

XII Internal Annual Research Seminar

26th September, 2016

Programme & Abstracts



XII - INTERNAL ANNUAL RESEARCH SEMINAR

PROGRAMME

Seminar Chairperson: Dr. Srikant Chandola, Former PCCF & HoFF, Uttarakhand

Monday, 26th September 2016

0930 – 0935	Welcome	Dr. Bitapi C. Sinha, Research Coordinator, WII
0935 – 0950	Opening Remarks	Dr. G.S. Rawat, Dean, FWS, WII

TECHNICAL SESSION – I CARNIVORE ECOLOGY

Chair : **Dr. S. Sathyakumar, Scientist-G**
Co-Chair(s) : **Dr. Bivash Pandav, Scientist-F**
Dr. Gopi G.V, Scientist-D

0950-1000	Status of prey and space use by tiger (<i>Panthera tigris</i>) in Sanjay Tiger Reserve, Madhya Pradesh	R. Rajasekar
1000-1010	Deciphering wolf howls	Sougata Sadhukhan
1010-1020	Its time to move on: Preliminary insights into tiger dispersal using radio collars	Pallavi Ghaskadbi
1020-1030	An update on reintroduction and recovery of tiger in Panna Tiger Reserve, Madhya Pradesh	Deepti Gupta
1030-1100	Discussion and comments of Chair and Co-chair	
1100-1130	Tea	

TECHNICAL SESSION – II
UNGULATE ECOLOGY

Chair : **Sh. Aseem Shrivastava, Scientist-G**
Co-Chair(s) : **Dr. Sonali Ghosh, Scientist-F**
Dr. Bilal Habib, Scientist-D

- 1130-1140 Current status and distribution of Swamp Deer along Ganga river and its tributaries in North India
Shrutarshi Paul
- 1140-1150 Long term ungulate population trend in Corbett Tiger Reserve
Sudip Banerjee
- 1150-1200 Occupancy and population estimation of key wildlife species in Aravallis, Haryana, India
Paridhi Jain
- 1200-1215 Discussion and comments of Chair and Co-chair

TECHNICAL SESSION – III
STUDIES ON HERPETOFAUNA AND HUMAN ECOLOGY

Chair : **Sh. Ajay Srivastava, Scientist-G**
Co-Chair(s) : **Dr. K. Sivakumar, Scientist-F**
Sh. Manoj Nair, Scientist-F

- 1215-1225 Distribution and breeding biology of *Raorchestes shillongensis* (Anura: Rhacophoridae) in Meghalaya
Bitupan Baruah
- 1225-1235 Cryptic diversity and lineage divergence of the Indomalayan frog genus *Fejervarya* (Anura, Dicroglossidae)
Prudhvi Raj Gunturu
- 1235-1245 Traditional ecological knowledge among Raji and Barpatiya tribes of eastern Uttarakhand: Research approach and preliminary findings
Naveen Chandra Joshi
- 1245-1300 Discussion and comments of Chair and Co-chair
- 1300-1500 Lunch**

TECHNICAL SESSION – IV

EX-SITU CONSERVATION AND CONSERVATION GENETICS

Chair : Dr. S.A. Hussain, Scientist-G
Co-Chair(s) : Dr. Parag Nigam, Scientist-E
Dr. Sandeep Gupta, Scientist-D

1500-1510	Evaluating housing and enrichment condition of lions at Sakkarbaug Zoo	Sitendu Goswami
1510-1520	Wild origin animals: Role of founders in <i>ex-situ</i> conservation	Anupam Srivastav
1520-1530	Mitochondrial DNA based genetic characterization of Sambar (<i>Rusa unicolor</i>) populations in North-East India	Mirza Ghazanffar Ullah
1530-1540	Spatial distribution and individual identification of tigers in Terai-Arc landscape, India: A step towards understanding meta-population dynamics	Suvankar Biswas
1540-1550	Genetic diversity and phylogeography of Himalayan Brown Bear (<i>Ursus arctos isabellinus</i>) in India	Sujeet Kumar Singh
1550-1600	Current population status and genetic assessment of Nilgiri Tahr in selected areas of Western Ghats, India	Predit, M.A.
1600-1620	Discussion and comments of Chair and Co-chair	
1620	Tea	

Status of prey and space use by tiger (*Panthera tigris*) in Sanjay Tiger Reserve, Madhya Pradesh

-R. Rajasekar

The present study aims to assess the status of prey and space use by tigers and its co-predators in Sanjay Tiger Reserve Madhya Pradesh.

Sanjay Tiger Reserve (1643.8 km²) is located in Madhya Pradesh of Central Indian Landscape. It was considered as Tiger-3 conservation unit in India by global standards. It is also ranked as one of low-density tiger population area with potential for recovery.

Status of prey was assessed by Line transect method (n= 45). Camera traps placed in 4 km² grids (n=161) to determine the space use of tigers and its co-predators across the area. Photographic encounter rates were calculated for tigers and its co-predators. In addition to this, carnivore sign survey (15 km) was carried out in each beat of core area.

The estimated prey density which included livestock was (39.7 ± 5.8). Of this, the density of langur was found to be the highest (17.6 ± 3.7), followed by livestock (11.6 ± 5.4) and rhesus macaque (4.5 ± 2.6). Densities of wild ungulates such as chital (2.0 ± 0.7), wild pig (1.8 ± 1.2), nilgai (1.7 ± 0.4) and chinkara (1.1 ± 1.0) were low. Detection of sambar and chousinga was too low that density could not be computed. We procured 69 photographs of 6 individual tigers in 6853 trap days/nights. Based on sign survey, sloth bear (50%) encounter rate was high followed by jackal (2%), hyaena (10%), leopard (10%) and tiger (5%).

Status of prey and tiger relationship in exceptionally low density population size. Although the reserve has significant potential to improve the population status in tiger and prey species, concerted management efforts including active recovery strategy may be required.

Keywords: Camera trap, encounter rate, line transect, sign survey, population recovery

Project Title	: Evaluation of prey availability and habitat suitability for tigers and its ranging patterns in Sanjay Tiger Reserve, Madhya Pradesh
Principal Investigator(s)	: K.Ramesh, K.Sankar, Qamar Qureshi and Parag Nigam
Researcher(s)	: R.Rajasekar (Junior Research Fellow) and Sankarshan Chaudhuri (Junior Research Fellow)
Funding Agency	: Madhya Pradesh Forest Department
Project Duration	: 2014 - 2017

Deciphering wolf howls

-Sougata Sadhukhan

Wolves are long ranging species. Howling evolved in wolves to communicate with other group members as well as to demarcate their large territories. Howling is a social communication process that is important in overall behaviour of many canid species. Howl can travel large distances owing to their high amplitudes and narrow frequency ranges. Howl modulation is not arbitrary, therefore, can be used to distinguish one population from another. In this study, our aim is to use howling as a tool to identify individual wolves to investigate its use as a population estimation tool for wolves.

We sampled 16 forest ranges in and around Pune and Nagpur District of Maharashtra for recording wolf howls. We also recorded wolf howls from Jaipur Zoo.

Howls recorded from the captive wolves were played in the field during early morning and evening hours expecting a response. A 50-second-long howl was played five times in a session at the interval of 3 minutes with increasing amplitude. In case a response was received, the session was repeated after the interval of 15 - 20 minutes to enhance possibility of recording a better howl.

Fundamental frequency, the lowest frequency of periodic wave form, of each howl was identified and data on thirteen main parameters of the sound were extracted using Raven Pro and Web plot digitizer software to identify individual wolves. We validated the method by using 54 howls of known wolves (n=4) from captivity as well as from wild. Data was analysed using Discriminant function analysis (DFA). During validation of the method from the howls of known individuals, we achieved 94.0% accuracy.

From this pilot study we infer that howling has a high potential to be used as a tool to monitor population of wolves and possibly with other species with individually unique vocal signatures. Further research is required to export this technique as a tool to monitor free ranging populations.

Keywords: Bioacoustics, population estimation, fundamental frequency

Project Title : Population estimation and home site selection by wolves in human dominated landscapes of Maharashtra, India

Principal Investigator(s) : Bilal Habib, Vinay Sinha, Sunil Limye and Satyajeet Gujjar

Researcher(s) : Sougata Sadhukahan (Junior Research Fellow)

Funding Agency : Maharashtra Forest Department

Project Duration : 2015-2016

Its time to move on: Preliminary insights into tiger dispersal using radio collars

-Pallavi Ghaskadbi

Over the last few years, the Eastern Vidarbha Tiger Landscape in Maharashtra has shown a rise in tiger populations as a result of suitable protection measures. Today, tigers are dispersing across the entire landscape dominated by human settlements in search of habitats and mates. The aim of our project titled "Studying dispersal of tigers across the Eastern Vidarbha Landscape, Maharashtra, India" is to understand the characteristics of dispersal which may aid policy making for tiger conservation in a landscape which is developing aggressively. We present preliminary results and discuss the applications of radio telemetry in tiger movement ecology.

The intensive study area is the Eastern Vidarbha Landscape which includes Pench Tiger Reserve (Maharashtra), Navegaon-Nagzira Tiger Reserve, Umred Karhandla Wildlife Sanctuary, Bor Tiger Reserve, Brahmपुरi Forest Division, Tadoba-Andhari Tiger Reserve and Tippeshwar Wildlife Sanctuary. The six PAs and one Forest Division are mainly mixed dry deciduous and mixed moist deciduous forests. Along with the human dominated landscape, the study area is about 51,336 sq.km. We present preliminary results of data collected over four months.

4 tigers (3 sub-adult males and 1 sub-adult female) were radio collared as a part of this project. We also present data of 1 (adult male) tiger which was not collared as a part of this project but was monitored for his extensive movement across the landscape. The inter-fix intervals of the collars were fixed at 5 hours (inside PA) and 2 hours (outside PA).

The radio collared data of 5 tigers yielded a total of 3452 fixes. Out of the total locations, 64.94% were observed in non-PAs and only 35.05% were inside PAs. We also characterized the locations based on land use patterns and found that deciduous forests were used the most (52.47%) followed by areas of Double/Triple cropping (16.94%). The mean step length, i.e., the distance between two consecutive locations, varied significantly inside PAs and outside PAs ($p=0.0034$) for the dispersing individuals. We tested various models like Brownian Bridge Model, First Passage Time and Bayesian Partitioning of Markov Model to understand movement characteristics of the animals.

Fine scale telemetry data offers exciting opportunities to study dispersing tigers (movement patterns, behaviour, food habits, etc.) especially, outside PAs. Movement ecology has opened up new avenues of research in tiger ecology and holds promise for influencing policy makers to make better informed decisions about corridor management.

Keywords: Radio telemetry, movement ecology, Eastern Vidarbha Landscape, Mean step length

Project Title	: Studying dispersal of tigers across the Eastern Vidarbha Landscape, Maharashtra, India
Principal Investigator(s)	: Bilal Habib, Parag Nigam and APCCF (WL) Nagpur (East), Maharashtra.
Researcher(s)	: Pallavi Ghaskadbi (Project Biologist), Zehidul Hussain (Project Biologist)
Funding Agency	: Maharashtra Forest Department
Project Duration	: 2015- 2017

An update on reintroduction and recovery of tiger in Panna Tiger Reserve, Madhya Pradesh

-Deepti Gupta

Tiger (*Panthera tigris*) population became functionally extinct from Panna Tiger Reserve (PTR), Madhya Pradesh in 2009 and in response; a species recovery program is being implemented in two phases. This presentation aims to provide an overview of the project activities and outcome in Phase I (2009-2014) as well the ongoing efforts in Phase II (2015-2020).

PTR is located in the Vindhyan Hill Ranges of central Indian Highlands in Madhya Pradesh. The total area of the reserve is 1576 km² (which includes both core and buffer). The area is dominated by dry deciduous elements and step-like topography, and support wide variety of fauna and flora.

In Phase I, six tigers were translocated from Bandhavgarh (T1), Kanha (T2, T4 & T5) and Pench (T6) Tiger Reserves for rebuilding the tiger population in PTR. These animals and their offspring were monitored based on telemetry tools (n =11) and camera trapping methods (n = 120). Prey population size was estimated by distance sampling involving line transect method (n=42). In Phase II, the activities of Phase I are being continued, but the focus is at population level than at individual level. Also capacity building of staff for population monitoring methods is being imparted.

The reintroduced tiger population bred successfully, with rapid population growth and the current population stands at >40 animals. The age-sex pyramid indicates healthy population size and in the current structure, long-term viability may be ensured. It was found that male tigers in Panna represent the largest home range in India and that the release site had no influence on home range or mate selection. Density of all ungulates including cattle was estimated to be 46.8 ± 5.1 (SE) /sq. km which roughly corresponds to earlier estimates. Sambar was the most abundant wild prey, followed by Nilgai and Chital. Population of co-predator such as leopard in PTR is amongst the high densities with 17.9 ± 0.2 /100 km². As PTR has now recovered significantly and dispersal events are also taking place, there needs to be landscape scale conservation focus, looking into source-sink dynamics and functional connectivity.

Keywords: Population estimation, home range, mate selection, distance sampling, mark-recapture method

Project Title	: Tiger reintroduction and recovery programme in Panna Tiger Reserve and landscape complex, Madhya Pradesh: Phase II
Principal Investigator(s)	: K. Ramesh, J. A. Johnson and Subhranjan Sen
Researcher(s)	: Deepti Gupta (Project Fellow), Manjari Malviya (Project Fellow), Rajat Saha (Project Fellow), Manish Kaneria (Project Fellow)
Funding Agency	: National Tiger Conservation Authority, Govt. of India and Madhya Pradesh Forest Department
Project Duration	: 2015 - 2020

Current status and distribution of Swamp Deer along Ganga river and its tributaries in North India

-Shrutarshi Paul

Using a combination of status and habitat survey, radio telemetry and conservation genetics, we aim to investigate movement patterns, demographic parameters and inbreeding status of the swamp deer populations along the Gangetic flood plain of Uttarakhand and Uttar Pradesh. The project also aims to evaluate the interactions between livestock and swamp deer in this landscape. Finally the information generated will be integrated to develop a long-term recovery plan for this species.

All swamp deer habitats in Uttarakhand and Uttar Pradesh.

To achieve our goals, we will combine intensive field sampling, molecular data generation and analysis to understand swamp deer movement patterns. In the first phase, we carried out pilot surveys along the river banks between Jhilmil Jheel Conservation Reserve and Hastinapur Wildlife Sanctuary. We conducted questionnaire surveys with local communities, followed by intensive swamp deer sign surveys along rivers Ganga, Solani and Ramganga. Direct sighting, hoofmarks, antlers and pellets were considered as evidence of presence. We also collected biological materials in the forms of pellets, antlers and opportunistic tissue samples.

We found swamp deer signs along both east and west banks of Ganges. We collected a total of 1605 pellets, 207 antlers and 5 opportunistic tissue samples during our survey. We also discovered an unreported swamp deer population at Jamanpur near Afzalgarh on the bank of Ramganga River. We spotted 11 individuals and recovered 26 pellets and 9 antlers from this area.

The discovery of an unreported population of swamp deer in Uttar Pradesh and presence of swamp deer in fragmented patches along the Ganges and its tributaries adds hope for the long-term survival of the species in this landscape. We will be radio collaring few individuals and collecting further biological samples to understand movement patterns and inbreeding status of these populations. The swamp deer are threatened with habitat loss, excessive poaching and lack of protection. A very careful and urgent planning is needed to conserve the last of these populations along Ganga.

Keywords: Jhilmil Jheel Conservation Reserve, Hastinapur Wildlife Sanctuary, poaching, habitat loss, species recovery

Project Title	: Movement pattern and inbreeding status of swamp deer (<i>Rucervus duvaucelii</i>) at Uttarakhand, India
Principal Investigator(s)	: Samrat Mondol, Bivash Pandav, Bilal Habib, Parag Nigam, Dhananjai Mohan
Researcher(s)	: Shrutarshi Paul, DST-INSPIRE JRF (PhD Scholar)
Funding Agency	: Uttarakhand Forest Department and Department of Science and Technology, Govt. of India
Project Duration	: 2016-2018

Long term ungulate population trend in Corbett Tiger Reserve

-Sudip Banerjee

Estimating abundance is fundamental to understanding several ecological processes such as response of prey population to environment and management or understanding prey predator relationships. This study aims to monitor the density/abundance of principal prey species of tiger in Corbett Tiger Reserve (CTR). Apart from intensive monitoring of tiger population over six years we have also conducted rigorous assessment of ungulate density and habitat. Besides estimating density of ungulate species for the park using Conventional Distance Sampling (CDS), we also attempted to assess their spatially explicit densities and their environmental correlates such as tiger density, habitat, and terrain using Density Surface Modelling (DSM).

We sampled Corbett National Park (~520 sq. km area) during 2010-12 and the entire Corbett Tiger Reserve (1288 sq. km) during 2013-15.

We walked line transects of 1-2 km length during summer and winter seasons of each year. During 2010-12, we walked 1-2 transects per beat with three temporal replicates and during 2013-15, we additionally sampled randomly placed transects without any temporal replication beside the conventional transects to attain full coverage of the tiger reserve. We modelled detection function for each ungulate species across seasons and habitats using CDS engine of Program DISTANCE 7.

Based on preliminary analysis, we estimated density (per sq. km) of Chital, the most abundant tiger prey in CTR, to be stable over sampling years, as 62.0 ± 23.1 (2010-11), 63.7 ± 20.9 (2011-12), 73.0 ± 14.2 (2012-13), 64.4 ± 8.6 (2014) and 70.9 ± 10.2 (2015). Similarly, density (per sq. km) of Sambar was stable across years as 10.1 ± 1.7 (2011-12), 9.3 ± 1.8 (2012-13), 9.1 ± 1.1 (2014) and 10.7 ± 1.4 (2015). Five years pooled density estimates of Chital and Sambar were 60.2 ± 6.3 and 7.65 ± 0.73 respectively. The total mean tiger prey biomass (Chital, Sambar, Barking deer and Wild pig) was estimated to be $3851.21/\text{km}^2$ with a bootstrap standard deviation of 353.35. Using Hayward's (2007) and Karanth's (2004) predictive models tiger density was estimated to be $15.62/100 \text{ km}^2$ and $15.65/100 \text{ km}^2$ respectively. Examination of the effects of environmental covariates on ungulate density using DSM engine is in progress.

Our long term abundance and density estimates of tiger prey will provide insights into the carrying capacity of the largest tiger population in the world.

Keywords: Distance sampling, prey, Density surface modelling, line transects, abundance

Project Title	: Space use and dispersal of tigers in Corbett landscape
Principal Investigator(s)	: Y.V.Jhala and Qamar Qureshi
Researcher(s)	: Shikha Bisht (Research Biologist), Sudip Banerjee, (Research Biologist)
Funding Agency	: National Tiger Conservation Authority, Govt. of India
Project Duration	: 2015- 2016

Occupancy and population estimation of key wildlife species in Aravallis, Haryana, India

-Paridhi Jain

The Aravalli mountains are the prominent landform shaping the western India and are one of the oldest ranges in the world. The oldest fold mountains are indeed a unique landscape offering home to diverse species of flora and fauna. The deforestation and developmental activities have destroyed what was once a dense forest. The study aimed at collecting basic information about the occurrence of species in Haryana part of the Aravalli Landscape.

The study area selected was the Aravalli region of Haryana across five forest divisions. We sampled forest areas in Gurgaon, Faridabad, Mewat, Mahendargarh and Rewari to estimate the status of key wildlife species.

A total of 51 sites were sampled for carnivore signs in five forest divisions of the Aravallis Haryana to estimate occupancy of key mammalian species. To estimate density of ungulate species 51 line transects (one in each site) were monitored and repeated once across the landscape. PRESENCE and DISTANCE program was used to analyze the data.

Signs surveys indicated presence of 10 species namely Leopard, Jackal, Hyena, Wolf, Fox, Jungle cat, Mongoose, Civet, Porcupine and Rhesus Macaque. Jackal was the most common species occurring in 47 of the sites whereas Rhesus Macaque was the rarest, occurring in only 2 sites.

The occupancy estimate was highest for Porcupine ($y 0.87 \pm 0.05$ SE) followed by Nilgai ($y 0.76 \pm 0.06$) & Hyena ($y 0.68 \pm 0.06$). The density estimate for Nilgai was 8.31 ± 2.69 SE animals per sq. km. There were only five sightings of Chinkara for Mahendargarh and Rewari divisions.

Beat Damdama had the highest intensity of signs for most of the species. The Aravallis area of Haryana still has potential to be conserved as a habitat for some of the representative species like Leopard and Hyena. Areas like Damdama are high priority conservation areas within the landscape.

Keywords:

Project Title	: Mapping landuse landcover pattern in Aravallis , Haryana with reference to status of key wildlife species.
Principal Investigator(s)	: Bilal Habib and Gautam Talukdar
Researcher(s)	: Paridhi Jain (Project Biologist) and Anchal Bhasin (Project Biologist)
Funding Agency	: Haryana Forest Department
Project Duration	: 2015-2016

Distribution and breeding biology of *Raorchestes shillongensis* (Anura: Rhacophoridae) in Meghalaya

-Bitupan Boruah

To generate first ever information on distribution, relative abundance and reproductive behaviour of critically endangered frog *Raorchestes shillongensis*, our study was conducted during May –August 2016 in Meghalaya, India.

The type locality of the species is Malki forest within Shillong city of East Khasi Hills district. Malki forest is a uninhabited hilly pine forest and surrounded by human settlements.

We employed nocturnal visual encounter survey, acoustic search to locate calling aggregation. We collected samples by using hand pick up method and used a GPS (Garmin 78s) for geographical co-ordinate. Breeding behaviour was studied based on ad libitum sampling. We observed 5 pair of breeding amplexus in three different sites. We revisited the taxonomy and redescribed the species (Body size 17.37 SD \pm 1.67, n=27) and provided field identification keys and variation across population. We added about 30 new localities in its distribution range. The species is found to be restricted within an elevation of 1087m to 1924m. Call aggregations are encountered from early evening and males attains average perch height of 66.36 cm SD \pm 39.67 (n=88) above ground. Amplexus is axial and was obtained in the month of May to July, which is correlated, with increase in rainfall in the study area. The reproductive mode of the species is assigned to mode 23 (Direct development of terrestrial eggs). Female laid large unpigmented creamy white eggs on ground under moist leaf litters. Average clutch size 12.16 SD \pm 3.97 (n=6) and number of eggs in a clutch depends on the body size of the female. Morphological changes during development of eyes, limbs, pigmentation were observed and froglet hatched after 31 days of development (n=2).

Finally, our results on morphology and behaviour are compared to congeneric species in South Asia and discussed in terms of evolutionary implication. The study found the species is rather widespread than was hitherto known and its breeding is unique. The species may however be sensitive to soil pollution. Genetic study to see its position in phylogeny is underway.

Key words: Threatened, *Raorchestes*, reproduction, conservation

Project Title	: Xmas Bush Frog <i>Raorchestes shillongensis</i> (Pillai and Chanda, 1973) Conservation Project, Meghalaya, India
Principal Investigator(s)	: Abhijit Das
Researcher(s)	: Bitupan Boruah (Project Biologist)
Funding Agency	: Mohamed bin Zayed Species Conservation Fund
Project Duration	: 2016

Cryptic diversity and lineage divergence of the Indomalayan frog genus *Fejervarya* (Anura, Dicroglossidae)

- Prudhvi Raj Gunturu

For many taxa, inaccuracy of species boundaries and distributions hampers inferences about diversity and evolution. This is particularly true in frogs of the genus *Fejervarya* (Anura: Dicroglossidae) in tropical Asia where prevalence of cryptic species has often been suspected for a long time. The genus was originally described as monotypic and suspected to harbour many species than the 36 currently recognized distributed across South and South East Asia. This widespread and taxonomically complex taxon group provides a good opportunity to (1) test species boundaries, and (2) investigate historical biogeography of Indian subcontinent and associated patterns of diversification.

Sampling was carried out in 52 locations across India (Western Ghats, Eastern Ghats, North East India, Western Himalayas and the Deccan plains). 220 individual specimens were collected of which 72 samples were used in the present study.

In the current study we primarily use mainly molecular data along with other lines of evidence to characterize species. DNA sequencing for portions of the mitochondrial 16S and 12S ribosomal RNA mitochondrial genes was done. Phylogenetic analysis of the molecular data was done using Maximum likelihood (ML) and Bayesian approaches.

The results revealed two evolutionary lineages that we could not distinguish based on external morphology. The two lineages can be further divided into eight clades based on their phylogeny, morphology and geographical distribution. Based on the present multi-gene sequence data, we hereby reveal about five novel species from the genus and other prospective candidate species that need further work.

Formal recognition of these species would facilitate future attempts to assess the diversity of this group of frogs and their reported distributions would have significant biogeographic implications, affecting estimates of the diversity in the region.

Key Words: DNA barcodes, Cryptic species, Historical Biogeography, Diversity, Phylogeny

Project Title	:	Delineating species boundaries of the family Dicroglossidae Andersson, 1871 (Anura) using an integrated taxonomic approach
Principal Investigator(s)	:	Abhijit Das
Researcher(s)	:	Prudhvi Raj Gunturu (DBT-RA)
Funding Agency	:	Department of Biotechnology, Govt. of India
Project Duration	:	2015-2017

Traditional ecological knowledge among Raji and Barpatiya tribes of eastern Uttarakhand: Research approach and preliminary findings

- Naveen Chandra Joshi

We conducted a preliminary survey of tribal areas covering two least known communities, viz., Barpatiya and Raji in Pithoragarh district, Uttarakhand. Objective of the study was to document the traditional ecological knowledge (TEK) among these two communities.

The present study was conducted in Namik, Papri, Bothi, Ringu and Chulkot villages of Barpatiya and Kantoli, Chifaltara and Kimkhola hamlets of Raji communities in Munsyari, Dharchula, Kanalichhina and Didihat blocks of Pithoragarh district.

The selection of communities and villages was done on the basis of detailed review of literature and preliminary survey of tribal villages. Demographic studies were conducted in these villages to ascertain age and gender class distribution and status of TEK. Overall 430 households with a total population of 2411 were surveyed covering various aspects related to demography and socio-economic status viz. gender, age, literacy, marital status, occupation, economic status and livestock. Informal interviews (n=32), informal group discussions and field-observations along with photo documentation covering all strata of population were conducted during October 2015-May 2016 to find out the past and present level of TEK among the two communities..

As per our survey the total population of Barpatiyas in 5 villages was 861, whereas Raji had a total population of 309 in 3 hamlets. Barpatiyas had about 9% population above 60 years of age, while Rajis were represented by only about 3% population. Population pyramid of Papri and Kimkhola were expansive type, whereas all others were constrictive type except Kantoli which seems to be of stationary type. Life expectancy was found to be greater in Barpatiyas above 65 years of age groups compared to Rajis, whereas females had more life expectancy in both the communities. The maximum use of medicinal herbs was recorded in Kimkhola (55% households) among Rajis, whereas in Barpatiyas it was recorded in Namik (35% households). The preliminary findings suggest that middle age group among Barpatiyas had maximum knowledge of Non-timber forest products NTFP (availability and use) while such trend was not evident among Rajis which may be due to their low and uneven population.

Results suggest that Barpatiya community still hold the TEK related to farming, livestock and NTFP, whereas Rajis related to wood carving, hunting and gathering. Rapid socio-economic transformation was noticed in both the communities causing decline in TEK. Implications of these changes are discussed.

Key Words: Documentation, indigenous ethnic communities, tribes, demography, population pyramid

Project Title	: Documentation of traditional ecological knowledge among indigenous ethnic communities of Pithoragarh District, Uttarakhand
Principal Investigator(s)	: G.S. Rawat and S. Sathyakumar
Researcher(s)	: Naveen Chandra Joshi (Project Associate)
Funding Agency	: Department of Science and Technology, Govt. of India
Project Duration	: 2015-2020

Evaluating housing and enrichment condition of lions at Sakkarbaug Zoo

-Sitendu Goswami

Wild animals housed in sterile captive environments are deprived of the opportunity to display a gamut of species-typical behaviours, which leads to an increase in allostatic load and development of physiological and behavioural abnormalities. Enrichment interventions improve enclosure complexity and create opportunities for animals to display near-natural behaviour repertoire. A study was conducted to assess the housing and enrichment conditions of lions at Sakkarbaug Zoo as a part of the ongoing Project on Partnering to Support Gir Lion Conservation in Gujarat. Subjects included 15 male and 25 female Asiatic lions with an average age of 8.2 years ($s=4.1$), housed in 15 enclosures of the conservation breeding facility.

Enclosures were rated according to a 41 point complexity scoring rubric and categorized as good($n=6$), average($n=7$), and sub-optimal($n=5$). One male and two females with a history of disease and ongoing treatments were excluded from the study. Information pertaining to the personality of subjects ($n=37$) was collected on a 23 point scale, where keepers and independent observers rated and coded study subjects on a scale of 1-9 for each attribute. After accounting for inter-rater reliability, subjects were categorized as timid ($n=12$), and curious ($n=25$) individuals. Scan sampling with 1 min intervals was used to record behavioural states and enclosure space usage in subjects in two session 0500-1100 hours and 1900-2100 hours. Over the course of seven months (2015-2016), 159,840 scan observations were recorded. Enrichment interventions were used to test the effect of better welfare on behaviour repertoires following an A-B-A-B design.

Results indicate that most captive-born individuals (4:14) showed leanings towards a more curious personality type. Animals rescued from wild (10:9), tend to be wary of human observers and novel objects. In the first phase of enrichment intervention, timid subjects ($n=12$) showed higher latency to novel objects averaging at 161.9 minutes ($s=29.78$) compared to curious subjects ($n=25$) averaging at 13.96 minutes ($s=3.96$). Species-typical behaviour diversity for all subjects ($n=37$) was 0.30($s=0.14$), and post-enrichment increased to 0.89 ($s=0.39$). Curious subjects were found to be more susceptible to display aberrant repetitive behaviours under poor welfare conditions compared to timid subjects.

Husbandry practices should be designed to accommodate individual traits of captive animals. Enrichment devices are effective in bringing a novelty value to sterile enclosures and lead to significant changes in captive animal behaviour repertoire and energy expenditure, which translates as better animal welfare. Animal welfare assessments should be a synthesis of enclosure complexity, behaviour repertoire, physiological state, psychological well-being and social status.

Keywords: Animal welfare, personality traits, enclosure enrichment, asiatic lion

Project Title	: Partnering to Support Gir Lion Conservation in Gujarat
Principal Investigator(s)	: P.C. Tyagi and P.K. Malik
Researcher(s)	: Sitendu Goswami (Senior Project Biologist)
Funding Agency	: Zoological Society of London
Project Duration	: 2015-2017

Wild origin animals: Role of founders in *ex-situ* conservation

-Anupam Srivastav

Ex-situ conservation is a management strategy employed for species that are threatened by extinction in their native habitats. Success of these efforts is dependent on effective population management and is aimed at retention of maximum genetic diversity while maintaining demographically stable populations. Activities include acquisition of unrelated wild origin animals as founders and subsequent management through regulated mating choices and optimizing reproductive output to maintain desired levels of genetic diversity and population size based on the goals of the program.

We review here the outcomes of *ex-situ* conservation efforts initiated for four species in captive facilities in India using pedigree databases. The species included are Hoolock gibbon (*Hoolock hoolock*), Phayre's leaf monkey (*Trachypithecus phayrei*), Asiatic lion (*Panthera leo persica*) and Indian wild ass (*Equus hemionus khur*). The pedigree databases maintained in Single Population Animal Record Keeping Software (SPARKS) were analyzed using PMx Software. Key parameters selected include census trends, genetic diversity and its relationship with population size and the relationship of founder related variables with time.

The analysis revealed similarities in the inclusion of a number of wild origin animals in the captive populations; however, only a few of these were effective founders. Unequal contributions of these founders lead to unequal number of founder descendants in the populations leading to low founder genome equivalents, limited retention of the sampled genetic diversity and a small effective population sizes. The populations with the exception of Asiatic lion were further characterized by their small sizes and poor growth rates.

The above results may be attributed to lack of a planned effort in collection of founders leading to incompatibility and absence of potential mates and limitations in housing and husbandry practice adopted. The study indicates the need for adoption of scientific principles for effective management of *ex-situ* conservation programs.

Keywords: Captive populations, pedigree records, Hoolock gibbon, Asiatic lion, Phayre's leaf monkey, Indian wild ass

Project Title	: Development and maintenance of studbooks for selected endangered species in Indian zoos
Principal Investigator(s)	: Parag Nigam and P.C.Tyagi
Researcher(s)	: Anupam Srivastav (Project Consultant), Neema Sangmo Lama (Research Assistant)
Funding Agency	: Central Zoo Authority, Govt. of India
Project Duration	: 2012- 2017

Mitochondrial DNA based genetic characterization of Sambar (*Rusa unicolor*) populations of North-East India

-Mirza Ghazanfar Ullah Ghazi

Sambar (*Rusa unicolor*) is the largest deer species in Southeast Asia. Phylogenetic revisions within *Cervus* genus indicated the taxonomic frailty within this subgenus *Rusa*. A recent study indicated distinct genetic variation among different sambar populations of North, Central and South India. In this study, we examined the utility of mitochondrial DNA cytochrome *b* (mtDNA *cyt b*) and control region (mtDNA CR) as molecular markers to infer the intra-species genetic relationships of Northeast Sambar with North, Central and South Indian populations.

Pakke Tiger Reserve, Itanagar Biological Park from Arunachal Pradesh and Nagaland Zoological Garden, Nagaland from North-Eastern India were targeted for this study.

A total of 112 samples were used in the present study including all the major populations of Sambar in India. From North-East India, Pakke Tiger Reserve (n=35), Biological Garden, Itanagar (n=7) Nokrek National Park (n=4) from Meghalaya and Nagaland Biological park (n=4) were collected. Also samples from north and central India (n=36) and south India (n=26), were included in our analysis to reveal the phylogenetic structuring of these populations. Partial fragments of 674 bp of mtDNA *cyt b* and 474 bp of mtDNA CR gene were used to construct the phylogenetic relationships among all observed haplotypes using Bayesian analysis. To assess the population genetic structure of Sambar populations across India a panel of 22 polymorphic microsatellite loci was also selected and successfully standardized.

The phylogenetic framework depicts distinct and unique clustering pattern of the North-East Sambar as compared to the rest of the Sambar population in India. This study provided valuable information for molecular screening and identification of Sambar populations. Our preliminary results reveal a diverse pattern of genetic diversity and existence of genetic differentiation among Sambar populations in India.

Keywords: Sambar, genetic variation, mitochondrial DNA marker, microsatellite marker

Project Title	: Genetic Assessment of Sambar (<i>Rusa unicolor</i>) Populations of North-East India
Principal Investigator(s)	: S.K. Gupta and S.A. Hussain
Researcher(s)	: Mirza Ghazanfar Ullah Ghazi (Junior Research Fellow)
Funding Agency	: Department of Science & Technology, Govt. of India
Project Duration	: 2014-2017

Spatial distribution and individual identification of tigers in the Terai-Arc landscape, India: A step towards understanding meta-population dynamics

-Suvankar Biswas

The Terai-Arc Landscape is one of the few remaining strong holds of wild tiger populations across the globe. Tiger survival in this landscape will depend on a conservation plan focused at the landscape level. This study aims to combine field, GIS and molecular tools to investigate tiger meta-population dynamics across the Terai-Arc landscape, north India. This presentation focuses on our initial understanding of spatial distribution and standardization of tiger individual identification protocol from faecal samples.

Indian part of Terai-Arc landscape, covering the states of Uttarakhand, Uttar Pradesh and Bihar. This area retains about 25000 sq. km. potential tiger habitat.

Between December 2015-May 2016, we collected 530 large carnivore scats from different parts of this landscape. We swabbed each scat twice and extracted DNA using already standardized protocols. We conducted PCR-based species identification tests to assess tiger spatial distribution patterns across our sampling areas. Further, we used a set of 13 microsatellite loci to standardize tiger individual identification from faecal samples. We initially selected 40 field collected faecal samples for this. We have also standardized molecular sexing of tiger and leopard samples.

We standardized a comprehensive suite of protocols for sample collection, storage, and DNA extraction from faecal samples. So far, we identified 257 tiger and 249 leopard samples from our field-collected feces, resulting in a species identification success rate of 95.47%. We identified 15 unique tiger individuals from the initial 40 test samples from Rajaji TR and Lansdowne FD with 25 recaptures from these samples. We calculated $P_{ID(sibs)}$ (Probability of identity for sibling) value of $4.8e-04$, assuring that our set of 13 microsatellites loci produces unambiguous individual identification of tigers from faecal samples.

So far, we validated a comprehensive protocol for faecal sample collection, storage and DNA extraction method from a range of wild animal species and standardized a set of 13 microsatellite loci for tiger individual identification. Currently we are working on individual identification of the remaining samples and molecular sexing. These data will be further used for large-scale meta-population dynamics analyses.

Keywords: Terai Arc landscape, tiger, connectivity, population structure, social dynamics

Project Title	:	Meta-population dynamics of tigers in the Terai-Arc landscape, India
Principal Investigator(s)	:	Samrat Mondol, Bivash Pandav and Gautam Talukdar
Researcher(s)	:	Suvankar Biswas (Junior Research Fellow)
Funding Agency	:	Wildlife Conservation Trust-Panthera Global Cat Alliance grants and Department of Science and Technology, Govt. of India
Project Duration	:	2015-2018

Genetic diversity and phylogeography of Himalayan Brown Bear (*Ursus arctos isabellinus*) in India

-Sujeet Kumar Singh

In India, the Himalayan brown bear (HBB) occurs in low density in the alpine regions of the greater and trans-Himalaya in the states of Jammu and Kashmir (J&K), Himachal Pradesh (HP) and Uttarakhand (UK). Of all the sub-species of brown bear, HBB has remained little studied except for a few studies on status, conflict surveys and ecological aspects. However, genetic information is lacking across distribution range of HBB except for a study of Deosai Plains of Pakistan. Therefore, the present study is aimed to investigate the genetic status and regional and global phylogeography of southernmost population of HBB in India.

Samples were western and north-western Himalaya in the states of J&K, HP, and the UK.

We utilized 269 bp control region (CR) of mitochondrial DNA (mtDNA) using fecal samples ($n=75$) from of HBB collected from habitats in J&K, HP and UK to estimate the genetic diversity indices, Bayesian-based Phylogeny and median-joining (MJ) network. Haplotype frequency was used to calculate the pairwise F_{ST} values. Demographic history of the HBB was estimated using different statistical approaches i.e. neutrality test, mismatch distribution and Bayesian skyline plot.

The Bayesian-based Phylogenetic analysis revealed the presence of five haplotypes (four in wild and one in captive) in five different lineages and all these were with the Gobi-Pakistan clad with a higher posterior probability value of 0.93. One haplotype of these was shared between J&K (Ovra-Aru and Ladakh) and HP (Kugti Tundah and Pin Vally National Park (PNP), HP. UK shared a haplotype with PNP. The MJ network analyses of reported and observed mtDNA haplotypes (Gobi-Pakistan-India) indicate the presence of core haplotype of Ladakh, JK-PNP. Genetic diversity is moderate in HBB in India i.e. Nucleotide (π) and haplotype (h) diversity was 0.693 and 0.00391 respectively. Significant and higher F_{ST} (from 0.209 to 1.00) indicated high genetic differentiation between populations in India. Neutrality test and Bayesian skyline plot suggested population decline of HBB in last 5,000 to 10,000 years while unimodal mismatch distribution plot showed populations expansion however the plot was not exactly unimodal.

Present study concluded that HBB population in India, Pakistan and Gobi constitute an ancient clade of brown bear among the brown bear sub-species and PNP-Ladakh area have core haplotype for the other HBB populations. Higher genetic differentiation in HBB population and population decline during the last 5000-10000 years might be due to the strong female philopatry, human-mediated disturbances and probably poaching.

Keywords: Brown Bear, Trans-Himalaya, Demography, and Population Structure

Project Title	: Population genetic structure and extent of gene flow in brown bear (<i>Ursus arctos isabellinus</i>) populations in India (Jammu and Kashmir, Himachal Pradesh and Uttarakhand) and assess extent of gene flow between populations of India and Pakistan: Conservation and Forensic Implications
Principal Investigator(s)	: S. Satyakumar and S.P. Goyal
Researcher(s)	: Sujeet Kumar Singh (Research Biologist), Shahid Dar (Project Biologist)
Funding Agency	: Department of Science and Technology, Govt. of India
Project Duration	: 2014-2017

Current population status and genetic assessment of Nilgiri Tahr in selected areas of Western Ghats, India

-Predit. M. A

To undertake current population demographic status, habitat conditions and genetic assessment of Nilgiri Tahr in selected areas of Western Ghats, India.

We surveyed Mukurthi National Park, Nilgiri South Forest Division, Anamalai and Parambikulam Tiger Reserves, and Grizzled Giant Squirrel Wildlife Sanctuary from February 2016 – August 2016.

We used direct count method in assessing populations, and each sighted animal was classified in different age and sex classes. An adult male was categorized into three classes (Saddle back male, Dark brown male, and Light brown male) whereas yearlings and young ones were not classified for sex. Information on anthropogenic pressures (livestock grazing, Non Timber Forest Produce collection) were collected based on signs observed during the survey. We collected faecal pellets from surveyed blocks for genetic study.

Herd size ranged from three to 31 individuals with an average of 10.4 individuals/herd during calving season whereas it was of 22 individuals (two to 170 individuals /herd) during post calving season in Mukurthi National Park. These differences were statistically significant. However, average herd size of 8.25 (1 to 17 individuals/herd) and 8.75 individuals (1 and 15 individuals/herd) observed in Anamalai and Parambikulam Tiger Reserves and Grizzled Giant Squirrel Wildlife Sanctuary respectively.

Disturbance regimes were in the increasing order of Mukurthi National Park-Nilgiri South Forest Division > Anamalai and Parambikulam Tiger Reserves > Grizzled Giant Squirrel Wildlife Sanctuary. Larger herd size (22 individuals) was recorded from relatively less disturbed than disturbed habitats (9 individuals/ herd). Faecal pellet samples of 324, 214 and 297 numbers were collected for genetic assessment from study areas. We discuss optimization of genetic methods for identifying species, sex, and individuals.

Keywords: Western Ghats, Nilgiri Tahr, population demography, genetic assessment, faecal samples

Project Title	: Population genetic structure of Nilgiri Tahr in Western ghats, India: Conservation and forensic implications
Principal Investigator(s)	: Bivash Pandav, S. P. Goyal and Parag Nigam
Researcher(s)	: Predit M. A. (Senior Research Fellow) and Rakesh Matura (Research Associate)
Funding Agency	: Department of Biotechnology, Govt. of India
Project Duration	: 2015-2018



Post Box 18, Chandrabani, Dehradun 248 001, Uttarakhand, India
EPABX: +91 135 2640114, 2640115, 2646100; Fax: +91 135 2640117
Email: wii@wii.gov.in; Website: www.wii.gov.in