15th
INTERNAL ANNUAL
RESEARCH SEMINAR

IARS
2019

भारतीय वन्यजीव संस्थान
Wildlife Institute of India

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**INTERNAL ANNUAL
RESEARCH SEMINAR**
19th – 20th August 2019

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2019

Programme & Abstracts

भारतीय वन्यजीव संस्थान
Wildlife Institute of India

Programme

SEMINAR CHAIRPERSON
Dr. S. K. Khanduri, Former IG (WL), MoEFCC

INAUGURAL SESSION

0930 – 0935 h	*Welcome*	*Dr. K. Vishnupriya, Scientist - C*
0935 – 0945 h	*Opening Remarks*	*Dr. G. S. Rawat, Dean, FWS, WII*
0945 - 1000 h	*Inaugural Address*	*Dr. S. K. Khanduri, Seminar Chairperson*

TECHNICAL SESSION – I

Chair:	**Dr. Pratap Singh, Scientist – G**
Co-Chair(s):	**Dr. R. Suresh Kumar, Scientist – E**
	Dr. Navendu Page, Scientist – C

Poster Presentations (Mixed Bag): Speed Talks

Time	Title	Presenter(s)
1000-1003 h	Biodiversity profile and livelihood of people around Bakhira Wetland, Eastern Uttar Pradesh	*Partha Sarathi & Pallabi Mitra*
1003-1006 h	Fish diversity of Sahyadri Tiger Reserve, Maharashtra	*Anurag Rokade*
1006-1009 h	Status and distribution of Indian pangolin, *Manis crassicaudata* in Terai Arc Landscape: Preliminary findings	*Bhaskar Bhandari*
1009-1012 h	Biodiversity assessment of Lalwan Community Reserve (LCR), Shalla-Pattan Wetland (SPW) and Ranjit Sagar Conservation Reserve (RSCR) in Punjab	*Umama Khan, Asma Parveen, Arif Ahmad*
1012-1015 h	Need and feasibility assessment for deployment of Unmanned Aerial Vehicle in Tiger Reserves of India	*Tamali Mondal and Ritwika Ghosh*
1015-1018 h	Preliminary observation on the status of invasive species in grassland ecosystem of Kaziranga Tiger Reserve, Assam	*Umar Saeed*
1018-1021 h	A knowledge repository of Snow Leopard landscapes in India	*Anindita Debnath*
1021-1024 h	Modelling connectivity and bottlenecks for *Ursus thibetanus laniger*, Pocock, 1932 in Sikkim	*Sneha Pandey, Malyasri Bhattacharya*
1024-1027 h	A preliminary study on the seed ecology of *Bombax ceiba* and its response to hydrological alterations in Kaziranga National Park, Assam	*Megha Shruti*
1027-1030 h	Rebuilding Satkosia for tigers: Experiences and future strategies	*Vaishali Vasudeva*
1030-1033 h	Individual interaction in a social mega-herbivore: A case study of Gaur (*Bos gaurus gaurus*) from Bandhavgarh Tiger Reserve (BTR)	*Ritesh Vishwakarma*
1033-1036 h	Genetic characterisation of tigers from Manas and Kaziranga Tiger Reserves, India	*Vinay Kumar*

Time	Title	Presenter(s)
1036-1039 h	Development of baseline and a management plan for Siswan Community Reserve of Punjab	*Bidyut B. Barman & Priya Prajapati*
1039-1042 h	Source to sea expedition: A preliminary study on macro plastic content in fish guts	*Sumit Kumar*
1042-1045 h	Understanding plastic leakage into Ganga through many sources using a citizen science tool	*Navin Kumar Das*
1045-1048 h	Social and economic factors influencing plastic pollution in Ganges	*Hina Khatoon*
1048-1051 h	Quantifying microplastics in the abiotic matrix of Ganga river: A comprehensive approach to assess plastic pollution from source to sea	*Sunanda Kumari Bhola*
1051-1115 h	**Tea**	

Oral Presentation
STATUS AND DISTRIBUTION

Time	Title	Presenter(s)
1115-1130 h	Dry river, dire situation, dying hope? Breeding distribution and proximate factors affecting nest survival of river-island nesting birds in the National Chambal Sanctuary, Uttar Pradesh	*Rohit Jha,* Project Fellow
1130-1145 h	Tracking the rain-bird: Modeling the distribution of Pied Cuckoo in India	*Debanjan Sarkar*, Junior Research Fellow
1145-1200 h	Status of *Mulleripicus pulverulentus* – the largest woodpecker in Pawalgarh Conservation Reserve	*Sarabjeet Kaur Narula*, Ph. D Research Affiliate
1200-1215 h	Terrestrial mammalian assemblages and occupancy pattern along forest-stream network in Sahyadri Tiger Reserve, Maharashtra	*Shah Nawaz Jelil*, Project Fellow
1215-1230 h	A sneak-peak into the forbidden forest: Preliminary assessment of tigers, co-predators and prey in Pranhita Wildlife Sanctuary (PWLS), Gadchiroli, Maharashtra	*Kunjan Joshi*, Project Fellow
1230-1300 h	**Discussion & Remarks by Chair and Co-Chairs**	
1300-1400 h	**Lunch**	

TECHNICAL SESSION – II
ECOLOGY & BEHAVIOUR

Chair: Dr. Bivash Pandav, Scientist – F
Co-Chair(s): Dr. Bilal Habib, Scientist – E
Dr. K. Vishnupriya, Scientist – C

Time	Title	Presenter(s)
1400-1415 h	Habitat use of young golden mahseers (*Tor putitora*) in Kosi and Kohlu rivers of Uttarakhand, India	*Bhawna Dhawan,* Junior Research Fellow
1415-1430 h	Seagrass meadows as Food and Space resource for fish in Palk Bay, Tamil Nadu	*Chinmaya Ghanekar*, DST INSPIRE Fellow
1430-1445 h	Thermal regime of gharial nests in wild	*Suyash Katdare*, Senior Research Fellow
1445-1500 h	Movement ecology of Indian Python (*Python molurus molurus*, Linn.1758), Moyar River Valley, Tamil Nadu	*Vishnu C.S*, Junior Research Fellow

1500-1515 h	"Manna from Heaven" - Is this why Amur falcons *Falco amurensis* stop-over in Nagaland?	*Alex Jacob S*, Junior Research Fellow
1515-1530 h	Tigers in Similipal: Past, present and future challenges	*Harshvardhan S. R.* Junior Research Fellow
1530-1600 h	**Discussion & Remarks by Chair and Co-Chairs**	
1600-1615 h	**Tea**	

TECHNICAL SESSION – III
HUMAN – WILDLIFE INTERFACE

Chair: Dr. Parag Nigam, Scientist – F
Co-Chair(s): Dr. Abhijit Das, Scientist – D
Dr. Lallianpuii Kawlni, Scientist – C

Time	Title	Presenter(s)
1615-1630 h	Maps propose, elephants dispose: Home range and movement patterns of elephants in tribal hinterlands of northern Chhattisgarh	*N. Lakshminarayanan*, Project Scientist *Ankit Kumar,* Project Biologist
1630-1645 h	Effect of inorganic materials on stress hormone analyses in large felids: a comparative study on tigers in the Terai-Arc landscape	*Shiv Kumari Patel*, Junior Research Fellow
1645-1700 h	Not so sweet! A case study of sugar-coated human-leopard conflict in Junnar Forest Division, Pune Maharashtra	*Kumar Ankit*, Junior Research Fellow
1700-1715 h	Understanding ecological patterns of species in human-wildlife conflict	*Divya Ramesh*, Project Scientist
1715-1745 h	**Discussion & Remarks by Chair and Co-Chairs**	

TECHNICAL SESSION – IV
VEGETATION SCIENCE

Chair:	Dr. B. S. Adhikari, Scientist – F
Co-Chair(s):	Dr. Gopi, G. V., Scientist – E
	Dr. Anju Baroth, Scientist – C

Time	Title	Presenter(s)
0930-0945 h	Tree species diversity, composition and recruitment pattern in Moyar River Valley, Tamil Nadu	*Thiru Murugan V*, Project Assistant
0945-1000 h	Losers and gainers in post-tsunami era: insights from the mangrove forest of Nicobar Islands	*Nehru Prabakaran,* DST INSPIRE Faculty
1000-1015 h	**Discussion & Remarks by Chair and Co-Chairs**	

TECHNICAL SESSION – V
TAXONOMY, GENETICS & ANTHROPOGENIC IMPACTS

Chair:	Dr. S. K. Gupta, Scientist – E
Co-Chair(s):	Dr. Samrat Mondol, Scientist – D
	Dr. C. Ramesh, Scientist – C

Time	Title	Presenter(s)
1015-1030 h	Genetic status of the largest Gharial (*Gavialis gangeticus*) population	*Surya P Sharma*, Junior Research Fellow
1030-1045 h	Genetic analyses reveal population structure and recent decline in leopards (*Panthera pardus fusca*) of India	*Supriya Bhatt*, Junior Research Fellow
1045-1100 h	To Avoid or to Adapt - Energy Infrastructure and its Impact on Large Avian Species	*Harindra Baraiya*, Project Assistant
1100-1115 h	**Discussion & Remarks by Chair and Co-Chairs**	

CONCLUDING SESSION

Time	
1115-1130 h	**Concluding Remarks by the Seminar Chairperson**
1130-1135 h	**Vote of Thanks - *Dr. K. Vishnupriya*,** Scientist-C
1135-1200 h	**Tea**

Biodiversity profile and livelihood of people around Bakhira Wetland, Eastern Uttar Pradesh

-Partha Sarathi Mondal, Pallabi Mitra

Aim : As part of Bakhira Wildlife Sanctuary Management Plan Preparation, the present study was aimed to assess the biodiversity profile especially fish and birds in the wetland and people dependency.

Location : Bakhira Bird Sanctuary, is the largest natural flood plain wetland of Uttar Pradesh located at Sant Kabir Nagar district with wetland area of 29 km^2.

Methods : A total of 82 points were taken over a distance of 250m apart. Each points were surveyed for every 5-8 minutes for avifauna and estimated their density, richness, diversity and evenness. In the case of ichthyofauna, 25 boats transects were used randomly inside the wetland and sampled using various nets and calculated their diversity and richness. The sanctuary is surrounded by 108 villages within 5 km radius. A socioeconomic survey was carried out in these villages by gathering a group of people and questioning about their livelihoods and dependency with informal questionnaire.

Result : A total of 72 species of birds belonging 40 families were recorded. Of these, 56 species were terrestrial and 16 were aquatic. Most of the species recorded are listed as Least Concern in IUCN Red List. However, an Endangered Steppe Eagle, vulnerable Lesser Adjutant Stork, Sarus Crane and Woolly Necked Stork and one Near Threatened River Tern found in the sanctuary. A total of 22 species of fish belonging to 15 genera, 7 order and 11families were recorded. Maximum number of species recorded was from the order Cypriniformes (31.81%), followed by Siluriformes (22.72%), Perciformes (18.18%), Anabantiformes (13.63%), Beloniformes (4.54%), Synbranchiformes (4.54%) and Osteoglossiformes (4.54%). *Wallago attu* and *Ailia coila* are threatened fishes found here. Of the 320 families interviewed, 173 were fishermen and 147 dependent on agriculture and other purposes like grass, fodder and lotus collections. It is planned to carry out more detail study covering all season for biodiversity profiling for writing the management plan with help of stakeholders consultations.

Conclusion: Bakhira Wildlife Sanctuary was found to be rich in bird and fish diversity but threatened due to over exploitation of these resources by local communities. Therefore, an integrated sustainable management plan with participation of local communities needs to prepare for the long term conservation of this sanctuary.

Keywords: Ichthyofauna, avifauna, dependency, socioeconomic, stakeholders

Fish diversity of Sahyadri Tiger Reserve, Maharashtra

-Anurag Rokade, Sutanu Satpathy

Aim: The main objective of this study was to record the checklist of fishes and to observe the habitat of Deccan Masheer (*Tor khudree*). This area was lacking scientific study of aquatic fauna so the study was done in three major dams of Sahyadri tiger Reserve.

Location: Sahyadri Tiger Reserve, Maharashtra.

Method: The sampling was done using gill nets, drag nets, cast nets, kick and scoop nets. Gill net deployment was done in deep waters (depth>2m) for 30 minutes. The unidentified specimens were preserved in 10% of formalin for lab analysis.

Results: The area was lacking scientific study of aquatic fauna so the was carried out in three major dams of Sahyadri Tiger Reserve i.e. Koyna dam, Chandoli dam and Radhanagri dam. We have recorded about 50 species belonging to 34 genera and 14 families. Among the 14 families the most dominant family was Cyprinidae family with (30 species) and 8 endemic, 4 near threatened, 3 vulnerable and 2 endangered species are reported from Sahyadri Tiger Reserve, Maharashtra.

Keywords: Biodiversity, Freshwater, Northern Western Ghats, Krishna river system, Protected area.

Project Title	:	Fish diversity of Sahyadri Tiger Reserve, Maharashtra
Principal Investigator(s)	:	Dr. J. A. Johnson, Dr. K. Sivakumar, Dr. Vidyadhar Atkore, Dr. Clement Ben
Researcher(s)	:	Research Biologist
Funding Agency	:	Sahyadri Tiger Reserve Foundation, Maharashtra
Project Duration	:	March 2017 - September 2018

Status and distribution of Indian pangolin, *Manis crassicaudata* in Terai Arc Landscape: Preliminary findings

-Bhaskar Bhandari

Aim: Uttarakhand is one of the major sources of illegal trade of the critically endangered and evolutionarily distinct Indian Pangolin. However, information on its distribution and population is limited. The present study is aimed to assess the distribution and micro-habitat characteristics of Indian pangolin in the Terai Arc Landscape of the state.

Location: The study was conducted along the Terai tract in Rajaji and Corbett Tiger Reserves as well as the Shivalik circle of Uttarakhand during November 2018 to June 2019.

Method: Field sampling was conducted through trail (n=44) searches and burrow counts (n=114). Micro-Habitat features that determine pangolin habitat use were also recorded to determine pangolin burrow characteristics. A presence only information based Maximum Entropy species distribution modelling was performed to predict the distribution of this species in the study area. Predictor variables such as NDVI, forest cover, forest type, elevation, slope, aspect and distance from water, roads and human settlements were extracted from remotely sensed data. We ran 60 models with variable features (5) and threshold levels (0.5-6). Best fit model was opted based on lowest AICc using model selection approach.

Result and Conclusion: Highest signs were collected from semi-sandy textured soil (97.06%), loamy soil (82.35%), plain terrain (76.47%), low canopy (88.24%), lesser human disturbance (55.88%) and mixed vegetation structure (44.12%). Pangolin presence was recorded from all surveyed ranges (n=16), these ranges are parts of Rajaji TR (8 ranges), Corbett TR (2 ranges), Haridwar FD (3 ranges), Lansdowne FD (1 ranges) and Dehradun FD (2 ranges). The prediction model with threshold feature (two regularisation multiplier) was opted as a best fit model (AUC 0.96 and AICc 4214.60). Based on ten percentile logistic presence threshold we found 1.87% (115.55 km²) and 6.21% (383.182 km²) study area as high and moderate potential respectively. Variables such as elevation, distance from anthropogenic factors, forest type and slope contributed maximum to prediction. Future efforts in covering remaining areas and identifying pangolin hotspots will be undertaken and validated subsequently.

Keywords: Distribution modelling, micro-habitat, conservation, EDGE species, Illegal trade

Project Title	:	Current Distribution, Population and Threats to Indian pangolin (*Manis crassicaudata*) in Terai Arc Landscape, Uttarakhand: A pilot studt
Principal Investigator(s)	:	Sh. Salvador Lyngdoh, Dr Parag NIgam, Dr S. P. Goyal, Sh. S. S. Rasaily, Dr Ved P. Kumar and Dr Saket Badola
Researcher(s)	:	Bhaskar Bhandari (Project Biologist)
Funding Agency	:	Uttarakhand State Biodiversity Board, Dehradun
Project Duration	:	2018-2020 (18 month)

Biodiversity assessment of Lalwan Community Reserve (LCR), Shalla-Pattan Wetland (SPW) and Ranjit Sagar Conservation Reserve (RSCR) in Punjab

-Umama Khan

Aim: Inventorization of biodiversity (flora, mammals, avifauna, entomofauna) and dependency of local communities in LCR, SPW and RSCR

Methods: To capture the floral diversity the study sites were traversed on foot from various habitats. Vegetation quantification was done following Misra (1968) by laying quadrats to enumerate trees and shrubs. For entomofauna, sweep netting, light trap and hand picking methods were used. Avifaunal diversity was recorded using point count method with a single observer in each sampling point. Mammalian diversity was estimated using indirect sign obtained through sign survey.

Results: A total of 142 plant species (trees 52, shrubs 17, herbs 32, climber 9, grasses 32) were recorded in LCR, of which 50 plant species were of medicinal importance. In SPW, 104 plant species (trees 21, shrubs 6, herbs 42, climber 5, grasses 12, Aquatic 18) and in RSCR, 139 plant species (trees 66, shrubs 21, herbs 27, climber 10, grasses 15) were recorded. Twelve and six plant communities were identified through TWINSPAN analysis in LCR and RSCR, respectively. A total of 73 and 27 species of entomofauna were recorded from LCR and RSCR, respectively. In LCR, SPW and RSCR a total of 12 species (10 families), 6 species (6 families) and 11 species (10 families), respectively of mammals were recorded, whereas 74 species (37 families), 61 species (33 families), and 122 species (50 families), respectively of birds were recorded.

Conclusion: The overall biodiversity was high in LCR followed by RSCR and SPW. Similarly, the dependency of local communities was high in LCR followed by SPW and RSCR.

Keywords: Conservation reserve, community reserve, vegetation communities, wetland

Project Title	:	To inventorize flora and fauna, dependency of local communities and identify level of threats in Lalwan community reserve, Shalla-Pattan wetland and Ranjit Sagar conservation reserve in Punjab
Principal Investigator(s)	:	Dr. B. S. Adhikari, Dr. S. A. Hussain, Dr. Ruchi Badola, Dr. V.P. Uniyal, Dr. Gopi G.V, Dr. Amit Kumar
Researcher(s)	:	Umama Khan, Asma Parveen, Arif Ahmad, Agni Chandra (Project Biologists), Amar Paul Singh (Project Assistant)
Funding Agency	:	Punjab Forest Department
Project Duration	:	Sept 2018 to Sept 2019

Need and feasibility assessment for deployment of Unmanned Aerial Vehicle in Tiger Reserves of India

-Tamali Mondal and Ritwika Ghosh

Aim: Unmanned aerial vehicles (UAV), popularly known as Drones have been widely used for monitoring of wildlife and their habitats including biological detectors and rapid response systems. Drones can be used more effectively in law enforcement and management of protected areas. Integration of technology advances is efficient but its adaptability is challenging. It needs to be involved on need basis under feasible conditions. The present study was initiated as one of the major objectives of the project, "E-Bird technology for tiger conservation" which aimed to map locations of human intervention prone areas in the tiger reserves, which would serve as a basis for technology integration.

Study area: Initially it was limited to only 13 tiger reserves but with the up-scaling of the project, it is now a pan India approach.

Methodology: A questionnaire survey form was prepared to cover the following parameters at beat level study; poaching, conflict, forest fire, anthropogenic pressure, weed presence and human encroachment. The level of the incident magnitude were decided using yearly occurrence (percentage in case of weed and encroachment) of the events in the reserve. Data was collected from the beat-guards from their respective beats. The form has been administered in all the 50 tiger reserves of India.

Results: Spatial mapping of presence and occurrence of poaching, conflict, forest fire, anthropogenic pressure, weed presence, human encroachment have been made and the sensitive beats have been identified thereafter. The data reflects the need for UAV surveillance in the buffer zone of the respective reserves for boundary patrols and collecting evidence of illegal intrusion in the reserve and deforestation. The result of the study aims to prioritize sensitive zones in individual tiger reserves for effective conservation and management planning using advance technology such as UAV.

Keywords: Technology, UAV, tiger conservation, surveillance, monitoring

Project Title	:	E-Bird Technology for Tiger Conservation: Development and Integration of unmanned aerial vehicles as surveillance and monitoring tool for protection of Tigers and capacity building of frontline staff
Principal Investigator(s)	:	Dr. K. Ramesh, Dr. Vaibhav C. Mathur and Shri. Nishant Verma
Researcher(s)	:	Sashank Sawan (Project Engineer), Tamali Mondal (Project Biologist), Ritwika Ghosh (Project Biologist), T Krishnakumar (Project Engineer)
Funding Agency	:	National Tiger Conservation Authority
Project Duration	:	2017-2020

Preliminary observation on the status of invasive species in grassland ecosystem of Kaziranga Tiger Reserve, Assam

- Umar Saeed

Aim : Kaziranga harbors a diverse grassland vegetation which supports a range of grassland dependent species. Incursion by alien species supplanting the native grassland species emerged as a major threat to Kaziranga ecosystems. The invasion may severely affect the distribution of related species and also disrupting the ecological processes in the Park. To assess the status of invasive species, we conducted a preliminary survey in infested areas of the Park with an aim to identify the invasive plant species and to quantify their abundance and regeneration.

Study area: Study has been carried out in the infested grassland of Baghori and Kohora range of Kaziranga Tiger Reserve, Assam.

Methodology : To assess the vegetation structure, circular plots of 10 m radius were laid (n=29) to sample trees and shrubs species. Four quadrats (1x1m) in each circular plot were laid to record the herbs and grass species. We calculated the density of trees along with the density of seedlings and saplings to estimate the regeneration success.

Results : A total of twelve species comprising of five species of trees, three species of shrubs, one climber and three herbs were recorded. *Bombax ceiba* was observed to invade the grassland ecosystems extensively. The preliminary results indicated that the density of *Bombax ceiba* was 15.37 ±7.22/ha followed by 6.58 ±4.49/ha of *Syzygium sp.* and 2.19 ±2.15/ha of *Careya arborea*. Regeneration of *Bombax ceiba* (sapling 304.195 ±89.79; seedling 171.31 ±63.72) was detected to be the highest followed by *Glochidion indiva* (sapling 273.44 ±83.77) and *Litsea salicifolia* (90.05 ±32.43). *Glochidion indiva* and *Litsea salicifolia* was observed to invaded in short grassland of Kaziranga. *Bombax ceiba* was observed to invade at a rapid rate and this can be attributed to the seasonal grassland burning which facilitates its seed dispersal.

The baseline information generated will be further used to develop methodology for quantification and infestation loads imposed by the invasive and alien species in the park.

Keywords: Invasive alien species, density, grassland, Kaziranga, herbivores

A knowledge repository of Snow Leopard landscapes in India

-Anindita Debnath

Aims & Objectives: The SECURE Himalaya (Securing livelihoods, conservation, sustainable use and restoration of high range Himalayan ecosystems) project aims to promote sustainable land and forest management in alpine pastures and forest. It also intends to support sustainable livelihoods and community resilience and ensures conservation of globally significant biodiversity and threatened species. To achieve this goal all relevant information needs to be compiled and subsequently the outputs from other components of the SECURE project required to be put in one particular place. The purpose of this assignment is to provide an information base in form of Interactive, Live and Dynamic Web based Database application and the primary objective is to furnish a knowledge repository through a web portal for the project.

Location: The project has been implemented in Changthang Landscape, Ladakh, J&K, Darma-Byans Landscape, Uttarakhand, Gangotri - Govind Landscape, Uttarakhand, Kinnaur landscape, Himachal Pradesh, Lahaul-Pangi Landscape, Himachal Pradesh, Khangchendzonga–Upper Teesta Landscape, Sikkim.

Methods: Database schema has been designed for effective data collection from various sources, for individual databases. Laravel framework was used for web portal development and the complete content is being managed through a Dynamic Content Management System (CMS) for creating, updating and deletion of web-pages in the backend of the portal. The portal can be accessible from any device e.g. computers, tablets, or mobile devices. The web portal has been developed in accordance with the essential Guidelines for Indian Government Websites (GIGW).

Results: Four distinct databases titled "past & existing studies", "best practices", "experts", and "ongoing schemes" have been created which incorporates published research work of the last 25 years. It specifically includes information relating to sustainable community-based practices in NRM based Livelihoods, prevention of human-wildlife conflict and biodiversity conservation in the project landscapes and adjacent areas. The prototype of the portal is available here- http://securehimalaya.in/beta/home

Conclusion: In future the web portal can be a comprehensive knowledge repository with non-spatial and spatial data which has the potential to aid decision support thus enabling snow leopard conservation.

Key words: SECURE Himalaya, database, conservation, dynamic web-portal, laravel framework

Project Title	:	Conducting baseline study and establishing a database on biodiversity conservation, sustainable natural resource management in SECURE Himalaya project landscapes in selected districts of Jammu and Kashmir, Himachal Pradesh, Uttarakhand and Sikkim
Principal Investigator(s)	:	Dr. Gautam Talukdar, Dr, S. Sathyakumar, Dr. G.S. Rawat, Dr. V.B.Mathur
Researcher(s)	:	Anindita Debnath, Dr. Nupoor Prasad, Sh. Dinesh Singh Pundir
Funding Agency	:	United Nations Development Program (UNDP)
Project Duration	:	November 2018 - September 2019

Modelling connectivity and bottlenecks for *Ursus thibetanus laniger*, Pocock, 1932 in Sikkim

-Sneha Pandey, Malyasri Bhattacharya

Introduction and aim: Connectivity among habitats and populations is considered a critical factor, determining a wide range of ecological phenomena. Preserving and restoring connectivity has become a significant conservation priority. In order to adapt with habitat fragmentation and degradation, the animals tend to move towards different suitable landscapes. They may enter human-dominated areas, as a result of which there is an increase in human-wildlife interface. With respect to increasing human-wildlife interface, the project is an attempt to study the habitat connectivity of Himalayan Black Bear (*Ursus thibetanus laniger)* between different protected areas of Sikkim. The primary objective was to delineate potential bottlenecks with a high probability of negative human-wildlife interface. We chose to model Himalayan Black Bear because they use a broad range of habitats and increasing conflict is being reported from across the state.

Location: The study was carried out in the entire state of Sikkim, from November 2018 to June 2019.

Methods: Presence data of Himalayan black bears were collected from sign and questionnaire surveys. Covariates viz. NDVI for all months, distance from river, elevation, aspect, slope and settlements were used to model habitat permeability layer (AUC value 0.95 indicated an excellent model fit). This layer was used as an input to model habitat connectivity between protected areas in Sikkim using Circuitscape version 3.5. Centrality analysis on the habitat connectivity layer revealed bottlenecks (which have a high probability of negative human-wildlife interface) in the landscape.

Results and discussion: Singba Rhododendron Sanctuary showed connectivity only with Khangchendzonga National Park. Kyongsola Alpine Sanctuary is connected to three protected areas, i.e. Fambonglho WLS, Pangalokha WLS and Khangchendzoonga National Park. Maximum connectivity was observed in Maenam and Fambonglho WLS. Also, the important bottlenecks (with highest human- black bear conflict) were found to be along Bichu, Singtam, Kabi and Aritar. The map showed almost all the bottlenecks are surrounded by human habitation. This may imply high anthropogenic pressures on the fragmented patches leading towards resource extraction and encroachment, resulting in habitat degradation.

Keywords: Circuitscape, habitat connectivity, protected areas

A preliminary study on the seed ecology of *Bombax ceiba* and its response to hydrological alterations in Kaziranga National Park, Assam

- Megha Shruti

Aim : The Kaziranga landscape is a monsoonal grassland, and is severely affected by the changing precipitation levels that cause seasonal floods and drawdown events. These events create fluxes in resource availability, water flow, soil moisture, varying inundation regimes and sediment deposition which affect the seed viability. Such hydrological alterations drive shifts to species that have adaptive suit of traits (invasive species), and changes the vegetation composition of the area. The aim of this study is to examine the autecology of such invasive species- like *Bombax ceiba* so that innovative strategies can be developed to control their propagation.

Location: The study has been carried out in invasive species affected areas of Bagori and Kohora ranges of Kaziranga National Park, Assam.

Methods: The seed production capacity of this species was determined by manually counting the pods on trees (n=29) and seeds inside each pod (n=62). The GBH, pod length and seeds produced were correlated to interpret the data. The seed viability and germination under different inundation levels was estimated through a greenhouse experiment. Soil samples were collected from six different areas of invasion in the park, sieved to remove other seeds, sown with bombax seeds (n=30) and left to germinate in three conditions - dry, moist and standing water (5cm). The length of germinating plumule was monitored.

Results: Results indicate that a big tree (GBH> 300cm) produces 377 ± 13.8 pods, containing ≈244 ± 24 seeds per pod. Observations for seed germination experiment for 20 days indicate that while only >10% of the seeds are viable; there will be no germination in dry and inundated conditions. The seeds germinating in moist conditions will grow steadily upto 5cm, but persistent flooding beyond this stage causes wilting and damping off in young saplings.

Conclusion: Observations indicate that seeds do not germinate in inundated conditions. Since this study is at a very preliminary stage, drawing firm conclusions is not reasonable. Similar studies on other invasive species in the area will be carried out in future with greater sample size and more parameters to understand their ecology and response to fluctuating water levels.

Key words: seed production, seed germination, viability, inundation, invasive species

Rebuilding Satkosia for tigers: Experiences and future strategies

-Vaishali Vasudeva

Aim: The ongoing tiger recovery program in Satkosia Tiger Reserve aims at bringing back tiger population which requires an understanding of habitat suitability, as well as, prey density, protection, connectivity and support from the local community. As a part of tiger recovery program, two tigers (a male and a female) were translocated from Madhya Pradesh, in a first ever inter-state tiger translocation efforts. However, following the series of events post-translocation, there has been mixed responses for tiger recovery in Satkosia, which also called for re-look at the entire process so as to move forward and ensure the tiger efforts meets positive response. Accordingly, there was a need to make recommendations towards 1) reorganization of core boundary, 2) habitat connectivity, 3) prey augmentation and 4) village relocation.

Location: Satkosia Tiger Reserve is one of the two tiger reserves in the state of Odisha, India. Notified in 2007, it witnessed a significant decline in tiger population to the extent of functional extinction. It has total area of 964 km^2, which will be increased to 1136.7 km^2 by reorganisation of the boundary. It includes Satkosia Gorge Wildlife Sanctuary and Baisipalli Wildlife Sanctuary.

Method: We developed a habitat suitability map for tiger, based on Boolean Overlay method. Four habitat variables relevant to tiger *viz.* land use land cover, distance from drainage, distance from human settlement and topography were considered. The predicted map was validated using presence points (GPS fixes and camera traps) of two settled tigers.

Results: The predicted results were represented as unsuitable (0.09% area; 0.99 km^2), low suitable (24.5% area; 270.36 km^2), moderately suitable (45.6% area; 500.49 km^2) and highly suitable (29.6% area; 325.62 km^2) areas. Upon validation, 73.28 % and 74.61% points were in the high suitability category, 24% and 24.4% in the moderate suitability and 2.71% and 0.91% in low suitability for male translocated tiger and female resident tiger, respectively.

Conclusion: Current efforts are targeted at management of resident/translocated tigers, prey augmentation and community engagement activities, including village relocation.

Keywords: Boolean Overlay; Connectivity; Habitat Suitability; Prey; Village Relocation

Individual interaction in a social mega-herbivore: A case study of Gaur (*Bos gaurus gaurus*) from Bandhavgarh Tiger Reserve (BTR)

-Ritesh Vishwakarma

Aim: The present study aims to investigates the social interaction and association within the gaur herd.

Location: Bandhavgarh Tiger Reserve, Madhya Pradesh, India

Method: Group-level social network of 20 gaurs were studied and were identified within the herd. A herd profile in the context of individual gaurs in BTR was prepared. The data was collected based on identified individual's association, their affiliation including agonist behavior. Focal and instantaneous scan sampling methods were used to collect 110.20 hours of possible interaction and associative data between January to April 2019.

Result and Conclusion: The data was analysed using SOCPROG (A MATLAB based program) to derive at interaction and network statistics, and group's association network was diagrammed in NetDraw. One individual, leading female (ID:1) was found central in proximity of other individual, while three sub adult males had little connection/interaction within the herd though showed strong association between each other. Group members reciprocally interacted between each other across age classes. The network analysis showed the group's dominance hierarchy to be statistically nonlinear based on one individual centrality.

Keywords: Association, Interaction**,** Social network analysis, Fission-fusion dynamics, SOCPROG, NetDraw

Project Title	:	Monitoring of reintroduced Gaur (*Bos gaurus gaurus*) in Bandhavgarh Tiger Reserve, M.P.- Phase II Extension
Principal Investigator(s)	:	Dr. Parag Nigam, Dr. Bilal Habib and Field Director- Bandhavgarh Tiger Reserve
Researcher(s)	:	Ritesh Vishwakarma (Senior Research Fellow)
Funding Agency	:	Madhya Pradesh Forest Department
Project Duration	:	2019-2021

Genetic characterisation of tigers from Manas and Kaziranga Tiger Reserves, India

-Vinay Kumar

Aims: To assess the suitability of using old scat samples collected under Phase –I for genetic analysis and determine population-specific genetic characteristics of tiger populations

Location: Samples collected from Kaziranga (n=120) and Manas (n=20) Tiger Reserves during 2006 and were stored at room temperature.

The recent development in the protocols for forensic DNA analysis has enabled tracking poaching of endangered species to its geographic origin and requires harmonized genetic database across species' range. Though there are genetic studies on tiger (*Panthera tigris tigris*), however, lacks compatibility among data across these studies. Hence a project titled "*Panthera tigris* genome: Implication in wildlife forensics" was initiated, to establish the harmonized genetic database of tigers based on mtDNA genes, multilocus genotyping and other markers across species' range in India for identifying the geographic origin of seized parts. Under Phase-I, we established a genetic database for northern, peninsular and Sundarbans tiger populations whereas Phase-II is to extend the scope of the work to other tiger populations of different bioclimatic zones.

Methods: We scraped the upper layer of the scat containing epithelial cells of intestine and rectum for DNA analysis with our modified protocols. We modified DNA extraction and PCR amplification protocols for three mtDNA regions (ND5, ATP6, and Cytb) and 27 microsatellite markers.

Results: We obtained ca. 70 percent success in PCR amplification with these markers. Hence, we demonstrate probably the first time in literature for the use of scat samples, which were 13 years old and stored at room temperature for molecular ecology work with our modified protocols. We describe genetic characteristics of these two populations.

Conclusion: Our modified protocols for DNA extraction and PCR amplification are suitable to use old scat samples even stored at room temperature. We discuss genetic characteristics of tigers from these two areas with our previous data and its applicability in the geographic assignment.

Keywords: Mitochondrial Marker, Microsatellites marker, *Panthera tigris, Genotyping*

Project Title	*Panthera tigris* genome: Implications in forensics and conservation. Phase II –DNA profiling of tiger populations from southern, eastern and northeast India
Principal Investigator(s)	: Dr. S.P. Goyal and Dr. Parag Nigam
Researcher(s)	: Vinay Kumar (Project Biologist)
Funding Agency	: WII-Grant in Aid
Project Duration	: 2017 to 2020

Development of baseline and a management plan for Siswan Community Reserve of Punjab

-Bidyut Bikash Barman and Priya Prajapati

Aim: The project aims to develop a Management Plan for the community reserve by generating baseline information on faunal and floral diversity, understanding the mutual linkages and issues between community and the reserve and by putting in place the processes of stakeholders engagement and community empowerment.

Location: Siswan reserve is in Majri tehsil of Sahibzada Ajit Singh Nagar, Mohali district of Punjab in the western Shivalik hill range. Siswan village is located south-west of the forest. The area is undulating and sub-mountainous with an average altitude of 246 m above sea level. The forest has an important reservoir (30º52'71"N, 76 º45'0.66"E).

Method: For mammalian survey camera traps were installed. Two bird surveys were conducted during Summer, 2017. Amphibian sampling was carried out during late evening and night hours. Rapid inventory of reptiles and amphibians was conducted. Insect sampling points to study insect diversity were selected at an interval of 1000 m and the sampling was done during day and night. Vegetation sampling was done based on traditional method (Misra 1968). Focused group discussions (FGDs), social and resource mapping and time line surveys were undertaken to understand peoples' perspective. Stakeholder workshop and a series of consultations were carried out with communities and staff as a part of capacity building.

Result: A total of 12 different species of mammals were photo captured of which Leopard and Sambar were two major species. A check list of 116 bird species was prepared. Seven species of amphibian and 3 species of reptiles were observed. A total of 169 species of insects belonging to 9 orders were also documented. A total of 160 species of plants forming seven different plant association were observed. Issues of community unemployment, crop-raiding, lack of awareness and capacities are being addressed as part of planning.

Conclusion: Management plan is being prepared for developing this reserve as an important eco-tourism destination and environment education centre in the urban settings of Chandigarh and Mohali through an appropriate and long term participatory mechanism with the local communities and other stakeholders.

Keywords: Shivalik, stakeholder, camera traps, reservoir, eco-tourism.

Project Title	:	Development of a Management Plan for Siswan Community Reserve, Punjab
Principal Investigator(s)	:	PI: Dr. Anil Kumar Bhardwaj, Co(PIs) Dr. Bivash Pandav, Dr. V.P. Uniyal, Dr. B.S. Adhikari, Sh. Ajay Srivastav, Dr. Pratap Singh, Dr. Ruchi Badola, Dr. J. A. Johnson, Dr. Gautam Talukdar, Dr. Abhijit Das, Dr. Bitapi Sinha
Researcher(s)	:	Bidyut Bikash Barman (Technical Assistant) and Priya Prajapati (Intern)
Funding Agency	:	Department of Forests and Wildlife Preservation, Govt. of Punjab
Project Duration	:	November, 2018 to October, 2019

Source to sea expedition: A preliminary study on macro plastic content in fish guts

-Sumit Kumar

Aim: Impact of plastic pollution on aquatic environment is widely recognized and is of increasing ecological concern. Large plastic objects such Navas discarded fishing nets and polythene bags pose threat to aquatic organisms by entanglement, whereas smaller items get into guts along with food items of many aquatic organisms specially turtles and fishes. Globally it is perceived that plastic materials enters into streams, river and sea may be ingested by the aquatic organisms. In this background Wildlife Institute of India in collaboration with National Geographic Society initiated scientific expedition to document plastic content in aquatic food chain.

Location: We selected total seven sampling sites, two in upper stretch starting from Harshil to Rishikesh and five (Anup sahar, Kannauj, Varanasi, Patna and Sahibganj) in lower stretch of the river Ganga.

Methods: At every sampling area, fish landing centre was examined, total length and mouth gape size of small and large size fish of each species were recorded. Gut analysis of 8-10 specimens of each fish species (*Sperata aor, Mystus cavasius, Cirrhinus reba, Tor putitora, Schizothorax progastus, Barilius bendelisis*) were examined.

Results: Total 52 guts were examined during pre monsoon expedition and found no macro plastic in the fish guts. Based on fish catch, we made the checklist of fish species found at each site. Among all the sites we found maximum number of fish species in Sahibganj and only one fish species (*Salmo trutta*) found at the Harshil site. At the site of Varanasi we observed the exotic carp *Cyprinus carpio* and *Oreochromis niloticus* found in abundance. In this expedition we have standardize the methodology and sampling procedure. The post monsoon expedition will be planned to document the macro and micro plastics in fish gut content.

Keywords: Plastic debris, entanglement, checklist, *Salmo trutta, Cyprinus carpio, Oreochromis niloticus.*

Project Title	:	Source to Sea Expedition: A preliminary study on macro plastic content in fish guts.
Principal Investigator(s)	:	Dr. J.A. Johnson
Researcher(s)	:	Sumit Kumar (Project Associate)
Funding Agency	:	National Geographic Society (NGS)
Project Duration	:	2019-2020

Understanding plastic leakage into Ganga through many sources using a citizen science tool

-Navin Kumar Das

Aim: Every year almost 8 million tons of plastic is entering the ocean as a result of debris being carried by rivers (a major contributor). Among these large significant rivers in Asia, the River Ganga is one of them. Ganga carries significant amount of plastics and dumping it into the ocean. To assess the magnitude of plastic in Ganga River a joint expedition by Wildlife Institute of India and National Geographic Society is being conducted.

Study area: The pre-monsoon expedition was carried out between May to June 2019 on the Ganga in the seven Ganga flowing sites.

Methodology: We attempted to observe the present scenario of plastic leakage coming from different sources in the Ganges along its populated river banks using a citizen science tool. Marine Debris Tracker is an android application for tracking types of litter by a user, coming out from local shops, households, markets, and other sources. Quadrat samplings were also done by choosing random quadrat transects of 100m along the roadside drainage and GPS points are marked for waste piles, drainage lines, dustbins, and municipal dumpsites for each site to analyze its distance from the river Ganga and trace the plastic leakage into it.

Result: Hitherto in the pre-monsoon expedition we came across several plastic products such as Food wrappers, Tobacco sachets, plastic bags which are the top three items recorded along with shampoo sachets, chip packets, and fragmented plastics in all the sites. A big chain of informal waste segregation in the form of waste pickers is active at every site for segregation.

Conclusion: Although the municipality's daily waste collection system has a big role on waste management in the communities, but waste segregation is still a matter of concern. In the post-monsoon expedition, we will try to recognize the pattern of waste management and will also undertake awareness campaign for sustainable waste management.

Keyword: Marine debris tracker, leakage, segregation.

Project Title	:	WII-NGS Sea to Source Plastic Expedition
Principal Investigator(s)	:	Dr. Bitapi C. Sinha, Dr. Anju Baroth
Researcher(s)	:	Navin Kumar Das (Project Associate)
Funding Agency	:	National Geographic Society
Project Duration	:	2019-20

Social and economic factors influencing plastic pollution in Ganges

-Dr. Hina Khatoon

Aim: To assess the socioeconomic factors affecting the use of plastics by local people and to determine the plastic waste management patterns and local solutions.

Locations: The Sea to Source plastic expedition study was carried out during May-June 2019 in seven sites along the Ganges *viz*. Maskaliya in Jharkhand, Dharnipatti in Bihar, Domri, Mehandipur and Ahar Bangar in Uttar Pradesh, Ganga Bhogpur Talla and Mukhawa in Uttarakhand.

Methods: Total 182 socio-economic surveys were administered to residents in 7 villages to obtain information about their household, income-generating activities, food access, well-being, waste management, waste disposal, plastic use and their interactions with the environment. Besides these total, 24 FGDs were conducted with main targeted group *viz.* male, female, fishermen, youth, landless and shopkeepers.

Results: This is an ongoing project and some data analysis work is under process. The overview of questionnaire surveys and FGDs with respondents reflected that villagers used products packaged in polythene bags and single use plastic, due to cost-effective and durable nature of plastic. Villagers had no systematic waste disposal facility, so they threw plastic waste directly or indirectly into the Ganges. They had no other alternative for plastic waste disposal and waste management in terms of dustbins, formal dumpsites and waste collector vehicles in their area.

Conclusion: The study reflected that, mostly all the respondents were aware of adverse effects of plastics on the environment. However, the usage of plastic was still high in the villages due to lack of proper alternatives. In future we are planning to aware villagers about plastic pollution in *Ganges* and to motivate their willingness to improve plastic waste management to reduce single use plastic usage.

Keywords: Focus group discussions (FGDs), plastic pollution, single use plastic, socio-economic surveys, waste disposal.

Project Title	:	WII-NGS Source to Sea Plastic Expedition
Principal Investigator(s)	:	Dr. Ruchi Badola, Dr. S.A. Hussain
Researcher(s)	:	Dr. Hina Khatoon (Project Associate)
Funding Agency	:	National Geographic Society (NGS)
Project Duration	:	18 Months

Quantifying microplastics in the abiotic matrix of Ganga river: A comprehensive approach to assess plastic pollution from source to sea

-Sunanda Kumari Bhola

Aim: Plastic pollution has globally become an alarming issue. It is estimated that around 311 million tones/year of plastics are produced worldwide(Europe, 2015) of which only 9% is recycled, 12% is incinerated, and the rest 79% ends up in the environment as landfill, where they further breakdown to smaller plastic particles. Unmanaged plastics ultimately end up in the sea through river channels, causing a major threat to the marine ecosystem affecting the marine organisms through entanglement and ingestion. Another issue associated with plastic waste is the generation of an emerging contaminant, microplastics that are plastic particles of less than 5mm diameter. This study aims to better understand the problem of plastics entry from rivers into sea through a multi-component approach, including quantifying microplastics in abiotic matrix viz air, water, and sediment. The study is part of a collaborative project "Sea to Source: Ganges river expedition," between Wildlife Institute of India and National Geographic Society.

Location: A pre-monsoon expedition (May-June, 2019) across seven sites in India i.e., Sahibganj, Bihar, Varanasi, Kannauj, Anupshahr, Rishikesh and Harsil and three sites in Bangladesh which included Bhola district, Chandpur and Rajbari was done.

Methods: For the quantification of microplastics, we collected abiotic samples (in replicates) through Standard NOAA method with suitable modifications was used for collection, storage, and transport of all the samples. The analysis will be performed as per the international protocol finalized by WII-NGS team. Additionally, for validating the data, observations on plastic waste through other tools like river bank quadrants, Marine Debris Tracker, deployment of drift cards, and bottle tags were recorded. An update on the above activities will be provided during the presentation.

Results: As the research work has recently been started, the processing and analysis of samples is in progress and the result is awaited.

Keywords: Plastic pollution, pre-monsoon, expedition, plastic, marine ecosystem, contaminant

Project Title	:	Sea to Source: Ganges river expedition
Principal Investigator(s)	:	Dr. Anju Baroth
Researcher(s)	:	Sunanda Kumari Bhola (Project Associate)
Funding Agency	:	National Geographic Society
Project Duration	:	18 Months

Dry river, dire situation, dying hope? Breeding distribution and proximate factors affecting nest survival of river-island nesting birds in the National Chambal Sanctuary, Uttar Pradesh

- Rohit R.S. Jha

Aim: Piscivorous, island-nesting birds are recognised to be ideal indicators of health of rivers and coastal landscapes. Four species of exclusively piscivorous and ground-nesting birds, Indian Skimmer *Rhynchops albicollis*, Black-bellied Tern *Sterna acuticauda*, River Tern *Sterna aurantia*, and Little Tern *Sterna albifrons*, nest on the riverine islands of river Chambal within the National Chambal Sanctuary (NCS).

Location and Methods: We assessed the breeding distribution and factors affecting nest survival in ca. 110 river-km section of the NCS in Uttar Pradesh, from upstream of its confluence with river Yamuna, during April to June 2019. Information on river-islands harbouring nesting birds was obtained from boat and field surveys during the pre-nesting period, and nest fates (~ 600 nests) of the four focal species on such islands (n = 8 island/island clusters) were regularly monitored until the nesting fate (fledge/fail) was determined. Nest survival data was analysed using Mayfield's method. Habitat factors such as (index of) human disturbance and river-island physical characteristics along with nesting initiation period hypothesised to influence nest survival were measured/noted in the field.

Results: Analyses revealed that the overall nest survival was low, especially in the egg-laying phase of second (and subsequent) clutch(es). Nests initiated early in the breeding season, when the above-mentioned threats were lower in intensity, and/or nests on islands that were more isolated than others from both banks positively affected nest survival.

Lower nest survival of nests initiated later in the breeding season was a result of decreasing water depth around river-islands as the dry season progressed facilitating access to opportunistic predators like dogs, jackals, hyaenas and people which devour/disturb eggs and/or depredate on hatchlings. Additional factors that negatively affected nest survival included cattle movement (causing egg trampling) and stochastic weather events like storms.

Synthesis and applications: Our results emphasise the urgency of implementing short-time measures like employing nest protectors/watchers round-the-clock during the breeding season to enhance nest survival of threatened river-island nesting birds, especially arising from non-natural and unfamiliar predators, while ensuring that environmental flow of the river is maintained during the lean/dry season.

Keywords: Bird conservation, domestic dog, freshwater ecosystem, piscivorous birds, species-habitat association

Project Title	:	Diet, foraging behavior and habitat factors affecting breeding success of riverine island-nesting birds in the National Chambal Sanctuary
Principal Investigator(s)	:	Dr Bivash Pandav (WII), Dr Gopi Sundar (NCF, Mysore)
Researcher(s)	:	Rohit R.S. Jha, Project Fellow
Funding Agency	:	WII Grant-in-aid
Project Duration	:	3 years 6 months (2018-2021)

Tracking the rain-bird: Modeling the distribution of Pied Cuckoo in India

-Debanjan Sarkar

Aim: Pied Cuckoo (*Clamator jacobinus*) is one of the four crested cuckoos found in South Asia, Mediterranean region and Africa. The bird is a summer migrant to the Indian subcontinent and a brood parasite to different birds of India, majorly from the genus Turdoides and Garrulax. The onset of the monsoon has been associated with the appearance of the Pied Cuckoo in India for ages. Here, we aimed to create temporally explicit species distribution models of *Clamator jacobinus* using Maximum Entropy Modeling to identify major bioclimatic factors that may be influencing the distribution of the species in India.

Location: The study was undertaken on the Pan India Scale, covering its resident and migratory population. The bird is known to make a sudden appearance in central and northern India in the last week of May or early June, indicating the imminent arrival of the monsoon with its unmistakably loud metallic calls. However, little information is available on its migration route and how climatic factor might be affecting its migration.

Methods: We have used MaxEnt (Maximum Entropy) to model the distribution of the species in India. E-Bird occurrence points along with nine environmental covariates were used for building the model.

Results & Discussion: Our modeling framework resulted in high AUC (Area under receiver operating characteristic curve) values (0.75-0.95) for every model. The monthly modeled output indicates dynamic distribution (peaking in the month of May-June) in Northern India, whereas it is resident in Southern India. The influence of environmental covariates used in SDM varied seasonally; Dec-Feb (Mean Temperature); March-May (Water vapor pressure) before the arrival of the species; June (NDVI) and from September- November it was wind speed.

Keywords: *Clamator jacobinus*, e-bird, migration, species distribution modeling.

Project Title	:	Linking Protected Area Network and Near Realtime 'Rain-bird' Locations with IBIN
Principal Investigator(s)	:	Dr. Gautam Talukdar; Dr. R. Suresh Kumar
Researcher(s)	:	Debanjan Sarkar
Funding Agency	:	Debanjan Sarkar
Project Duration	:	3 years

Status of *Mulleripicus pulverulentus* - the largest woodpecker in Pawalgarh Conservation Reserve

-Sarabjeet Kaur Narula

Aim: The Great slaty Woodpecker *Mulleripicus pulverulentus* is the largest woodpecker in the world and one of several Picid species to have suffered population decline in recent decades. It is recognised as a species dependent on mature, moist deciduous forest and, evergreen forests which dominates much of its range, however, little is known about the habitat determinants of the focal species. The irregular distribution makes the species vulnerable and therefore it becomes very important to understand their selection of habitat. The main objective of the project is to understand the utilisation of the habitat by the focal species during different seasons and implementation of viable conservation measures to achieve encouraging conservation status of this vulnerable forest bird species.

Location: Pawalgarh Conservation Reserve in Uttarakhand, Western Himalaya is situated at the junction of Bhabhar and *Terai* formations extending up to the Dabka. The area contains moist deciduous forest with *Shorea robusta* as the principal tree and supports 17 species of woodpeckers and its allies.

Methods: Systematic trail walks were carried out both in post-breeding as well as breeding season. Information on foraging was collected and following variables were recorded – foraging substrate, manoeuvres, substrate diameter, and, individuals. Moreover, structural data differentiating the stands with Great Slaty Woodpecker cavities was also recorded.

Results: In accordance with field data from post-breeding season and breeding season of 2018 and 2019 respectively, 43 individuals of Great Slaty Woodpecker are present both inside as well as outside the study area representing 12 groups. During these two successive seasons, a total of 12 and 50 foraging observations were recorded most of which were on live trees. Individuals frequently foraged by pecking and probing on the main trunk of the trees with a mean dbh of 2.03 m. With this study, we hope to determine the conservation status for the territories used by the species.

Keyword(s): Cavity-nester, insectivorous, old-growth forest, picidae, vulnerable

Project Title	:	Foraging ecology of Great Slaty Woodpecker (*Mulleripicus pulverulentus*) in and around Pawalgarh Conservation Reserve in Western Himalaya
Principal Investigator(s)	:	Dr Gopi G.V. and Dr V.P. Uniyal
Researcher(s)	:	Sarabjeet Kaur, Ph D Scholar
Funding Agency	:	Rufford Foundation and Idea Wild
Project Duration	:	October 2018 & September 2020

Terrestrial mammalian assemblages and occupancy pattern along forest-stream network in Sahyadri Tiger Reserve, Maharashtra

-Shah Nawaz Jelil

Aim: Our understanding of mammalian species assemblages and space-use patterns throughout riparian areas is limited. This research aimed to test the role that riparian habitat structure plays in determining mammalian occupancy.

Location: Koyna Wildlife Sanctuary forms the northern part of the Sahyadri Tiger Reserve in the state of Maharashtra and covers an area of 424 km^2. Mean annual rainfall is around 5000 mm, which falls from June–September. Red clay is the main soil type and the vegetation is classified as southern tropical evergreen forest and southern moist-deciduous forest.

Methods: We used a catchment-wide field design where different stream orders were sampling units, i. e. perennial stream, intermittent stream, ephemeral and headwater in Koyna Wildlife Sanctuary. Riparian habitat assessment and camera trapping in 72 riparian buffers were undertaken in these sampling units during summer 2018 and 2019.

Results: Camera trapping revealed 17 species of terrestrial mammals that use riparian forests. Of these, occupancy models showed that Indian gaur *Bos gaurus* and wild boar *Sus scrofa* occupy 79% and 76% respectively. The habitat variables that had significant correlation with species occupancy were elevation, tree richness, sapling richness, number of fallen logs and stream type. It was found that detection probability was the function of sampling effort and survey occasions.

Conclusion: This study was conducted in the summer season only and thus the prediction from the resulting models should be limited to this season. The study provides a snapshot of the occupancy and space-use of terrestrial mammals in the riparian forests of Koyna Wildlife Sanctuary, reiterating the presence of terrestrial and aquatic continuum in the species assemblages.

Keywords: Riparian buffer, terrestrial mammals, camera trapping, intermittent rivers

Project Title	:	Tiger Recovery Strategy and Long-term Monitoring in Sahyadri Tiger Reserve, Maharashtra
Principal Investigator(s)	:	Dr. K. Ramesh, PI, Dr. V. Clement Ben, CoPI
Researcher(s)	:	Shah Nawaz Jelil, Project Fellow; Natasha Girkar, Project Fellow; Avinash Gaykar, Project Fellow
Funding Agency	:	Sahyadri Tiger Conservation Foundation; National Tiger Conservation Authority
Project Duration	:	2016-2021

A sneak-peak into the forbidden forest: Preliminary assessment of tigers, co-predators and prey in Pranhita Wildlife Sanctuary (PWLS), Gadchiroli, Maharashtra

-Kunjan Joshi

Aim: The Eastern Vidarbha Landscape (EVL) holds a high density of carnivores both inside and outside protected areas leading to an increase in human-wildlife interactions. Pranhita Wildlife Sanctuary (PWLS) is a part of EVL and could be an important corridor. To explore new habitats for carnivore species, we conducted a preliminary assessment of tigers, co-predators and prey in Pranhita Wildlife Sanctuary (PWLS).

Study Area: The study was carried out in Pranhita WLS in Gadchiroli district of Maharashtra from January-April 2019. With an area of 418.85 km^2, PWLS is mainly dominated by Southern Tropical Dry Deciduous forest.

Methodology: We conducted carnivore and ungulate sign surveys and deployed camera traps (n=25) in 40 km^2 area. Camera traps sampling effort was 1030 trap nights. For prey species density estimation, 24 line transects of 2 km length were walked in 43 beats with 5-7 replicates. We used both spatial and temporal data for occupancy estimation. Data were analysed using the software Presence 2.12.32 and Distance 7.2 for respective analysis.

Results: A total of 11 prey species were recorded during line transect survey. Overall density estimation of major ungulate species was 14.82/km^2. Encounter rate of cattle, nilgai, spotted deer, chousingha and wild pig were 43.1%, 50.7%, 44.1%, 38.2% and 17.3% respectively. Individual density estimate of major ungulate species like spotted deer and nilgai were 2.27 and 0.72 respectively. Occupancy estimate (ψ) of leopard in the null model was 0.20 while for other carnivore species like sloth bear, jungle cat and wild dog were 0.70, 0.74 and 0.68 respectively. Occupancy estimate of ungulate species like sambar, spotted deer, chousingha, Indian gaur and nilgai were 0.27, 0.44, 0.51, 0.07 and 0.59 respectively. We also observed widespread cattle grazing, hunting by locals and other anthropogenic disturbances in the sanctuary.

Conclusion: This was the first-ever scientific study conducted to document prey and predator presence in PWLS. Further detailed and long term studies are required for a better understanding of species ecology and their habitat. Such studies will help not only in better management and conservation of species in the area but also in decision making on conservation translocations.

Keywords: Occupancy, density, conservation translocation, habitats, carnivore

Project Title	:	Preliminary assessment of tigers, co-predators and prey species in Pranhita Wildlife Sanctuary, Maharashtra, India for exploring options for conservation translocation
Principal Investigator(s)	:	Dr. Bilal Habib
Researcher(s)	:	Kunjan Joshi (Project Fellow), Pandurang Pawar (Project Fellow)
Funding Agency	:	Maharashtra Forest Department
Project Duration	:	December 2018 - Ongoing

Habitat use of young golden mahseers (*Tor putitora*) in Kosi and Kohlu rivers of Uttarakhand, India

-Bhawna Dhawan

Aim: Nursery grounds are the ecologically important habitats for recruitment of early life-history stages of fish species. Present study aimed to assess the nursery and foraging habitats of young (fingerlings/juveniles) golden mahseers in Kosi and Kohlu rivers.

Location: This study was conducted in 32km long Kosi River, one of the tributaries of river Ramganga. Another, 15km stretch of Kohlu river was also assessed which is flowing inside the reserved forests of Lansdowne division in Uttarakhand.

Methods: Stretch of both the rivers have been mapped to locate all the nursery grounds of young golden mahseer; fingerlings (1.5-10cm) & juveniles (10-30cm) during the post-monsoon, post-winter and pre-monsoon seasons for the year (2018-2019) using ArcGIS. Systematically both the rivers were divided into three zones; upper, middle and downstreams. About 200-500 m of river sampled for habitat assessment in each identified zones of both rivers. Micro-habitats of nursery grounds of young mahseer was further classified into six types as backwater pool, secondary channels, run habitat, associated stream, isolated pools and confluence point. Use of these micro-habitats and its suitability for fingerlings and juveniles were analyzed using three major habitat variables such as depth, flow and substratum in excel and R software.

Results: In general, backwater pools, secondary channels and run habitats were highly used habitats of fingerlings in all seasons in both rivers. But, run habitats were mostly used by juveniles in these rivers. Fingerlings were mostly seen at depth ranges (0.1-0.6 m) with velocity(0-1.2 m/s) where dominant substratum was gravel and sand. Similarly, depth (0.3->1.8 m), velocity (0.3->1.2 m/s) and habitats having cobbles, bed rock and gravel as substratum were used by the juveniles.

Conclusion: Since habitats having less flow and optimal depth provide refuge for the development of early life-history stages; backwater pool, secondary channels and run habitats are used as nursing grounds by fingerlings and juveniles. Also, these habitats provide relatively more contribution to adult recruitment when gets connectivity with the main river channels in different seasons.

Keywords: Backwater pool, fingerlings, juveniles, micro-habitats, recruitment

Seagrass meadows as Food and Space resource for fish in Palk Bay, Tamil Nadu

-Chinmaya Ghanekar

Aim: Seagrass ecosystem is one of the richest coastal and marine ecosystem in terms of species diversity. It provides feeding and hiding cover for many fish species. Therefore, this study aimed to understand seagrass resource use by fish species in shallow depths of Palk Bay, Tamil Nadu.

Location: The study was conducted at Palk Bay stretched from latitudes 10˚ 15' N to 9˚ 17' N and longitudes 79˚16' E to 79˚08' E in depths of 1-2 m. The area consists of seagrass habitats with dominance of *Cymodocea serrulata* and *Syringodium isoetifolium* at shallow depths.

Methods: Fifty-seven underwater point counts, each span of 10 minutes were conducted manually by snorkelling randomly covering entire Palk Bay. Thirteen camera point counts each span of approximately 40 minutes were also recorded underwater. Diet of two common fish species of seagrass meadows were studied for understanding linkage between seagrass and fish using occurrence method.

Results: Nineteen fish species belonging to 15 genera and 13 families were observed in seagrass meadows. Of total 57 points, 28 points were deployed in mixed species meadow and 29 points were deployed in mono-species meadows. Mostly, fish utilized the lower canopy of seagrasses (54.76%) than the upper canopy (19.04%). Activities of fish in seagrass beds primarily include moving, feeding and hiding. About 54.62% of fish activities were observed as moving, 16.51% were feeding and 12.11% were hiding between seagrass. The fishes, *Pleurosicya mossambica* was mostly observed perching on broad leaf blades and *Syngnathoides biaculeatus* was observed camouflaging with the leaf blades. Maximum activity of fishes of Terapontidae family was observed in 8 hours and 40 minutes of camera videos recording. Gut contents of *Gerres erythronus* consisted of 16% of fish scales followed by 7.2% of algal matter whereas gut contents of *Psammoperca waigensis* consisted of 82.33% shrimp fragments.

Conclusion: Seagrass beds provide space for movement, shelter and food such as epiphytic algae, invertebrates and detrivorous matter such as fish scales for various fish species. Therefore, they can be considered as key resource for shallow water fish.

Keywords: Underwater point counts, *Pleurosicya mossambica, Syngnathoides biaculeatus,* lower canopy, gut content analysis

Thermal regime of gharial nests in wild

-Suyash Katdare

Crocodiles are ectotherms that are reliant on temperature to facilitate major life processes. One such process is the temperature dependent sex determination (TSD). In TSD, incubation temperature experienced by a nest determines the sex of individual embryos. TSD has been extensively studied in several species of crocodilians. However, it remains under studied in the gharial (*Gavialis gangeticus*). As a part of understanding the TSD mechanism, this study describes the thermal environment of gharial nests in the wild.

The study was carried out in the National Chambal Sanctuary (NCS).

A total of six gharial nests, across two nesting sites Baroli and Nadigao were sampled in 2017 and 2019 respectively in the NCS. Freshly laid nests (<30 hrs) were selected and fitted with temperature data loggers (ibuttons). In each nest three iButtons were placed in the top, middle and the bottom sections, programmed to record temperature at every ninety minutes. An abandoned trial nest was selected as a control nest and similarly fitted with three ibuttons. The ibuttons were retrieved during late incubation period when the nests were brought to the Deori Gharial Rearing Centre. One ibutton was placed at a secure location to record the ambient temperature.

Maximum incubation temperature recorded was 40°C and minimum was 24°C. Warmest nests recorded were in 2017 at Baroli, with mean temperatures over 32°C. All the nests showed a positive correlation with the ambient temperature in both the years. Nests at Nadigao showed highest diurnal variation up to 1.69°C. Temperature in top layers of all nests was most variable and most stable in the bottom layers. Significant difference in temperature between nests was seen at Baroli in 2019 and at Nadigao in 2017. Including both years, temperature within nests differed significantly in one nest at Baroli. Conversely, at Nadigao, significant difference was seen in temperature within nests in all except one nest in 2017.

Keywords: Crocodilians, ectotherms**,** incubation temperature, temperature-dependent sex determination

Movement ecology of Indian Python (*Python molurus molurus*, Linn.1758), Moyar River Valley, Tamil Nadu

-Vishnu C.S

Aim: Aim of our study is to determine the habitat utilization of Indian rock pythons and its movement. Understanding movement pattern and habitat usage of giant reptiles are essential for their conservation and to mitigate human-snake negative interactions.

Location: Moyar River valley lies between Mudumalai and Sathyamangalam Tiger Reserves, the area which is maintaining connectivity between both Eastern and the Western Ghats.

Methods: Radio telemetry study (implanted VHF transmitters) conducted on three females and seven male pythons between December 2018 and July 2019. The linear distance of each successive radio-telemetric locations were measured. Chi-square test performed to analyse the variables. 5. Results: During the study, all ten pythons covered a total distance of 37.69 km with an average movement of 3.14±2.37 km. The male (3.17±2.35 km) and female (3.07 ±2.78 km) python movements were more or less similar. Seasonality (Summer, Winter, and Monsoon) and surface body temperature of pythons were associated ($p= 0.000871$). Similarly, atmospheric humidity and surface body temperature of pythons were also associated with each other ($p=0.009793$). Further, the forest canopy covers related to the activity of pythons ($p= 0.000153$). During the study, maximum encounter rate of radio-tagged pythons observed in Terrestrially (87.75%) followed by Aquatic and Arboreal (6.1%) habitats.

Conclusions: There is a significant relation among seasonality, and atmospheric humidity with pythons surface body temperature. Similarly, canopy cover and activity of pythons also found substantial. Whereas not much difference in the movement of male and female pythons in the study.

Keywords: Home range, activity pattern, behavioural thermoregulation, canopy cover, snakes.

Project Title	:	Spatio-temporal and thermal ecology of Indian Python in Moyar River Valley, Tamil Nadu
Principal Investigator(s)	:	Dr. Ramesh Chinnasamy (PI), Dr. Gautam Talukdar (CO_PI) & Dr. Abhjit Das
Researcher(s)	:	Vishnu C.S (JRF), Thiru Murugan (Project Assistant)
Funding Agency	:	Science and Engineering Research Board- Department of Science and Technology (EMR/2016/003963)
Project Duration	:	2017- 2020

"Manna from Heaven" - Is this why Amur falcons *Falco amurensis* stop-over in Nagaland?

-Alex Jacob S S

Aim: Amur falcon *Falco amurensis,* a long-distance, trans-equatorial migrant, travels up to 20,000 km one way from its breeding grounds in North-east Asia to wintering grounds in Southern Africa and back. On their southbound migration during October and November, Amur Falcons congregate in very large numbers at select sites in northeast India specifically in Nagaland where they stop-over. Why specifically in Nagaland do Amur falcons stop-over to roost and or forage and not elsewhere in India is not known, and why only during the southbound migration?

Location: To understand this a study on diet of the migrating Amur Falcons was carried out during the stop-over period in 2017 and 2018, and at the three major sites in Nagaland: Pangti, Yaongyimchen and Hakhizhe.

Methods: Amur falcons regurgitate undigested parts in the form of a pellet and was collected at the roost sites, and then examined for prey remains in the lab using a dissecting microscope. Only fresh and whole pellets were collected and across different sessions from the time of arrival to departure of falcons to assess differences in prey items in their diet. Prey items were identified to the Order level and their frequency of occurrence was calculated by dividing the number of pellets in which particular item was present by the total number of pellets examined. A total of 1530 pellets: 810 in 2017 and 720 in 2018 were collected and examined.

Results: The prey remains observed across the two years were only of insects and belonged to five Orders with Isoptera (Termites) being the most dominant item (93%). The other insect Orders in the diet and in the order of their frequency of occurrence were Hemiptera (22%), Coleoptera (10%), Orthoptera (5%) and Hymenoptera (3%).

Conclusion: The arrival of Amur falcons in Nagaland appears to coincide with mass emergence of termites in the region leading to their dominance in the diet. The termite species occurring in the region and their emergence pattern is currently being studied so as to understand further the reason for Amur falcon stopping over in Nagaland.

Keywords: Migration, raptor diet, isoptera, termite emergence, roost-site

Tigers in Similipal: Past, Present and Future Challenges

-Harshvardhan Singh Rathore

Conserving vast landscapes as protected areas is imperative to safeguard and sustain viable populations of large carnivores. Similipal Tiger Reserve (STR), Odisha - the fourth largest Tiger Reserve in the country is one such protected area. However, as evident from the results of the past All India Tiger Estimation exercises (2006-2014), STR has underperformed in terms of tiger abundance despite the large tract of land available for the big cat. The 2014 estimate of tiger density stands at $0.48 \pm 0.20/100$ km^2. We aimed at estimating the current abundance and spatial distribution of tiger and leopard in STR.

The study was undertaken in STR, Odisha, India.

The abundance of tiger and leopard in STR was assessed using the capture-recapture framework. We deployed a pair of camera-trap in each 2 km^2 grid in the core of the STR, resulting in a minimum sampling area of 501.62 km^2 and 265 camera-trap locations. The density was estimated by Spatially Explicit Capture-Recapture (SECR) maximum likelihood approach using package 'secr 3.2.1' in the R programming environment. We also generated the spatial maps of tiger and leopard densities.

With an effort of 8723 trap-nights, a total of eight individual tigers were identified, resulting in a density of $0.728 \pm 0.26/100$ km^2. We captured forty-one unique leopards with an estimated density of $4.28 \pm 0.70/100$ km^2. To compare our tiger density with the 2014 estimate ($0.48 \pm 0.20/100$ km^2), we reanalysed the data using camera trap information confined to Southern Similipal. Our assessment of current tiger density in Southern Similipal is $1.122 \pm 0.41/100$ km^2 which is a significant growth from 2014. With two cubs photographed, STR is probably the last breeding ground of tigers in the East-Central landscape. The detection corrected male: female sex ratio was highly female-biased for tiger 0.09 ± 0.08 and leopard 0.25 ± 0.05.

The primary concern for the future is the detection of a single male tiger and the spatial distribution of the tiger being confined only to Southern Similipal. The leopards are distributed throughout the sampling area.

Key-words: camera-trap, density, leopard, SECR

Project Title	:	Wild Tigers of Similipal: A study on spatial distribution, abundance and population genetics
Principal Investigator(s)	:	Dr. Bivash Pandav, Dr.Samrat Mondol, Shri. Manoj Nair, Dr. Bilal Habib, Shri. Debabrat Swain, Field Director, Similipal Tiger Reserve
Researcher(s)	:	Harshvardhan Singh Rathore
Funding Agency	:	National Tiger Conservation Authority
Project Duration	:	Three Years

Maps propose, elephants dispose: Home range and movement patterns of elephants in tribal hinterlands of northern Chhattisgarh

-N. Lakshminarayanan and Ankit Kumar

Aim: In areas boundaries between forests and human use areas are diffuse, understanding animal movement shall be useful to identify and validate corridors. In northern Chhattisgarh landscape where there is a high overlap between forests and human use areas, we assess elephant home range and habitat use. We describe their movement and discuss its implications for conflict management

Location: Surguja and Bilaspur Forest Circles in northern Chhattisgarh

Methods: We deployed Iridium satellite collars developed by Savannah tracking on six elephants, of which three elephants (two bulls and a female in a herd) were monitored for a longer period. We computed home ranges using 95% Minimum Convex Polygon (MCP) and estimated space use based on 50% and 95% Utilization Distribution (UD) probability contours.

Results: Home ranges estimated using 95% MCP for two male elephants CGM001 and CGM003 were 1170 km^2(for 13 months) and 997 km^2respectively (nine months). For the female elephant CGF010 that operated with a herd, 95% MCP home range for a period of 13 months was 2337 km^2. For the same period, space use estimated using 95% UD probability contours for, CGM001 and CGM003 were 280 $km^2$and 235 km^2respectively and for CGF010, it was 334 km^2. Home ranges of elephants in the fragmented northern Chhattisgarh appear larger than the home ranges of elephants occurring in relatively intact habitats like the Nilgiris and the Terai. Further, around 30 - 37% of space use by collared elephants as per 95% UD probability contours was outside forests. This illustrates the fact that the landscape offers minimal resistance for elephants to move, especially during night.In northern Chhattisgarh, the elephant landscape is a hinterland of forest patches interspersed with settlements and agriculture. Stark differences between forests and non-forests do not exist, as agriculture is still marginal and seasonal in most areas. Consequently, identifying corridors just based on structural connectivity could be misleading. Therefore, across this vast expanse of wilderness, understanding the complex use of elephants' range using satellite tracking can be useful for conservation planning.

Keywords: Home range, satellite tracking, minimum convex polygon, utilization distribution, movement

Project Title	:	Conservation management of elephants in Chhattisgarh: A capacity building initiative on study of dispersal and ranging patterns for effective management of human–elephant interactions
Principal Investigator(s)	:	Dr. Bivash Pandav and Dr. Parag Nigam
Researcher(s)	:	N. Lakshminarayanan, Project Scientist - Elephant Cell and Ankit Kumar, Research Biologist
Funding Agency	:	Chhattisgarh Forest Department
Project Duration	:	2017 to 2020

Effect of inorganic materials on stress hormone analyses in large felids: a comparative study on tigers in the Terai-Arc landscape

-Shiv Kumari Patel

Title: Effect of inorganic materials on stress hormone analyses in large felids: a comparative study on tigers in the Terai-Arc landscape.

Aim: Measurement of faecal Glucocorticoid stress hormone (GC) from field-collected samples is challenging due to presence of inorganic materials, which may confound the interpretation of faecal hormone data. We tested the effect of soil and sand in tiger faeces on the interpretation of stress data from field collected faecal samples across the Terai-Arc Landscape, India.

Study Area: Terai-Arc landscape.

Method: We collected 450 fresh potentially tiger faeces between 2015-18 from various protected and non-protected tiger habitats of Terai-Arc landscape. Genetically identified tiger faeces (n=373) were processed for faecal glucocorticoid metabolite (fGM) quantification using Corticosterone Enzyme Immuno Assay (EIA) kits. Assay was validated using parallelism and accuracy test. Dried faecal material was ashed in muffle furnace and reweighed to get the weight of organic matter combusted and inorganic matter left behind. Kruskal-Wallis test was used to look for differences between groups of contrast.

Results: fGM values expressed as per gram of total dry mass showed positive correlation (r_s=0.52, p<0.01) with percent organic matter in faeces. Indicating that changes in fGM values can actually be an artifact of percent organic matter in faeces. Further analysis was done by expressing fGM data per gram of organic matter to control for the differences arising due presence of inorganic matter. Kruskal-Wallis test showed significant difference between fGM levels ($\chi^2(4)$= 10.508, p= 0.03) as well as organic matter percentage ($\chi^2(4)$= 12.825, p= 0.012) of different protected areas. Post hoc pair wise comparison revealed that Dudhwa (n=36, fGMs: 5.8±3.7, OM: 40.71±14.93) has significantly lower fGM levels and higer percent organic matter compared to Rajaji Tiger Reserve (n=57, fGMs: 10.11±9.1, OM: 30.85±19.8). Non protected areas differed significantly only in percent organic matter ($\chi^2(4)$= 17.231, p= 0.002), differences in fGM levels didn't come out to be significant.

Conclusion: Our results indicate that measuring fGMs as per gram of total organic matter is more accurate. Dudhwa Tiger Reserve among PAs and Ramnagar Forest Division among NPAs shows lowest fGMs levels.

Keywords: Feacal glucocorticoids metabolites (fGMs), organic matter, tigers, Terai-Arc Landscape.

Project Title	:	Understanding disturbance impacts on psychological, nutritional health and their effect on reproductive capacity of wild tigers in the Terai-Arc landscape
Principal Investigator(s)	:	Dr. Samrat Mondol, Dr Bivash Pandav
Researcher(s)	:	Shiv Kumari Patel (Junior Research Fellow)
Funding Agency	:	Grant-in-Aid, WII
Project Duration	:	April 2017-April 2020

Not so sweet! A case study of sugar-coated human-leopard conflict in Junnar Forest Division, Pune Maharashtra

-Kumar Ankit

Leopard, *Panthera pardus* represents one of the most widely distributed and adaptable member of the Felidae family. Leopards are frequently found outside protected areas, in modified landscapes and are highly vulnerable to conflict with humans. Such incidents are a big hurdle to conservation of large felids in modified landscapes. In Junnar Forest Division, sugarcane covers an area of 317.22 km^2, which in continuity with the intermittent forest patches, offers good cover and food subsidies facilitated by human presence (feral dogs and domestic pigs), helping leopards thrive in this landscape. In this study, we have evaluated the dynamics of human-leopard conflict over the last decade in Junnar forest division.

The Junnar Forest Division, owing to its proximity to two wildlife sanctuaries in the Western Ghats, availability of abundant water sources, and presence of intermittent forest cover, provides a suitable habitat for leopards. The division has a human population of 10,85,390 and covers a geographical area of 4360 km^2.

Data on human-wildlife conflict was collected from compensation records of the forest department. We compiled and evaluated conflict pattern based on records of leopard attacks on human and livestock. Exploratory analysis was done to investigate spatial and temporal trends in the data. We identified and mapped spatial clusters of conflict hotspots and coldspots in GIS using hotspot analysis.

An abrupt surge in human-leopard conflict was observed after 2011. A total of 5383 incidents of human-leopard conflict were recorded. Out of this, there were 133 attacks on human leading to death (n=34) or injury (n=99). Remaining 5250 records showed livestock depredation (n=3316 goat, n=995 sheep and n=927 cattle). With reference to these preliminary results, we presume that there is a relation between change in cropping pattern, irrigation regime, infrastructure development, increase in human population, and rise in human-leopard conflict, which is yet to be tested.

Keywords: Conflict-hotspot, sugarcane field, human-leopard conflict

Understanding ecological patterns of species in human-wildlife conflict

-Divya Ramesh

Aim and introduction: Human-wildlife conflict is caused by numerous factors such as loss of habitat and human population growth, and has severe consequences including loss of both human and animal lives. While current methods to reduce conflict are mostly short-term, the increased levels of conflict across India urge the exploration and use of alternative methods to actively manage animal populations in the long-term. We explore sterilization and contraception methods including surgery and vaccines on four species in conflict – Rhesus macaque, nilgai, Asian elephant, and wild pig. Towards this, we collected population, demographic, and behavioural information to understand and monitor ecological patterns of these species throughout the study, and present the results here.

Location: 16 sq. km. around WII campus, Dehradun (Uttarakhand), Pench National Park (Madhya Pradesh)

Methods: We conducted distance sampling-based line transects to estimate populations of nilgai and wild pig in Pench NP, and of Rhesus macaque at the Dehradun site. We analysed this data using Distance software to acquire density estimates for each species. We used radio-telemetry to study movement and space-use patterns of five troops of Rhesus macaques and analysed this data using kernel density estimation methods in ArcGIS. We also conducted behavioural monitoring of Rhesus macaques using focal and scan sampling. To understand macaque feeding patterns, we set camera traps at garbage dumps and estimated percentage organic nitrogen (index of protein content) from faecal samples using Kjeldahl method. These data were analysed using R program.

Results: Nilgai and wild pig densities were estimated to be 2.68 ± 2.43 individuals per sq. km. and 3.57 ± 1.49 individuals per sq. km. respectively. Nilgai densities were higher in grassland and mixed dry deciduous habitat and low in mixed moist forests. Wild pig density was estimated only in short grasslands due to few observations in other habitat types. Rhesus macaque density was 75.69 ± 34.26 individuals per sq. km. Home ranges of macaques extend from 2.77 sq. km. to 8.76 sq. km., with an average of 14 garbage dumps within each home range. While there was no significant difference in proportion of feeding events on natural and anthropogenic food, macaques spent more time feeding at garbage dumps compared to natural areas. The average percentage of organic nitrogen in faecal samples was 2.49%, but this broad index of protein content showed no significant difference between troops.

Keywords: Population density, human-use landscape, behaviour, space-use, foraging

Project Title	:	Population management of species involved in human-wildlife conflict
Principal Investigator(s)	:	Prof. Qamar Qureshi and Dr. Y.V. Jhala
Researcher(s)	:	Divya Ramesh, Priya Gusain, Sanath K. Muliya (Project Scientists) and Uddalak T. Bindhani (Project Fellow)
Funding Agency	:	Ministry of Environment, Forest and Climate Change
Project Duration	:	August 2018 - July 2021

Tree species diversity, composition and recruitment pattern in Moyar River Valley, Tamil Nadu

-Thiru Murugan V

Aim: Understanding the species diversity patterns and recruitment of trees will be crucial for the management of any protected area. Therefore, we attempted to study the diversity patterns of trees, sapling and seedlings across five major vegetation types in the Moyar River Valley Landscape (MRVL)

Location: MRVL is part of Nilgiri Biosphere Reserve and traverses through Mudumalai and Sathyamangalam tiger reserves in Tamil Nadu. MRVL consist of five major vegetation types, namely Riparian Forest, Southern Thorn Forest, Southern Scrub Forest, Tropical Dry Deciduous Forest, and Tropical Moist Deciduous Forest.

Methods: One km transect (n=50) consisting of ten equally distanced 10m x 10m plots (n=500) were laid randomly in the above-mentioned five forest types (n=10/forest type). All the trees (≥20 cm Girth at Breast Height) were enumerated from the plots; sapling (> 1m but < 10 cm GBH) and seedling (<1 m height) enumerated from the nested subplots of (3 x 3 m) and (1 x 1 m) respectively, established at the two corners of the plot. The software program Estimate S used for analysis.

Results: A total of 164 species were recorded from the survey of trees (n=1988), saplings (n=1743) and seedlings (n=903). Diversity was high for trees (n=148) followed by seedlings (n=99) and saplings (n=78). The tree diversity and composition was significantly different across the five vegetation types. Most of the dominant species showed moderate representation in sapling and seedling except abundant species *Anogeissus latifolia* (236 Trees> 5 Sapling < 26 Seedling). The invasive species *Prosopis juliflora* (133 Trees< 377 Sapling > 176 Seedling) found in high densities in the recruitment layer (ie. Sapling & seedling).

Conclusion: Tree species diversity and recruitment in MRVL is highly heterogeneous. The anthropogenic disturbances in the landscape (eg. livestock grazing) may be causing such heterogeneity. In addition, proliferation of invasive trees also inhibiting the recruitment of native species. Therefore, the future research should concentrate on how various disturbance factors influences the tree diversity and recruitment patterns in MRVL.

Keywords: Tropical forest; vegetation classification; tree community; forest disturbance

Project Title	:	Spatio-temporal and Thermal ecology of Indian Python in Moyar River Valley, Tamil Nadu
Principal Investigator(s)	:	Dr. Ramesh Chinnasamy, Dr. Gautam Talukdar and Dr. Abhijit Das
Researcher(s)	:	Thiru Murugan (Project Assistant), Vishnu C.S (Junior Research Fellow)
Funding Agency	:	Science and Engineering Research Board- Department of Science and Technology (EMR/2016/003963)
Project Duration	:	2017-2020

Losers and gainers in post-tsunami era: insights from the mangrove forest of Nicobar Islands

-Nehru Prabakaran

Aim: The inter-specific resilience among mangrove species to sea level rise (SLR) is key to design conservation strategies for this important ecosystem that is among the most vulnerable to SLR. In addition to the eustatic sea level rise, tectonic processes can also cause increase or drop in sea level, which can provide critical insights on mangrove responses to sea level change. Land submergence of 1 - 2.8 m due to tectonic subsidence during 2004 Sumatra Andaman earthquake has resulted in severe loss of coastal & inter-tidal habitats in Nicobar Islands. Interestingly, mangroves rebound with the disaster by colonizing new inter-tidal areas that were terrestrial forest before. Our aim in this study is to make use of the drastic sea level change in Nicobar group of islands caused by the 2004 Sumatra Andaman earthquake to understand how mangrove ecosystem respond to such drastic natural events in a long-term.

Location: the study is conducted in the Nicobar group of islands that is situated in the Bay of Bengal.

Methods: We have sampled selected sites for mangrove species composition. The collected data was compared with the similar data from the sites collected during 2011. Such comparison allow us to understand the trends in the species colonization in the successional mangrove habitats that were previously terrestrial habitat.

Results: *Rhizophora mucronata* and *Bruguiera gymnorhiza* were the dominant species in the sampled sites. Site-specific dominance of other species such as, *Lumnitzera racemosa*, *Sonneratia* spp., and *Nypa fruticans* was also observed. Four species viz. *Acanthus illicifolius*, *Bruguiera cylindrica*, *Avicinea marina* and *Pemphis acidula* were recorded for the first time after tsunami. The presence or absence of survival trees has greatly influenced the rate of succession.

Conclusion: The seaward mangroves showed high resilience to the SLR than the landward mangroves. Also, the rate of succession seems to be influenced by site specific habitat characteristics and seed source availability. Therefore, a long-term monitoring of these habitats is required to understand the spatio-temporal dynamics of mangrove succession after this rare natural disturbance.

Keywords: Tectonic subsidence, sea level change, succession, early colonizers

Genetic status of the largest Gharial (*Gavialis gangeticus*) population

-Surya P Sharma

The gharial is a critically endangered crocodile species endemic to the Indian subcontinent. Gharial underwent a rapid decline in the last century due to hunting, mortality in finishing nets and habitat degradation, resulting in small and isolated populations. Conservation efforts initiated during the mid-1970s assisted in gharial recovery. Despite the importance of genetic diversity in monitoring population recovery, limited information is available on the genetics of the gharial populations. This study aims to determine the current genetic status of largest gharial population, located in the National Chambal Sanctuary (NCS) using mitochondrial control-region (mt-CR) and nuclear microsatellite markers.

Sampling was carried along the Chambal river, within NCS.

Biological samples for the study were collected from 16 nesting locations. Total genomic DNA was extracted using the Phenol-Chloroform method. A 520 bp fragment of the mt-CR region was sequenced and used to calculate the mtDNA diversity indices. A total of 27 nuclear microsatellite markers, including both species-specific and cross-species markers, were screened. All the screening and standardization was done using known gharial samples. The overall summary statistics were calculated using Arlequin, v. 3.0. Qualitative summary statistics-based tests (BOTTLENECK and M-ratio) were performed to detect the evidence of genetic bottleneck in the sampled population.

Virtually no variation (one haplotype) was observed in mt-CR which is similar to the low level of diversity reported in other crocodilian species. The microsatellite loci genotyped showed a varied level of polymorphism: mean allelic richness 3.0 (1.7) mean observed heterozygosity 0.41 (0.15) and mean expected heterozygosity 0.40 (0.13). A significant departure from Hardy-Weinberg equilibrium was observed at loci G13_7 and G13_8. The test for heterozygosity excess (HE) was non-significant at a higher proportion of SMM. However, at a lower proportion of SMM, the HE was significant. Similarly, the calculated M-ratio was 0.311 (0.15) suggesting a genetic bottleneck in the sampled population.

A detailed study using samples from existing gharial populations using novel microsatellite markers is required to understand the effect of past demography, mating system and gene-flow.

Keywords: Bottleneck, cross-species, decline, diversity

Project Title	:	Ecological Monitoring of Chambal River basin with special reference to water requirement of key aquatic species
Principal Investigator(s)	:	Dr. S. A. Hussain, Dr. Ruchi Badola and Dr. S. K. Gupta
Researcher(s)	:	Surya P Sharma (Junior Research Fellow)
Funding Agency	:	Grant-in-aid, Wildlife Institute of India
Project Duration	:	October 2016- October 2020 (4 Years)

Genetic analyses reveal population structure and recent decline in leopards (*Panthera pardus fusca*) of India

-Supriya Bhatt

Aim: Large carnivores maintain the stability and functioning of ecosystems. Currently, many carnivore species face declining population sizes due to natural and anthropogenic pressures. The leopard, *Panthera pardus*, is probably the most widely distributed and adaptable large carnivore, still persisting in only about 25-37% of its' historic range. However, we lack population and landscape level data on leopard population trends, as ecological monitoring approaches are difficult to apply on such wide-ranging species. Much of our knowledge on leopard ecology and demography in the Indian subcontinent come from location-specific studies, and lack of detailed, systematic field data makes it difficult to generate accurate population estimates as well as demographic patterns at landscape scales. In this study, we used non-invasive samples to investigate leopard population structure and patterns of demographic decline across Indian subcontinent.

Location: Major leopard habitats across India.

Methods: We opportunistically collected 921 large carnivore faecal samples from major leopard habitats across India. In the laboratory, we used DNA-based approaches to identify leopard faecal samples. Further, we identified unique individual leopards using a panel of 13 microsatellite loci. Further analyses were done to determine genetic structure and past population demography of leopards across the Indian subcontinent.

Results: We confirmed 199 unique unrelated leopards were used for further analyses. Bayesian clustering approach revealed four distinct genetic subpopulations (K=4). These subpopulations correspond majorly to Western Ghats, central India- semi Arid, Shivalik and Terai plains, each with high genetic variations. Genetic differentiation among these populations ranged between 0.027-0.218 ($p<0.05$). Coalescent simulations revealed 75-90% population decline between 120-200 years ago, possibly human induced. These are in concordance with ecological estimates of local extinction probabilities obtained from occupancy modeling of historic and current leopard distribution.

Conclusion: Our results suggest drastic population decline in recent times for a widely distributed, adaptable large carnivore. We recommend that detailed, landscape-level ecological studies on leopard populations are critical to future conservation efforts.

Keywords: Population decline, genetic subpopulation, biogeographic zone, coalescent simulation

Project Title	:	Understanding metapopulation dynamics of tigers in Terai-Arc landscape, India
Principal Investigator(s)	:	Dr. Samrat Mondol, Dr. Bivash Pandav
Researcher(s)	:	Supriya Bhatt (Ph.D. Scholar)
Funding Agency	:	Department of Science and Technology, Government of India, Wildlife Conservation Trust - Panthera Global Cat Alliance Grants
Project Duration	:	Jan 2016- Dec 2018

To Avoid or to Adapt - Energy Infrastructure and its Impact on Large Avian Species

-Harindra Baraiya

Aim: Energy infrastructure are of major concern to birds as they pose a risk of collision, electrocution, change in behaviour and loss of habitat. The impacts vary across landscapes and is of particular concern in the arid and semi-arid regions in India where large avian species such as migratory cranes, flamingos, raptors and others occur. Conflicting with this, major renewable energy projects and industries are being setup or in operation requiring extensive powerline infrastructure which are potentially posing risks to birds. To assess these impact a study to understand space use by wintering Common Crane *Grus grus* and their flight behaviour with respect to wind farms and power-lines was carried out in the arid plains of Kutch district in western Gujarat.

Study Area: The study was carried out during January-February 2019 within a 321 sq.km area in the Bhachau taluk, Kutch where land use is predominantly dry agriculture. 240 windmills are located as a cluster and covers nearly 40% of the area.

Methods: Systematic vehicular surveys along six roads criss-crossing the study area of 153 km in length were carried out to record presence of cranes in and outside of the wind-mill area. Regular observations of cranes in flight specifically their response to power-lines were recorded and analysed for flight behaviour.

Results: During the survey covering a total of 1530 km, 51 crane sightings were made: 8 sightings in wind-mill area, while 43 others were recorded in the area outside, clearly indicating displacement of cranes from the wind-mill area. For observation of crane interaction with powerlines, a total of 79 sightings were made, of which no response was observed in 15 as the cranes were flying more than 10m above the earth wire. Of the remaining, in 14 cases flocks changed their course, in 13 flocks split, and in 8 flaring by individual cranes were observed. The number of attempts to cross powerlines also varied across the flocks. A more detailed study on the space use and flight behaviour of cranes in the area is currently underway.

Keywords: Displacement, flight behaviour, distribution, common crane, Kutch

Project Title	:	Assessing the impacts of Power-lines on avian species in the arid plains of western Gujarat
Principal Investigator(s)	:	Dr. R. Suresh Kumar and Dr. Anju Baroth
Researcher(s)	:	Harindra Baraiya (Project Assistant), Pravin Kumar, Palak Joshi, Prachi Laddha, Rahul Tripathi, Manojkumar Roy (Project Interns)
Funding Agency	:	Powergrid Corporation of India Limited
Project Duration	:	2 Years
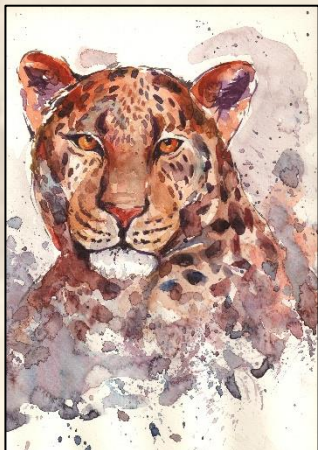
Cover: *Leopard (Watercolor on paper), painting by Ms. Poonam Pal. She is working as Project Assistant in NMCG Project. Leopard is one of the most widely distributed big cats in India.*

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