors. Upstream water diversion, and possibly climate change in recent years have greatly reduced the water available to the Park, leading to drought conditions of the last 15-20 years. This has adversely affected the agro productivity of the region and consequentially the use of chemical fertilizers and pesticides in boosting the agro-productivity and containing the pest outbreak, respectively has become extensive and rampant. In the meanwhile, due to the reduced water availability several birds have started depending on wetlands (satellite) in neighboring districts. As these satellite wetlands are

receivers of agro-run off from the neighboring farmlands, there is likelihood of accumulation of agrochemicals (chemical fertilizers and pesticides) residues in different trophic levels and the potential indirect effects operating through the food chain and reflected through survival of birds. Therefore, this study is aimed at assessing the level of residues of different groups of agro-chemicals in different trophic levels and impact on breeding success in piscivorous and granivorous birds.

Objectives

- Examine the cropping pattern and agro-inputs in the catchment area of KNP
- Assess the level of heavy metals and chemical pesticide residues in different trophic levels and environmental matrices in the area
- Examine the impact of agrochemical residues on birds

<i>Principal Investigator</i>	: B Anjan Kumar Prusty
<i>Co-Investigator</i>	: P A Azeez
<i>Collaborative agency</i>	: Institute for Forest Genetics and Tree Breeding, Coimbatore
<i>Research Personnel</i>	: Piu Ghosh (since 5th February 2013)
<i>Duration</i>	: Three years
<i>Date of Commencement</i>	: September 2012
<i>Expected date of completion</i>	: August 2015
<i>Budget</i>	: Rs 35.95 lakhs
<i>Funding source</i>	: SERB, DST, Govt. of India, New Delhi
<i>Status</i>	: Ongoing

Methodology

The proposed study includes (i) identification of sites for intensive survey and ecological parameters to be examined, (ii) collection of environmental samples from different trophic levels, i.e. sediment, water, soil, aquatic vegetation and birds, (iii) processing these samples for gross estimation of the level of select groups of heavy metals and pesticides in the laboratory, (iv) studying the breeding chronology and success of birds, (v) attaching radio tags to few individuals to know their movements to different foraging grounds, in turn, the source of contamination (wetlands/farm lands), (vi) establishing relation between agrochemical residues and breeding success as an indicator of impact of agrochemicals on birds, and (vii) presenting the site specific agrochemical residues in a GIS platform in order to obtain an overall status map of the region with regard to contamination.

Results

Reconnaissance of the study is completed and other site-specific details were collected. A comprehensive literature survey was made and sampling protocols standardized. The data collection is in progress.



ECOLOGICAL AND ETHNO-CULTURAL EXAMINATION OF THE RISE AND FALL IN RICE DIVERSITY IN SOUTHERN INDIA WITH SPECIAL REFERENCE TO THE WESTERN GHATS

Background

Rice belongs to the genus *Oryza* having 20 wild species and two cultivated ones; the African rice *Oryza glaberrima*, and the Asian rice *Oryza sativa*. It is reported that until few decades back 50,000 to 60,000 rice varieties were cultivated in India. Many of these varieties played a major role in the livelihoods, culture and traditions of local people. Several varieties of rice were grown in many parts of India just for their use during festivals, marriages, or other auspicious occasions. Several others were grown for their colour, taste, smell or other such desirable qualities, yet others for their survival adaptations such as pest resistance, soil fertilization and drought resistance qualities.

Rice paddies, unique in several ecological characteristics, provide food and fiber and support several other ecosystem services such as regulating quality and quantity of water, decomposition of organic wastes, formation of soil, biological nitrogen fixation, and local climate and biotic regulation. Adding to the value of this unique ecosystem, the rice paddies provide habitats for numerous species of plants and animals, which include several water bird species that are known to face serious pressures threatening their survival.

Objectives

- Identify and document the diversity of the traditional rice varieties of Western Ghats and associated traditional knowledge
- Identify Important Rice Areas (IRAs) based on rice biodiversity, ecological status, agronomical practices, commercial and socio religious importance
- Study the historical changes in rice cultivation practices and explore the reasons for the same
- Assess and compare the ecological values / services of rice / rice paddies, traditional vs. modern

Methodology

a) Identification of important Rice Cultivating Areas (IRCAAs)

IRCAAs will be located/ identified by using historical imageries and maps including irrigation maps/ forest

<i>Principal Investigator</i>	: Mathew K Sebastian
<i>Co-investigators</i>	: P R Arun & P A Azeez
<i>Research Personnel</i>	: S Navaneethakrishnan
<i>Duration</i>	: Two years
<i>Date of Commencement</i>	: July 2012
<i>Date of Completion</i>	: July 2014
<i>Budget</i>	: Rs 14.75 lakhs
<i>Funding Source</i>	: Indira Gandhi National Centre for Arts, Ministry of Culture, Govt of India
<i>Status</i>	: Ongoing



'Ara' - Traditional rice storage facility in Kuttanad house

survey maps / shikar maps etc. We would also draw information from grey literatures and published reports at various government and nongovernmental offices/ institutes. Further, extensive field surveys in the Western Ghats will be carried out for collecting information. RCAs will be identified based on the rice biodiversity richness, dependence on the population on rice as food and/or as a source of income or for socio religious and/or cultural purposes and/or the extent of rice cultivation.

b) Customized questionnaire survey

A customised questionnaire survey was conducted at each location using standard sampling protocols. The questionnaire was designed in such a way to collect data on varieties, pattern of cropping, water requirements, use and type of fertiliser, yield /productivity of local rice culture, preservation of seeds, storage of rice, reasons for cultivating the traditional varieties and such related information. The questionnaire, also document land type, associated local plants, animals and local hydro-meteorological conditions and rituals if any associated with sowing and harvesting.



Traditional rice measurement containers

c) Ecological assessment of Important RCAs

A comparative analysis of the traditional and modern rice culture is being carried out using standard analytical tools / to estimate the water footprint and virtual water content of rice paddies and economics of traditional practices. Similarly, life cycle analyses (LCA) is proposed to be performed to compare the modern and traditional systems.

Results

In Kerala, the area under paddy cultivation has decreased drastically. During the decade from 2001-02 to 2010-11 there has been a reduction of 34% area under paddy cultivation. During 1961-62 7.35 lakh ha. were under paddy cultivation whereas in 2010-11 it has come down to 2.13 lakh ha. The declining interest among the farmers, fragmentation of land holdings, conversion of rice paddies into plantation crops, breaking up of joint families, labor shortage, and rising labor costs are among the major reasons for this decline. Rice cultivation in Tamil Nadu and Karnataka has remained more or less consistent. The recent cultivation trend in both of these southern Indian states shows increasing trend in area under rice cultivation.



Njavara Rice

Discussions/recommendations

Our initial fieldwork indicates that the available rice varieties might have come down to 600-700 from 2000 to 3000 varieties available at few decades back. There are several organizations/individuals committed to the conservation of traditional rice varieties by taking up several activities such as popularization of the varieties through campaigns, rice melas, exhibitions, and cultivation of varieties exist in this part of the country without any governmental support. If their efforts have to be sustained, strong governmental support is needed since rice cultivation is becoming prohibitively costly. A strong networking of the interested group is essential to maintain the present momentum in conserving the traditional varieties.



'Kol' rice paddies at Trichur district, Kerala



ENVIS –WETLANDS ECOSYSTEMS INCLUDING INLAND WETLANDS

The ENVIS centre is a project of the Ministry of Environment and Forests, Govt. of India. Among the many centers across the country, SACON is allotted the thematic centre on wetland ecosystems including the inland wetlands. Major works undertaken during the reporting period are (1) updation of database on wetland ecosystems on website in regional language (2) create and operate a mechanism to answer and channel queries related to the allocated subject (3) develop linkages with information users, carriers and providers from

government, academic, business and non-governmental organizations including that with ENVIS (4) Identify information/data gaps in the specified subject areas and action taken to fill these gaps and (5) publication of ENVIS newsletters for dissemination of wetland information.

Research articles, news, events, and laws relating to the wetlands are being collated from various sources using the internet. Information on conferences, workshops, and symposia on wetlands is also being collected. The research articles are being sorted into categories such as birds, hydrology, hydrobiology, migration, flyways, and the like. These are being readied for linking with ENVIS website for wider access and information dissemination. Further emails are also being sent out to several institutions and departments associated with wetland research and management to procure first hand information on the wetlands. We published three Newsletters as per the mandate and a poster on the wetlands day. The centre has successfully redone the website with a number of new features added for easy access to the users.

The updation of the website and regular publications was well appreciated at the workshop on national evaluation of ENVIS centres' held at Bhopal during 29- 30 August, 2012 organized by the MoEF. Dr. P S Rawat deputy Director, MoEF visited the ENVIS centre at SACON and assessed the progress. The centre has published a poster on threatened birds of Coimbatore wetlands on the occasion of World Wetlands Day 2013. The ENVIS team attended a workshop on the Ramsar India sites organized by ATREE at Alappuzha and gathered information as well as disseminated information on the wetlands and the SACON ENVIS centre. The ENVIS team also participated in a conference on Lakes, Rivers and Coastal wetlands at Annamalai University and presented two papers on the work done by the ENVIS centre for Coimbatore wetlands.

<i>Coordinator</i>	: Goldin Quadros
<i>Research Personnel</i>	: Sheeba Nanjan and K A Nishadh (May- June 2012) R Raja Mammanan, Sheeba Nanjan & A Julfia Begum (January - March 2013).
<i>Programme Period</i>	: Long-term (since 2003)
<i>Budget</i>	: Rs 7.07 lakhs (2012-13)
<i>Funding source</i>	: MoEF, Gol
<i>Status</i>	: On Going

COP-11 EXHIBITION 'INDIAN ORNITHOLOGY – PAST, PRESENT AND FUTURE'

The National Biodiversity Authority asked SACON to prepare the exhibition on 'Indian Ornithology-Past, Present and Future' to be showcased in the Indian Panorama section of the COP-11 to be held at Hyderabad from 1st to 19th October 2012. An exhibition comprising of nine panels were also prepared. In addition to the exhibition, we also made a film titled 'Indian Ornithology passage through time'. This film

was regularly screened at the exhibition centre in addition to the special screenings held during six occasions of CEPA fair and UNDP events. The CEPA organizers also coordinated a press meeting and specially screened the film for the media.

Coordinator	: Goldin Quadros
Co-coordinator	: Rajah Jayapal
Budget	: Rs 4.00 lakhs
Funding source	: National Biodiversity Authority, MoEF, Gol

ASSESSMENT OF THE MORPHOLOGICAL DIVERSITY AND THE ECOLOGICAL PATTERNS IN NEAR THREATENED COLONIAL WATER BIRDS ACROSS INDIAN SUB-CONTINENT USING NOVEL APPROACH

Background

Heronry birds which are mostly colonial nesters, distributed widely over the Indian subcontinent. This group receives considerable amount of

conservational significance, as many of them namely, Black-headed Ibis *Threskiornis melanocephalus*, Painted Stork *Mycteria leucocephala*, and Oriental Darter *Anhinga melanogaster* have been included in near threatened by BirdLife International. However, the detailed ecological information on these fish-eating, colonial nesting birds are limited. Interestingly, these heronries provide an ideal place to videograph the nesting birds at close quarters. One of the main hurdles in studying

morphometric in large birds is the difficulty with which the desired number of specimens can be captured or culled, due to restrictive laws and the endangered status of the species. Therefore, one has to rely upon either museum specimens or chance encounters with dead specimens. However, it is possible to obtain reliable measurements of external characters in a wild population of birds by using innovative non-invasive field methods.

Principal Investigator	: Mahendiran Mylswamy
Research Personnel	: Archita Banerjee
Project Period	: Three Years
Date of Commencement	: May 2012
Expected Date of Completion	: May 2015
Budget	: Rs 16, 45, 000/-
Funding Source	: SERB-DST (Fast Track Programme)
Status	: Ongoing

Objectives

The present study proposed to investigate the morphological patterns of Painted Stork *Mycteria leucocephala* at selected heronries in north and south India using a novel video graphic method.

Methodology

Images of the individual birds will be captured on a video camera. The video images will be downloaded to computer, and then by incorporating appropriate correction factor, these images will be measured using specific software. Initially the bill length will be taken as a standard or reference length. The software (MOTIC IMAGES PLUS 2.0), basically developed for microscopes and the measurement of cytological and histological images, adapted for quantifying the dimensions of various external body parts. Since the video camera is not calibrated with this software, the dimensions estimated were initially in arbitrary units. Selected body parts (length of the bill, tibia, tarsus) were measured using standard protocols.

Results

The work undertaken included (1) standardization of camera and methods (2) survey of northern & southern Indian heronries and collection of digital data of Painted Storks and (3) standardization of data using various softwares. Calibration of measurements obtained from video images is being done with those from specimens available at the museums of Bombay Natural History Society and Zoological Survey of India.



NATURE EDUCATION ACTIVITIES FOR COIMBATORE

With an aim of inculcating the message of conservation among the public in general and students in particular, various nature awareness programmes are being conducted. The activities at SACON campus include lectures and nature camps for school and college students. A brief of the programs conducted during the reporting period is as below.

Coordinator : P Pramod
Program Duration : Long term
Funding source : SACON & local sponsors

I. Sálím Ali Trophy Nature Competitions :

Inter-school competitions for the Sálím Ali Trophy Nature Awareness program had the participation of around 1500 students from 48 schools. In all, 134 students from 15 schools won the prizes, and G D Mat. Hr. Sec. School, Coimbatore won the Rolling Trophy for the best school.

2. One day camp for students

Thirty-one nature camps were conducted with the participation of 1740 students and 111 teachers from various schools and colleges. Talks, slide shows, nature walk and short film shows were conducted.

3. Sálím Ali Naturalist Forum

Sálím Ali Naturalist Forum (SANF) is a platform for nature education, initiated, promoted and technically supported by SACON. SANF regularly conducts the bird watching and trekking programmes in forests and wetlands in and around Coimbatore. This year SANF has conducted 13 bird watching programmes involving nearly 100 individuals from the city.

4. Other Extension and Education activities

Two programmes were conducted for the bank employees; one for all the employees of State Bank of India (SBI), Government College of Technology branch in Coimbatore, and the other for 54 branch managers of SBI from Coimbatore region.

DNA CLUBS FOR ANDAMAN ISLANDS

Principal Investigator : P Pramod
Research Personnel : P Rajan & M Suhirtha Muhil
Project period : 2007-2013
Funding : Rs 52.00 lakhs
Source : Department of Bio-technology, Gol, New Delhi.

'The DNA Clubs' for School Children– (DBT's Natural Resources Awareness Clubs) is an initiative of the National Bioresource Development Board, of Department of Biotechnology to promote awareness among school students regarding the importance of biodiversity, biotechnology and the relation of all these with everyday life and environment.

SACON is coordinating, as a regional resource

agency in 10 schools across the Andaman and Nicobar Islands.

Following activities were conducted in the selected schools from Andaman Islands during the year:

- Invited lectures: Every two months a lecture was arranged focusing on the local biodiversity and conservation issues.
- Field visits: Every alternate month a field visit was organized to study the local biodiversity.
- Hands on activities, laboratory experiment / demonstrations were conducted on monthly basis.
- Regular audiovisual programmes were conducted for the members of DNA clubs in all the schools.

ACADEMIC PROGRAMMES

ZOOLOGY

	C Ramesh	Ph D	Ecology of the Indian Python in Keoladeo National Park, Bharatpur	Awarded
S Bhupathy	N Sathish Kumar	Ph D	Ecology of reptiles in High Wavy Mountains, Western Ghats	On going
	J V Jins	Ph D	Reptile communities of Agasthyamalai Hills, Western Ghats	On going
	Madhumita Panigrahi	Ph D	Bird communities of Agasthyamalai Hills, Western Ghats	On going
P Pramod	L Joseph Reginald	Ph D	Diversity and habitat preference of bats (Order Chiroptera) of Coimbatore	On going
	Chetan Nag	Ph D	Addressing the issue of taxonomic position of peninsular Indian Hanuman langurs (<i>Semnopithecus entellus</i>) through a multidisciplinary approach	Submitted
	A P Zaibin	Ph D	Insular biogeography of Nicobar Islands from a bird community perspective	On going
	P Rajan	Ph D	Bird community of Andaman Islands with emphasis on human associated and introduced birds	On going
	K Priya	M Phil	Genetic diversity analysis of Andaman Day Gecko <i>Phelsuma andamanense</i> by DNA fingerprinting	Submitted
S Manchi Shirish	Akshaya Mohan Mane	Ph D	Population dispersal studies of Edible nest Swiftlet in Andaman & Nicobar islands, India	On going
H N Kumara	K Santhosh	Ph D	Status, ecology and conservation of Lion Tailed Macaque in Sirsi-Honnava forests of Western Ghats, Karnataka	On going

BOTANY

	C Anbarasu	Ph D	Avian frugivory and seed dispersal in the <i>shola</i> forests of Nilgiris, Western Ghats, India.	On going
P Balasubramanian	R Aruna	Ph D	Frugivory and seed dispersal by birds in mixed dry deciduous and scrub forests	Awarded
	P Nehru	Ph D	Floristic diversity, dynamics and recovery of littoral forests of Nicobar Islands, India- a post Tsunami scenario	Submitted
	P. Manikandan	Ph D	Study on nest tree preferences by cavity nesting birds in the riverine forests of Athikadavu Valley, Western Ghats	On going

ENVIRONMENTAL SCIENCES

P A Azeez	J Ranjini	Ph D	Adaptation and tolerance of birds to urbanization – a critical evaluation with emphasis on life strategy	On-going
	K A Nishad	PhD	Usage and application of real time and continuous environmental data for climate change adaptation	On going
	R Chandran	Ph D	Environmental Education: Impact on Higher Education	On Going
S Muralidharan	P Jayanthi	Ph D	Organochlorine pesticides residues in the commercial marine fishes of Coimbatore - suitability for human consumption	Awarded
	A Alaguraj	Ph D	Organic contaminants in the marine fishes available in Coimbatore and their suitability for human consumption	Submitted
	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	On going
	K Ganesan	Ph D	Comparative study on pesticide residues in select components of an agro ecosystem adopting organic and chemical farming in Padayetti village, Palakkad District, Kerala-	On going
	V Kirubhanandhini	Ph D	Levels of metal contamination in select species of birds	On going
B Anjan Kumar Prusty	P Navamani	M Phil	Poly Cyclic Aromatic Hydrocarbon (PAHs) in marine fishes collected from Cochin and Rameshwaram coasts and their suitability for human consumption	Awarded
	Mohd. Zeeshan Malik	Ph D	Assessment of environmental changes in three districts (Jammu, Rajouri & Ramban) representing altitudinal gradients in Jammu region.	On going

TRAINING WORKSHOP ON SEABIRDS IDENTIFICATION

A "Training Workshop on Identification and Population Monitoring of Seabirds in Indian Marine Waters" was conducted by SACON for the scientific staff of the Fishery Survey of India (FSI) at SACON campus during 5-7 November, 2012. Dr Rajah Jayapal and Dr Babu of the Division of Ornithology, SACON coordinated the workshop, which was inaugurated by Dr. K. Vijayakumaran, Director-General of FSI while Dr. P.A. Azeez, Director of SACON gave the welcome address. In total, 16 participants from six Field Stations of FSI (viz. Mumbai, Mormugoa, Kochi, Chennai, Visakhapatnam, and Port Blair) attended the training workshop. In all, nine interactive sessions were held covering various topics including natural history and field identification of Indian seabirds, impacts of marine pollution on seabird populations, current problems and prospects of marine EIAs in India, policy initiatives for seabird's conservation, and techniques of seabird population census and monitoring. In the end, panel discussions were held on developing a long-term collaborative program for seabird population monitoring and bringing out a field manual for seabirds identification in Indian waters. A pocket manual for identification of Indian seabirds was also developed for the personal use of the FSI scientific staff.



ORNITHOLOGY COURSE FOR PG STUDENTS OF NCBS, BANGALORE

SACON conducted the ornithology module for the students of M.Sc. (Wildlife Biology & Conservation) course of National Centre for Biological Sciences (NCBS), Bangalore during 17-21 December, 2012. Dr Rajah Jayapal of the Division of Ornithology, SACON developed the course contents of the module and coordinated the proceedings. In total, 16 students along with Dr Ajith Kumar, Course Director, visited SACON. Students stayed at the SACON campus and underwent a rigorous course in ornithology which comprised 12 lectures, four thematic talks, and a field practice session. The lecture series included topics like introduction to birds of India (Passerines & Non-Passerines), avian taxonomy and classification, evolution and adaptive radiation, biogeography of Indian birds, comparative morphology and adaptive radiation in birds, sexual selection and mating system, structure and organization of bird communities, bird migration, and threats to bird populations and avian extinctions. Thematic talks were delivered on principles of molecular phylogenetics, frugivory in birds, impacts of pesticides on bird populations, and landscape ecology of bird populations. In addition, group discussions were held on life-history strategies of birds using published review-papers on avian territoriality, vocal mimicry, extra-pair paternity, hatching asynchrony, and adaptive sex allocation in birds. At the end of the course, a field-practice session was conducted on bird census techniques and standard protocol for using mist nets.



JOURNAL ARTICLE

National

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- Shinde, A. S., Mohan, J., Singh, R.P., Agarwal, R., Tyagi, J.S. and Sastry, K.V.H. (2012). Physico-biochemical characteristics of Kadaknath and broiler chicken semen under storage condition. *Ind. J. Poultry Sci.* 47(3): 336-339.

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Papers in conferences / seminar / proceedings / edited volumes

National

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- Anbarasu, C and Balasubramanian, P. (2012). Ecology and management of bird-dispersed weeds, *Solanum erianthum* and *Lantana camara* in the shola forest ecosystem of the Nilgiri hills, Western Ghats. Abstract Proceedings, Tamil Nadu Forest Academy, Coimbatore.
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- Balaji S, Sarkar MK, Upreti A, Kumaran K, Pramod P and Chandrasekaran G (2012). Forestry Vision 2023: TNFA centenary National Seminar, Tamilnadu Forest Academy, Coimbatore, Pp: 94.
- Ganesan K and S Muralidharan. Comparative study on monitoring of pesticide residues in an agro-ecosystem adopting organic and chemical farms in Padayetti village, Kerala at Student Conference on Conservation Science (SCCS), Bangalore on 2-4 August 2012. Jointly organized by Indian Institute of Science, Madras Crocodile Bank Trust, National Centre for Biological Sciences, Nature Conservation Foundation and SACON.
- Ganesan K and S Muralidharan. How organic farming enrich the biodiversity? - A case study from an agriculture habitat in Kerala at Young Ecologist Talk and Interaction (YETI-2012). Held at Wildlife Institute of India, Dehradun on 5-7 December 2012.
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- Lavanya C, Prusty BAK and Azeez PA (2013). An overview of agrochemical residues in the catchment of Keoladeo National Park and associated environmental casualties. National Conference on Forest and Wildlife: Present Status, future needs and challenges ahead. 30-31 January 2013, Keoladeo National park, Bharatpur, Rajasthan, Pp. 03.
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- Singh RP (2013). Gene based mechanism of sex determination in birds. International training course on gene based techniques for research in biotechnology, 18th Feb - 9th March, 2013. Ministry of External Affairs, India.
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International

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Books / Chapters in books

Balasubramanian, P., Nehru, P., and Sebastian, M.K. (2012). Forest genetic resources conservation in SACON, Anaikatty, Coimbatore, in: Forest Genetic Resources Management in India (Eds.) K. Palanisamy, and N. Krishnakumar, IFGTB, Coimbatore. P.314-319.

Bhupathy S, Rameshkumar S, Paramanandam J, Thirumalainathan P, and Pranjit Kumar Sarma (2013). Conservation of Reptiles in Nagaland India. (Eds) Khelchandra singh, K., Das KC., Lalruatsunga, H., Bio-resources and traditional knowledge of northeast India. 181 - 186.

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Thangalakshmi R, Eswaran R and Mahendran M (2013). Preliminary observations on the bird diversity, environmental and sociological aspects of selected wetlands of Madurai. In: Food security, issues and concern (Ed. Joseph J). Shanlax publications, Madurai, India.

Reports

Arun R, Jayapal R and Murugesan M (2013). Impact of construction of high rise towers on migration of fauna including avifauna – Bengal NRI Township Project (Urbana), Anandapur. Final EIA Report. Sálim Ali Centre for Ornithology and Natural History, Anaikatty, Coimbatore. 32 pp.

Balasubramanian, P. and Anbarasu, C. (2012). Study on Avian frugivory and seed dispersal of endemic tree species in Thai shola forest of Nilgiri Hills, Western Ghats. Project Report submitted to the Tamil Nadu Forest Department.

Das S, Dutta S, Sen S, Ali J, Babu S, Kumara HN and Singh M (2012). Identifying forest regions for conservation of sloth bears in Hospet and Koppal, Karnataka through Occupancy modelling. Report submitted to Karnataka Forest Department, Karnataka. 24 pp.

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Mukherjee S (2013). Small cats in human-dominated landscapes in Madhya Pradesh. Report and Recommendations submitted to the Madhya Pradesh Forest Department.

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Netalkar PS and Kumara HN (2012). Primates of Kudremukh Wildlife Division: Special emphasis on current status of lion-tailed macaque *Macaca silenus*. Technical report submitted to Karnataka Forest department, Kudremukh, Karnataka. India.

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Sebastian MK, Arun PR, Arthi T, Murugesan M, and Azeez PA, (2012) Wetlands of Srikakulam – An ecological status survey. Report and recommendations submitted to Ministry of Environment and Forest, Government of India.

Srinivas G, Babu S, Kumara HN and Molur S (2013). Assessing the status and distribution of large mammals in Highway and its environs, southern Western Ghats. Final report submitted to Rufford small grant and ATREE-CEPF.

Talks delivered

- B. Anjan Kumar Prusty. Invited talk delivered on “Advanced tools for studying chemical speciation of heavy metals in water and realistic estimation of their bioavailability” in the National Seminar on “Water Contamination and its Impact on Human Beings”, Dept. of Zoology, JP University, Chapra, Bihar, 25 – 26 September 2012.
- B. Anjan Kumar Prusty. Invited talk delivered on “Historical account of agrochemical residues in and around Keoladeo National Park, Bharatpur: Need for regional scale assessments” in the National Seminar on “Status of Environment and Biodiversity: Rio+ 20 and role of space technology”, Department of Zoology and Environmental Science, Gurukul Kangri University, Haridwar, Uttarakhand, 2 – 3 November, 2012.
- B. Anjan Kumar Prusty. Talks delivered to students of Kongunadu Arts and Science College, Coimbatore on 11 September 2012, Principles of Analytical Methods and Instrumentation, Principles of Environmental Impact Assessment.
- Arun PR Delivered invited Lecture on Environmental Impact Assessment (EIA) Process, Practice and possibilities at Bharathiar University Refresher course for College Teachers, on 10th Oct 2012
- Arun PR Delivered an Invited lecture on EIA- Process and case studies. At Training –cum-Workshop on ‘Legal Issues in Forestry and Wildlife’ organised by Central Academy for State Forest Service (CASFOS), on 20th Feb 2013
- Balasubramanian P. Lecture delivered on “Biodiversity Conservation” as part of Interactive Lecture Series of the Environment Science Dept. of the Bharathidasan University, Tiruchirapalli.
- Balasubramanian P. Lecture delivered on “Biodiversity Conservation” for Biotechnology Graduate students of TNAU, Coimbatore.
- Balasubramanian P. Lecture delivered on “Bird Conservation” at CASFOS, Coimbatore.
- Balasubramanian P. Lecture delivered on “Frugivory in birds; an ecological perspective” for NCBS- M.Sc course students.
- Balasubramanian P. Lecture delivered on “Habitat restoration in bird sanctuaries of Tamil Nadu” at the Tamil Nadu Forest Academy, Coimbatore.
- Balasubramanian P. Lecture delivered on “Ornithology” at St. Mary’s Higher Secondary School, Coimbatore.
- Balasubramanian P. Lecture delivered on “Plant-animal Interactions” at PSG College of Arts and Science, Coimbatore.
- Goldin Quadros. Delivered a talk on “Ramsar sites of India” during the “National seminar on Wetlands” organised by M.E.S. Asmabi college Trissur, Kerala.
- Goldin Quadros. Delivered a talk on “Role of Intertidal Fauna along the Mangrove ecosystem” during the National seminar on ‘Emerging trends in biological sciences’ organised by St. Agnes College, Mangalore, Karnataka. 19 January 2013.
- Goldin Quadros. Delivered a talk on “Wetlands and Sustainability” during the National seminar on “Ecological Networks – species to landscape in a riverine bioscene” organised by Farook College at Farook, Kerala. 06 – 07 February 2013.
- Jayapal R. Delivered an invited lecture and presentation on "Trade in Wild Birds in India" at the 'Workshop on Awareness Training to CITES Implementation Agencies in India' organized by Institute of Forest Genetics and Tree Breeding (IFGTB), ICFRE, Coimbatore for the southern zone participants during 29-31 August, 2012, for the western zone participants during 16-18 January, 2013 and for the northern and eastern zone participants during 19-21 March, 2013.
- Jayapal R. Delivered an invited lecture and presentation on "Ecosystem Goods and Services of Birds" at a training workshop on 'Role of Biodiversity Conservation in Poverty Alleviation and Livelihood Options' organized by Institute of Forest Genetics and Tree Breeding (IFGTB), ICFRE, Coimbatore during 29-31 October 2012.
- Jayapal R. Delivered special address and presentation on "Common Birds of Tamil Nadu: From Common to Rare in 100 years?" at the Enviro Meet – February 2013 organized by OSAI at Coimbatore on 24 February, 2013.

- Kumara HN. Diversity, distribution and conservation of mammals. In National seminar on conservation of faunal diversity of Western Ghats: problems and perspectives, 30 - 31 August 2012, organised by Sri Jagadguru Chandrashekhara Bharathi Memorial College and Sri Sharada Peetha, Sringeri, Karnataka, India.
- Kumara HN. Mammals: Beyond the park. In national seminar on Conservation of Natural Resources (NASCON 12), 16 - 17 March 2012, organised by A.V.C. College, Mannampandal, Mayiladuthurai, Tamil Nadu, India.
- Muralidharan S. Environmental chemicals and health hazards: Birds as indicators. Canara Bank Regional Office Coimbatore, Study circle meeting on the 11th July 2012.
- Muralidharan S. Art of Science Writing at the Research Convention organized by Avinashilingam University on 14th Sep 2012.
- Muralidharan S. Impacts of Xenobiotics on ecosystem with special reference to Birds Refreshers Course organized by the Bharathiar University on the 8th October 2012.
- Muralidharan S. Toxicology and Human Physiology at In-service training programme for Higher Secondary Teachers organized by Government College of Education for Women, Coimbatore on 23rd Nov. 2012.
- Muralidharan S. Environmental Contaminants and Vultures in India at Indian Veterinary Association, Coonoor organized by Arulagam on 1st Feb. 2013.
- Muralidharan S. Environmental Chemicals and Health Hazards- Birds as Indicators. Science day celebrations at Central University of Tamil Nadu, Thiruvavur on 28th February 2013.
- Muralidharan S. Why Science is Important? Chemistry association meeting at Avinashilingam University on 4th March 2013.
- Muralidharan S. Fish - The most vulnerable category of food product to pesticide contamination in India at Green Peace Workshop, Bangalore on 6-7 March 2013.
- Pramod P. Energy: Explore, Harness and Conserve: Invited talks given to the District coordinators / Guide teachers and facilitators held in Kavarathhi Lakshadweep 07 October 2012.
- Pramod P. Invited Lecture entitled Challenges in India's Wildlife conservation in the section of Animal Veterinary and Fisheries Sciences in the Regional Science Congress held at Kongunadu Arts and Science College Coimbatore on 15 December 2012.
- Pramod P. Invited talk entitled delivered on Biodiversity of India in the National Seminar on Save Green Save Earth organized by Sree Narayana College Alathur on 04 January 2013.
- Pramod P. Invited talk on Bird Identification in Tamilnadu forest Academy to the Forest Range officers on 16 November 2012.
- Pramod P. Energy systems in Nature in the National Orientation Workshop for resources persons from all states and UTs. conducted at Regional Institute of Education Mysore, 11-13 June 2012.
- Shomita Mukherjee. Presentation titled "Modern Times: the power of molecular technology in conservation and ecological studies", made at TNFA Centenary National Seminar. Forestry vision 2023. 05- 06 July 2012, Coimbatore
- Shomita Mukherjee. Presentation titled "Snoop through poop: understanding the ecology and distribution of cats through non-invasive sampling", made at the Indo-UK Scientific Seminar Mammalian diversity assessment & monitoring interdisciplinary & multi-scale approaches, 13 - 15 February 2013, Corbett Tiger Reserve.

Technical Manual

- Krishnakumar N, Jayapal R, Hegde M, Suresh K, and Raghunath T P (2013). Indian Birds Listed in CITES Appendices. Information Manual published by the Institute of Forest Genetics and Tree Breeding, ICFRE, Coimbatore. 32 pp.

INFRASTRUCTURE

SACON campus at Anaikatty with the backdrop of the Western Ghats, one of the 'hot spots' of biodiversity in the world, offers great opportunities for long-term studies on various aspects of its varied



avifauna, other wildlife and on biological principles involved in the functioning of ecosystems. The tri-junction of Kerala, Tamil Nadu and Karnataka in the Western Ghats, one of the best wildlife areas in the country, is only a few hours' drive away.



As advised by the Governing Council, we have created two shallow static water tanks each 4500 liters capacity in the SACON campus to cater to the needs of birds and wild animals. These strategically located water bodies are being utilized by elephants, spotted deer, wild boar, wild gaur, and various birds. The tanks are connected with fresh water supply for everyday replenishment.

Laboratory : Currently, our laboratory is equipped with 1) UV-Vis Spectrophotometer, Perkin Elmer Model Lambda 35, 2) HPLC Agilent Technology Model 1100 series with DAD and Florescence detector,



3) Water Quality analyzer - Multi Parameter TROLL - 9500, Portable PC testr35, Eutech instruments, 4) Ultra Deep Freezer (-80°C), New Brunswick, Model U 410 Premium, 5) Deep freezers (-20°C), Carrier, Model CHP-30, Cryo Make, and refrigerators Model LG and Samsung, 6) Flame Atomic Absorption Spectrophotometer (AAS) Perkin Elmer, Model 3300 with 13 lamps, 7) Mercury Hydride Generator, Perkin Elmer, 8) Gas Chromatograph, Hewlett Packard Model 5890 Series II with three detectors, (Electron Capture Detector - ECD, Nitrogen Phosphorous Detector - NPD and Flame Photometric Detector - FPD), 9) ANG generator, Claind, Model ANG 2381HC, 10) Microwave Digestion System, Milestone Model I200, 11) Dissolved Oxygen (DO) Analyzer, 12) Biochemical Oxygen Demand (BOD) Incubator, Sanyo Model Mir 154, 13) Flame Photometer, Systronics 128, 14) Vertical Laminar Flow Chambers, 15) Respirable Dust Samplers, 16) Ultra Centrifuge, 17) Microprocessor research centrifuge, 18) Walk-in cold room, 19) Rotary Flask Evaporator Model Cyberlab RE-10, 20) Micrometer, 21) Digital Camera, 22) Thermo-hygrometer, 23) All Quartz Double Distillation unit, 24) Millipore water purification system, 25) Hot-air Oven, 26) Binoculars, 27) Induction Hot Plate, 28) Digital Caliper, 29) Soxhlet Mantle, (30) Ultrasonic water bath, Crest 275, 2.7 lts, 31) Desiccators, 32) Blenders, 33) Rotary spinner, and 34) Inverted microscope.



Library and documentation : SACON library has 3263 Books, 2508 Back Volumes, 2706 Maps, 91 CD/DVDs, 101 Project Technical Reports, 34 PhD Thesis, 62 Current Periodicals {62 (National - 40; International - 22)}, Online Subscription of JSTOR Archive: Biological Science. Facility for literature searches has been provided to all the staff and students. As in the previous years, the library facilities were used also by students, scholars and scientists from other institutions in and around the Coimbatore.



