



SEMINAR ON NATIONAL MISSION FOR CLEAN GANGA – WII PROJECT BIODIVERSITY CONSERVATION AND GANGA REJUVENATION

Monday, 17th September 2018

PROGRAMME

Seminar Chairperson: Dr. Savita, Director, FRI

INAUGURAL SESSION

0910 – 0915 h	Welcome	Dr. Ruchi Badola , Scientist G, WII
0915 – 0925 h	Opening Remarks	Dr. V.B. Mathur , Director, WII
0925 – 0935 h	Remarks by Guest of honour	Shri Rozy Agarwal , Executive Director (Finance), NMCG
0935 – 0945 h	Inaugural address	Shri Jairaj , PCCF & HoFF, UKFD
0945 – 1000 h	Release of Publications	
	1. Wings of Ganga	
	2. Training Approach and Curriculum	
	3. Stakeholders for Ganga aqualife conservation	

TECHNICAL SESSION – I

BIODIVERSITY CONSERVATION IN GANGA

Chair : **Shri Rozy Agarwal**, Executive Director (Finance), NMCG

Co-Chair(s) : **1. Dr. Sandeep Behera**, Biodiversity Consultant, NMCG
2. Dr. J.A. Johnson, Scientist-E, WII

1000 – 1015 h	Prioritization of areas for conservation in mainstem Ganga River	Dr. Niladri Dasgupta , Project Scientist
1015 – 1030 h	Status of river bank vegetation and selected aquatic fauna in river Ganga	Zeeshan Ali , Project Associate
1030 – 1045 h	Factors affecting occurrence of birds and mammals of conservation significance in Ganga River	Goura Chandra Das , Project Associate
1045 – 1100 h	Moving Towards Conservation: Rescue and Rehabilitation of Fresh water turtles along Ganga Basin	Dr. Animesh Talukdar , Veterinary Officer

1100 – 1115 h	Ecotoxicological risk assessment of pesticides in abiotic and biotic environmental matrices across river Ganga - Preliminary Status and Trends Ms. Ruchika Shah , Project Associate
1115 – 1130 h	Assessment of genetic status, diversity and gene flow of selected aquatic fauna of Ganga River Dr. Ajit Kumar , Project Associate & Dr. Prabhaker Yadav , Project Fellow
1130 – 1145 h	Discussion & Remarks by Chair and Co-Chairs
1145 – 1200 h	Tea

TECHNICAL SESSION – II

COMMUNITY PARTICIPATION & AWARENESS CREATION

Chair : Prof. Prakash Nautiyal, HNB Garhwal University

Co-Chair(s) : 1. Dr. Asghar Nawab, Senior Manager, WWF - India
2. Dr. Ruchi Badola, Scientist-G, WII

1200-1215 h	Community based conservation programmes for species restoration in Ganga River Pariva Dobriyal , Project Scientist
1215-1230 h	Capacity building for biodiversity conservation of various stakeholders of Ganga River Dr. Sangeeta Angom , Project Scientist
1230-1245 h	Identifying effective education strategies for creating a connect between the resources and community living along the Ganga Ravi Sharma , Project Fellow
1245-1300 h	Life less ordinary “Ganga Prahari - Guardians of the Ganga” Dr. Deepika Dogra , Project Associate
1300-1315 h	Discussion & Remarks by Chair and Co-Chairs
1315-1330 h	Concluding Remarks by the Seminar Chairperson
1330-1335 h	Vote of Thanks - Aditi Dev
1335 – 1435 h	LUNCH
1435 – 1730 h	POSTER SESSION (25 POSTERS)

National Mission For Clean Ganga Seminar Programme: List of Posters

Sl. No.	Title	Presenter
1.	Floral Assemblages and Vegetation Patterns along the River Ganga: A Rapid Assessment	Ms. Dipti Dey & Megha Shruti
2.	Diversity of Dragonflies and Damselflies in river Ganga	Mr. Kritish De
3.	Fish assemblage structure along the middle reaches of the Ganga River	Mr. Rahul Rana
4.	An overview of anuran and squamate reptile diversity along Ganga and Alaknanda Rivers, India	Mr. Bitupan Baruah
5.	Ecological Appraisal of Potential Release Sites for Chelonians along Ganga River: An Elemental Conservation Need	Mr. Akshay Bajaj
6.	Insights into freshwater turtle diversity of the river Ganga and perceived threats	Ms. Anuja Mital
7.	Rapid assessment of abundance and distribution of crocodiles and freshwater turtles in Ganga River	Mr. Saurav Gawan
8.	Diversity of Waterbirds along the Mainstem of Ganga River	Ms. Anita Devi
9.	Breeding Status and Distribution of Indian Skimmer <i>Rynchops albicollis</i> in the Ganga River, Uttar Pradesh, India	Ms. Ajay Prakash Rawat
10.	The past and present distribution of aquatic and semi-aquatic mammals of the Ganga River basin	Ms. Sayantika Banerjee
11.	GACMC – A centre to spearhead science based conservation planning and information dissemination	Dr. Shivani Barthwal
12.	GIS in conservation planning of the Ganga River : 'River-map of Ganga-life'	Ms. Aishwarya Ramchandran
13.	Digital repository for conservation planning and sensitization	Mr. Ravindra Nath Tripathi
14.	Multimedia Platform: Information dissemination amongst stakeholders	Ms. Shatakshi Sharma
15.	Livelihood and Biodiversity: Two sides of the same coin	Ms. Hemlata Khanduri
16.	Role of Panchayati Raj system in Ganga Conservation	Mr. Vipul Maurya and Rahil Khan
17.	Achieving coherence in diversity: Stakeholders for Ganga aqualife conservation	Ms. Michelle Irengbam
18.	Digital Microplans for Linking Conservation and Development at the Grassroots Level	Ms. Aditi Dev
19.	Evaluating the ecosystem services of Ganga River: A framework	Ms. Amanat K. Gill
20.	Pathway for community mobilization in Biodiversity Conservation and Ganga Rejuvenation: Case Studies from Bihar, Jharkhand and West Bengal	Ms. Ekta Sharma and Manisha Mallick
21.	"Women's contribution in Ganga Rejuvenation"	Ms. Sunita Rawat and Shashi Joshi
22.	Spearhead team: A sustainable approach to capacity building in different aspects of biodiversity conservation	Ms. Monika Sharma
23.	Mobilizing youth for Biodiversity conservation and Ganga Rejuvenation	Ms. Monika Mehralu
24.	Ganga Aqualife Rescue and Rehabilitation Centre Narora: Story of a unique partnership	Mr. Aftab A. Usmani
25.	The Ganges River Dolphin (<i>Platanista gangetica</i>): Evaluating their occurrence in Uttar Pradesh	Mr. Rahim Shaikh

Prioritization of areas for conservation in mainstem Ganga River

-Niladri Dasgupta

Biodiversity restoration in the Ganga River needs a systematic, strategic and landscape-level planning. In view of this, the project aims to identify and prioritize high biodiversity stretches along the Ganga River, as an initial step towards ecological restoration.

A multistage approach was adopted. First, extensive literature review was carried out to get an overview of historical and present distribution of priority species in the mainstem Ganga River. Second, rapid biodiversity assessments were undertaken from Devprayag, Uttarakhand to Nurgpur, West Bengal to assess the occurrence and distribution of species of conservation concern, habitat features in terms of hydrology and water quality, and the threats to species and their habitat. Third, the priority areas were identified by integrating the species occurrence information with habitat parameters and threats in a geo-spatial platform.

The priority species such as Gangetic river dolphin was sighted from downstream of Bijnor barrage to Nurgpur, however the population is fragmented by barrages. Smooth-coated otters were sighted near Rajaji National Park and in the Vikramshila Gangetic Dolphin Sanctuary. Island nesting birds were most frequently encountered between Bijnor and Ghazipur, Kachhla and Farrukhabad, Sahibganj and Rajmahal with meanders, mid-channel islands and bars. Gharials were sighted near Rajaji National Park and at Ramsar site near Brijghat, whereas, mugger were sighted near Bijnor and at upstream of the Farakka Barrage. Large congregation of turtles were encountered from Makdumpur to Narora and between Farrukhabad and Kanpur. Major water extraction at Bhimgoda, Narora and Kanpur barrages, active wastewater inflow points, over-fishing, destructive fishing, sand mining, river-bed agriculture, solid waste and species movement barriers such as barrages were identified as major threats to the species and their habitat.

Six high biodiversity value areas were thus identified. These priority stretches cover about 50% of the river's length. The relative species assemblage was higher in the stretches falling within the Protected Areas. These stretches shall act as template for planning ecologically sound conservation strategies of the Ganga River.

Keywords: Biodiversity, conservation planning, hydrology, species assemblage, threat, wastewater, species restoration

Project Title	: Biodiversity Conservation and Ganga Rejuvenation
Principal Investigator(s)	: S.A. Hussain, Ruchi Badola
Researcher(s)	: Niadri Dasgupta, Shivani Barthwal, Michelle Irengbam, Anita Devi, Saurav Gawan, Aishwarya R. Chandran, Ravindra Tripathi, Shatakshi Sharma
Funding Agency	: National Mission for Clean Ganga
Project Duration	: 2016 to 2019

Status of river bank vegetation and selected aquatic fauna in river Ganga

-Sk. Zeeshan Ali

Ganga River is the largest river in the Indian subcontinent flowing through multiple environmental regimes. Depending upon the geomorphic variability, topographic features and hydrological regimes, the river was categorized in six ecological zones. A total of 32 intensive monitoring sites were selected with approximately 75 km interval of which a stretch of 5 km was selected for intensive monitoring. Previous studies carried out on biodiversity and their relationships with water quality parameters in River Ganga were conducted in an incoherent manner. The aim of this study was i) to generate baseline information on current distribution and abundance of river bank vegetation, odonates, fishes, amphibians and turtles of the River Ganga and ii) to assess the effect of water quality parameters on the observed patterns in distribution and abundance of aquatic fauna.

A total of 289 species of herbs, shrubs and trees representing 88 families were recorded of which 66.6 % were native and rest 33.4% were exotic. A total of 37 species of Odonates belong to 26 genera, 6 families and 2 suborders were found, of which 24 species were Anisoptera (dragonfly) and 13 species were Zygoptera (damselfly). A total of 125 species of fishes belonging to 88 genera, 34 families and 11 orders including Golden Mahseer (*Tor putitora*) and 8 exotic species were recorded. In the case of Herpetofauna, 10 species of amphibians belong to 8 genera and 30 species of reptiles belonging to 23 genera were recorded. A total of 11 species of turtles were encountered including the endangered *Batagur dhongoka* and *Chitra indica* from three unprotected sites indicating these regions are important turtle conservation priority areas. Maximum faunal diversity was recorded in areas between Bijnor to Narora which are protected in the form of Ramsar site and Hastinapur Wildlife sanctuary. Maximum floral diversity was recorded in areas between Dharasu and Bijnor which is a part of the Rajaji National Park and Hastinapur Wildlife sanctuary respectively, followed by Kahalgaon-Sahibganj stretch which lies in the Vikramshila Gangetic Dolphin sanctuary. We found a significant relationship between water quality parameters and species richness as well as Shannon diversity index.

The result shows that diversity in habitat zone 2 is consistently high across the studied taxa along the Ganga river. This suggest the importance of healthy ecological conditions for biodiversity conservation and management, and provide a framework for future course of action in planning of aquatic species restoration in the River Ganga.

Keywords: Aquatic biodiversity, water quality, River Ganga

Project Title	: Biodiversity Conservation and Ganga Rejuvenation (Component 2: Planning Aquatic Species Restoration for Ganga River)
Principal Investigator(s)	: Coordinator(s): Dr. J.A. Johnson, Dr. S.A. Hussain, PI (s): Dr. V.P. Uniyal, Dr. B.S. Adhikari, Dr. K. Sivakumar, Dr. Gautam Talukdar, Dr. R. Suresh Kumar, Dr. Abhijit Das
Researcher(s)	: Dr. Arvind Kumar. Dwivedi, Dr. Rohitashva Shukla, Sk. Zeeshan Ali (Project Associates), Bitupan Boruah, Dipti Dey, Anuja Mital, Kritish De, Rahul Rana (Project fellows), Megha Shruti, Arkojyoti Sarkar (Project Assistants)
Funding Agency	: National Mission for Clean Ganga
Project Duration	: 2016-2019

Factors affecting occurrence of birds and mammals of conservation significance in Ganga River

-Goura Chandra Das

The Ganga River is abode to unique habitat mosaics that support distinctive biota and provide numerous life sustaining ecosystem services, creating a strong imperative for their rejuvenation, restoration and systematic conservation. The riverine biota of the Ganga River is under threat due to water pollution, extensive fishing, and shift in natural flow regime, invasion of exotic species, climate change impacts and human-induced habitat loss.

The present study was undertaken to assess the status of aquatic mammals and waterbirds and factors affecting their occurrence in the Ganga River. We classified the Ganga River into six habitat zones and 32 intensive sampling sites of 5 km were chosen that were 75 km apart.

Boat based Visual Encounter Method was performed to enumerate the occurrence of Gangetic River dolphin whereas a combination of linear walks along the banks and boat surveys were adopted to enlist the diversity of waterbirds. To distinguish eco-geographical factors such as channel depth, channel width, air temperature, water temperature, dissolve oxygen (DO), conductivity, total dissolve solute (TDS), salinity, pH, nitrate (NO₃), agriculture, fishing, boating, religious activities and sand mining affecting the occurrence of dolphins, we used generalized liner model in R (Version 3.5.1).

The present study revealed that dolphin sightings were highly clustered and had a clumped distribution. Sightings were recorded in 11 representative sites and 12 representative sites during post monsoon and pre- monsoon season respectively. Altogether 86 species of water associated birds of which 16 species in RET category were recorded during the survey. The maximum species richness (67 species) and species diversity (2.83 ± 0.06) were recorded in Zone 2 (Haridwar-Narora). Our results showed that dissolved oxygen (DO), channel depth, fishing and religious activities are the most influential predictors affecting dolphin occurrence.

The present study concluded that each site has its unique set of habitats characteristics, species composition and anthropogenic influences. Based on the present outcomes our future endeavor will be to derive best population estimates using robust methods and derive population trend along entire stretch of the Ganga River.

Keywords: Ganga River, Gangetic dolphin, intensive sites, waterbirds, eco-geographical factors

Project Title	: Biodiversity Conservation & Ganga Rejuvenation
Principal Investigator(s)	: Dr. J.A. Johnson (Coordinator), Dr. S.A. Hussain (Co-Coordinator)
Researcher(s)	: Goura Chandra Das, Aftab Alam Usmani (Project Associate); Ajay Rawat, P. Gangaiyamaran (Project Fellow); Rahim Seikh (Project Assistant)
Funding Agency	: National Mission for Clean Ganga
Project Duration	: 36 months

Moving Towards Conservation: Rescue and Rehabilitation of Fresh water turtles along Ganga Basin

-Dr. Animesh Talukdar

Kachua Punarvas Kendra, Sarnath and Ganga Aqualife Rescue and Rehabilitation Centre, Narora in Uttar Pradesh were established in response to dramatic decline of native turtle population resulting from degradation and fragmentation of the available habitat, unregulated developmental activities along the river, improper fishing activities and consumptive exploitation. These centres act as recovery stations for confiscated or displaced chelonians.

Wildlife Institute of India under the aegis of National Mission for Clean Ganga has been providing scientific inputs in upgrading the facilities and modifying the infrastructure based on species specific needs including developing protocols for rescue and rehabilitation and capacity enhancement of wildlife professional and local communities.

The centres received a total of 1738 animals representing ten of the fourteen species of turtles found along Ganga basin. Animals were received in conditions requiring varying level of intervention. Enclosures were modified and maintained to serve purposes of quarantine to rehabilitation with emphasis on species appropriate enrichment, specialized feeding and requisite veterinary interventions. Following a quarantine of minimum 30 days and intensive care specific to the species, 1104 animals were successfully released in identified sites based on survey due consideration of threat to survival and further recruitment into the population. The remaining animals are planned for release in near future. Capacity building training program for field veterinary officers have been organized with the objective of sensitizing the officers to the various facets of conservation and management of aquatic fauna. Training programs for the first responders of the rescue situation were also organized and included representatives from the local communities.

The scientific inputs so far have resulted in positive outcomes with improved husbandry and captive care resulting in release of healthy individuals fit for survive in natural habitat. The project envisages proactive participation and collaboration between different line agencies including the civil administration, local communities and scientific organizations for ensuring scientific, humane and ethical handling and management of fresh water turtles in distress.

Keywords: Intervention, quarantine, enrichment, husbandry

Project Title	: Biodiversity Conservation & Ganga Rejuvenation
Principal Investigator(s)	: Dr Parag Nigam, Dr Pradeep K Malik, Dr Suresh Kumar, Dr. S.A. Hussain
Researcher(s)	: Dr. Animesh Talukdar (Veterinary Officer), Akshay Bajaj (Project Fellow), Dr Gowri Mallapur (Subject matter Specialist)
Funding Agency	: National Mission for Clean Ganga
Project Duration	: 2016-2019

Ecotoxicological risk assessment of pesticides in abiotic and biotic environmental matrices across river Ganga - Preliminary Status and Trends

-Ruchika Sah

One of the key contributors of organic contamination in river Ganga is the excessive discharge of banned and regulated pesticides, which poses high risk to the physiology, reproduction and survival of aquatic communities due to their persistent, bio-accumulative and toxic nature. Thus, quantification of these contaminants in abiotic and biotic matrices is essential to assess the extent of the problem.

Thus, this study was conducted to elucidate the spatial trends and degree of contamination of persistent Organochlorine pesticides (OCP) and neurotoxic Organophosphates pesticides (OPP) in the sediment, water and tissue samples.

The samples were collected across 32 sites covering entire Ganga river between Oct-Dec, 2017. Standard USEPA methods and CPCB guidelines were followed for collection and analysis. Results were obtained through Gas Chromatograph equipped with Electron capture/Nitrogen-Phosphorous Detector.

Results revealed Σ OCPs contamination upto 16.228 $\mu\text{g/L}$ in water where Heptachlor epoxide was the most frequently detected pesticide, exceeding the acceptable levels (Aquatic Life Criteria as per international environmental agencies) at about 30% sites. In the sediment, Σ OCP was found as high as 703.413 $\mu\text{g/kg}$ and Heptachlor, Heptachlor epoxide, Hexachlorocyclohexane (HCH) isomers, endrin and its metabolite were the most frequently detected OCPs. Heptachlor and its metabolite exceeded the permissible levels at about 95% sites. Among the biotic component, elevated concentrations of Σ OCP residues were recorded in tissues of 4 fish species ranging as high as 356.621 $\mu\text{g/kg}$.

The Σ OPP concentration showed upto 0.397 $\mu\text{g/L}$ in water, 30.053 $\mu\text{g/kg}$ in sediment and 31.214 $\mu\text{g/kg}$ in fish samples. Methyl parathion was the most frequently detected OPP among all the three matrices.

It is observed that high pesticide contamination and site-specific variation prevail at different sampling sites. Highest concentration of pesticides was recorded at Hashimpur, West Bengal (Water) and Mirzapur, Uttar Pradesh (Sediment) suggesting that these stretches are highly influenced by flow conditions, agriculture stretches and industrial settlements. Further, pesticide residues in fish tissues indicate difference in accumulation pattern in all the fish species based on their habitat preferences and foraging behaviour.

Keywords: Ganga, OCPs, OPPs, Water, Sediment, Fish

Project Title : Biodiversity Conservation and Ganga rejuvenation

Principal Investigator(s) : Dr. Anju Baroth and Dr. S.A Hussain

Researcher(s) : Ms. Ruchika Sah (Project Associate), Chetan PS Ahada (Project Fellow), Ms. Sunanda Bhola (Intern)

Funding Agency : National Mission For Clean Ganga

Project Duration : 2016-2019

Assessment of genetic status, diversity and gene flow of selected aquatic fauna of Ganga River

-Dr. Ajit Kumar and Dr. Prabhaker Yadav

The Ganges is the largest River in India and has a rich diversity of aquatic fauna. Degradation of the habitat, overfishing, sand mining, construction of dams, pollution, and low water level seems to be the major threats to the aquatic fauna. Therefore, our aim was to assess the level of genetic variability and gene flow of the endangered and selective aquatic species of River Ganga.

This study was carried out in Bhagirathi and Ganga River covering stretch of 2525 kms. We sequenced 242 biological samples from upper, middle and lower stretch of River Ganga, covering 101 samples of golden mahseer (*Tor putitora*) and 141 turtle samples from 11 species. We examined the genetic status and gene flow among golden mahseer using complete Cytochrome (Cyt b) and 11 turtles spp. using Cyt b and nuclear (Cmos) gene.

Analysis of golden mahseer revealed 16 and 9 haplotypes from Bhagirathi and Ganga River populations, respectively. The overall high haplotype diversity (0.832), low genetic distance (F_{ST} : 0.001) with sharing of four haplotypes was observed between the populations.

The pairwise genetic distance based on Cyt b and Cmos between Geoemydidae and Trionychidae turtles were 0.284 ± 0.014 and 0.128 ± 0.016 , respectively. The haplotype diversity of *B. dhongoka*, *B. Kachuga*, *G. hamiltonii* and *P. tecta* ranges from 0.692 to 0.77, whereas it was 0.33 in *L. punctata*.

Genetic analysis identified high levels of genetic diversity and gene flow between the *Tor putitora* populations. On the other hand, high levels of genetic diversity was observed in few species of turtles. The genetic distance within the hard and soft shell turtles was much higher. More samples and microsatellite markers would be needed for gaining more insights into genetic diversity and gene flow of aquatic species.

Keywords: mtDNA, diversity, gene flow, golden mahseer, turtles.

Project Title	: Biodiversity Conservation and Ganga Rejuvenation-Genetic Component
Principal Investigator(s)	: Dr. S. K. Gupta and Dr. S.A Hussain
Researcher(s)	: Dr. Ajit Kumar, Project Associate; Dr. Prabhaker Yadav, Project Fellow
Funding Agency	: Ministry of Water Resource, River Development and Ganga Rejuvenation
Project Duration	: Three Years (2016-19)

Community based conservation programmes for species restoration in Ganga River

-Pariva Dobriyal

The key challenge in Ganga conservation is to negotiate the reasonable and equitable utilization of its resources among various stakeholders with different demands. Present programme is being conducted to assess the role of different stakeholders and to ensure their participation in Ganga River conservation and rejuvenation and evaluate benefits accrued by them for planning efficient allocation of the resources, in Uttarakhand, Uttar Pradesh, Bihar, Jharkhand and West Bengal. 865 orientation and sensitization activities including meetings, workshops, and cleanliness and awareness rallies were conducted. Local level institutions like self-help groups (SHGs) and Ganga Prahari were established. Market, raw material availability and interest of local people were assessed and livelihood training modules were designed. Primary and secondary data on village demography, resource use, local institutions and developmental activities were collected and village development microplanning guidelines were developed. Literature review, field survey and stakeholder perception were conducted to identify the key ecosystem services of Ganga. Questionnaire survey (n= 324) was conducted to understand the perception of various stakeholders towards benefits from Ganga. Memorandum of agreement (n= 155) were signed with Village Panchayats and Nagar Palikas and they are regularly conducting awareness and Ganga cleanliness activities. Three SHGs and a cadre of 664 Ganga Praharis were established and with support from project personnel. Six livelihood training centres were established and 160 local people have been trained. One mobile livelihood centre “Jalaj” has been established to create market for products developed at livelihood training centres. Linkages have been established with governmental and non-governmental departments to promote sustainable livelihoods and include biodiversity in their activities. Digital microplanning guidelines were developed to strengthen implementation, monitoring of development and conservation activities, broaden future possibilities of policy interventions, regional planning and decision making processes pertaining to biodiversity conservation and sustainable development. Ecosystem services (ES) assessment framework was developed and five ES were selected for extensive study on the basis of value assigned by stakeholders in three stretches of Ganga River. Model areas will be created for sustainable development and biodiversity conservation by involving multiple stakeholders.

Keywords: Community participation; local level institutions; livelihood interventions; microplanning guidelines; ecosystem services

Project Title : Biodiversity Conservation and Ganga Rejuvenation

Principal Investigator(s) : Dr. Ruchi Badola; Dr. Syed Ainul Hussain

Researcher(s) : Hemlata Khanduri, Ecodevelopment Officer; Deepika Dogra, Vipul Maurya, Project Associate; Aditi Dev, Amanat K. Gill, Ekta Sharma, Project Fellow; Sunita Rawat, Shashi Joshi, Community Officer; Rahil Khan, Manisha Mallick, Project Assistant

Funding Agency : National Mission for Clean Ganga

Project Duration : 2016-2019

Capacity building for biodiversity conservation of various stakeholders of Ganga River

-Dr. Sangeeta Angom

Success of efforts to restore the biodiversity of the Ganga would depend on the involvement of people who are aware and trained in field methodologies for undertaking habitat assessment, ecological monitoring, controlling environmental pollution, community participation, and imparting conservation education. The aim was to build the capacity of major stakeholders, so they can effectively contribute to the restoration and conservation of the biodiversity of Ganga.

The approach to capacity building was: (i) Identification of target groups (ii) Identification of capacity development needs (iii) Formulation of training programme (iv) Implementation (v) Evaluation. For training need assessment, 16 training workshops with different target groups were conducted to finalize the design of training programmes. Training programmes were designed and implemented for capacity building of identified stakeholders in five Ganga states viz. Uttarakhand, Uttar Pradesh, Bihar, Jharkhand and West Bengal respectively.

A total of eleven training workshops and forty-one sensitization programmes have been conducted in which 412 participants were trained and 4111 were sensitized. Comparison was done between pre and post training assessment to evaluate how much the training programme contributed to various stakeholder's engagement and skill development in restoration of biodiversity of Ganga.

We found differences in awareness levels, attitudes, opinions before and after the training, among various stakeholder groups. However, most of the participants indicated that cleaning of the Ganga and conservation of its biodiversity was to be a synergistic effort. Local people, youth, religious groups saw pollution as major threat to the river and ecosystem, and majority advocated for stringent laws and strict punishments for offenders. 'Training approach and curriculum' has been developed and different training manuals are in various stages of preparation. A website with a retrievable database has been developed.

Our efforts suggest that such programs result in change in attitudes of stakeholders and also provide them a pathway to engage meaningfully in the efforts to restore the Ganga river ecosystem. Though a large number of people went through this program we have just skimmed the surface and showed the usefulness of the effort which needs to be continued.

Keywords: Impact assessment, Skill development, target groups, training needs

Project Title	: Biodiversity Conservation and Ganga Rejuvenation
Principal Investigator(s)	: Dr. Ruchi Badola
Researcher(s)	: Dr. Sangeeta Angom (Project Scientist), Monika Sharma (Research Fellow), Monika Mehralu (Assistant Training Coordinator)
Funding Agency	: National Mission For Clean Ganga, Ministry of Water Resources, River Development and Ganga Rejuvenation, Government of India
Project Duration	: 2016 - 2019

Identifying effective education strategies for creating a connect between the resources and community living along the Ganga

-Ravi Sharma

One of the greatest challenges that Ganga faces is its changing image from a holy river, much respected and appreciated for its natural resources and cultural and aesthetic value to a highly polluted river. Education and outreach activities with community involvement can help to reconnect people to the river and better help them value the diverse natural resources, recreational and economic opportunities available from the river system. This will lead to garner greater support for protection of the biodiversity in the Ganga river basin.

The main objectives of “Nature Interpretation and Education for Conservation of Ganga river” are:

1. Outreach programs to disseminate the value of aquatic biodiversity and natural processes through the establishment of Interpretation Centre.
2. Educating and involving the local people by creating environmental awareness and education programs.

Conservation education can become effective only if it can help people forge connections with the surrounds they are living in. Awareness and knowledge is required for understanding the causes, linkages and consequences of environmental trends. Conservation education and outreach activities supporting the capacity development efforts in two sites namely Narora and Sarnath are described.

The scientific information gathered was compiled and translated into simple-easy to understand language. In order to make the information attractive, relevant line drawings and paintings are prepared. These are then transformed into posters, leaflets, fact sheets, teacher training manual, wall paintings, signage and exhibits for wider circulation and distribution. A floating exhibition on a houseboat (*Bajra*) has been planned. The fabrication work for this exhibition is in progress. A building at the Turtle Breeding Centre, Sarnath has been renovated to house the Interpretation Centre. As part of the Outreach Program, local communities are being involved through the sensitization workshops. Tin boxes were distributed to boatmen for installing them in over 50 boats in Varanasi to reduce the disposal of floral offerings and plastic material. Dustbins and signage for proper disposal of waste material have also been installed on the ghats in Narora.

Project Title	: Nature interpretation and education for biodiversity conservation of Ganga river
Principal Investigator(s)	: Dr Bitapi C. Sinha
Researcher(s)	: Ravi Sharma (Project Fellow), Anjali Pathak (Extension Officer), Taniya Trivedi (Project Assistant), Aisho Sharma (Project Intern), Dimpi Patel (Project Fellow), Digvijay Semwal (Extension Officer)
Funding Agency	: Ministry of Water Resources, River Development and Ganga Rejuvenation
Project Duration	: 2016-2019

Life less ordinary “Ganga Prahari - Guardians of the Ganga”

-Dr. Deepika Dogra

For sustainable community participation in the conservation of Ganga Aqualife, a total of 664 *Ganga Praharis* have been recruited in the five Ganga River states viz. Uttarakhand, Uttar Pradesh, Bihar, Jharkhand and West Bengal, through multiple site-level consultative meetings and workshops (n= 171), and one to one interactions.

The Ganga Praharis have been trained to conduct activities related to Ganga biodiversity conservation such as ecological survey, reporting of animals in distress, cleanliness drives, plantation, awareness and alternate livelihoods. Sensitized and trained in these fields' *Ganga Praharis* have conducted the above-mentioned activities (n= 193) not only along the Ghats but also in their respective villages and locality. *Ganga Praharis* are today are being engaged by various State Agencies like State Forest Departments for their on-site activities. In order to reduce their direct dependency on Ganga River they are being trained in various alternate livelihood programmes. Till date 237 Ganga Praharis have been trained in alternative sustainable livelihood training centers at Uttarakhand and Uttar Pradesh that includes recently trained volunteers under the Green skills enhancement programme of ENVIS, MoEFCC. Women involved in this programme have been formalized into Self help groups (SHGs) with bank linkages and further provided market through collaboration with Integrated Livelihood Support Project, National Rural Livelihood Mission, Rural Self Employment Training Programme etc.

The community participation through *Ganga Praharis* is not only promoting local pride and also generating a sense of belongingness towards the Ganga River ecosystem. This initiative will ensure sustainable efforts for biodiversity conservation of Ganga River through a bottom up approach.

Keywords: *Ganga Prahari*, volunteers programme, Ganga biodiversity conservation

Project Title : Biodiversity Conservation and Ganga Rejuvenation

Principal Investigator(s) : Dr. Ruchi Badola

Researcher(s) : Dr. Deepika Dogra, Project Associate

Funding Agency : National Mission for Clean Ganga

Project Duration : 2016-2019

Floral Assemblages and Vegetation Patterns along the River Ganga: A Rapid Assessment

-Dipti Dey and Megha Shruti

The floral communities along the riparian land of the river are excellent indicators of both upland and aquatic communities and helps to assess the health of the river in a particular area. Any changes in the dynamics of the riparian habitat can have a knock-on effect on aquatic and river dependent faunal diversity and also affect the river infrastructure, flood cycle, agriculture and human communities in the river basins.

The Ganga River was classified into six ecological zones and 32 intensive sampling sites with a 5 km sampling segment at every 70-75 km interval. The segment comprises of a combination of habitats viz. wetland, grassland, agricultural land, riverine forest, mangrove which were surveyed in the pre monsoon and post monsoon season to assess the status and distribution of riparian and aquatic flora using quadrat method.

A total of 289 plant species (56 % herbs, 10 % shrubs, 21 % trees, 6 % climbers and 7% Grasses, reeds and redges) representing 88 families and 219 genera have been recorded based on field survey. The nativity status of the recorded species indicates that 67% species were native to India. The dominant families were Asteraceae (30 species), Poaceae (16 species), Euphorbiaceae, Fabaceae, Polygonaceae (12 species each) and Solanaceae (11 species). The prominence values for individual species was calculated. The diversity was highest in Uttarakhand-Dharasu, Nayar and Haridwar, Uttar Pradesh-Bijnor and Ballia, Bihar-Kahalgau, Jharkhand-Sahibganj, West Bengal-Murshidabad and Jiaganj as compared to other sites.

Among zones, the diversity was in following order: Zone 1 (Gangotri - Haridwar) > Zone 5 (Varanasi - Farakka) > Zone 6 (Farakka - Ganga Sagar) > Zone 2 (Haridwar - Narora) > Zone 4 (Kanpur - Varanasi) > Zone 3 (Narora - Kanpur). The study will be further continued for calculating the riparian vegetation index (RVI) and estimating the health of riparian habitat along the river. Planning for restoring degraded habitats will be suggested based on the health of the riparian vegetation.

Keywords: Ganga River, riparian vegetation, flora, exotic species, diversity

Project Title	: Planning Aquatic Species Restoration for Ganga River (Component-2) NMCG
Principal Investigator(s)	: Dr. B.S. Adhikari, Dr. J.A. Johnson and Dr. S.A. Hussain
Researcher(s)	: Dipti Dey (Project Fellow) and Megha Shruti (Project Assistant)
Funding Agency	: National Mission for Clean Ganga
Project Duration	: 2016-2019

Diversity of Dragonflies and Damselflies in river Ganga

-Kritish De

One of the most fruitful means of evaluating the aquatic ecosystem health is the use of bioindicators, and aquatic insects, especially odonates (dragonflies and damselflies) are among the best aquatic bioindicators. The present study was designed to understand diversity and distribution pattern of odonates and their relationship with water quality parameters in river Ganga.

For the study, the entire stretch of river Ganga was partitioned into 6 zones, based on geomorphological and ecological distinctness. Within these zones, a total of 32 sampling sites, each characterized by a 5 km long stretch was selected for the study.

In each 5 km stretch, 6 sampling points having a distance of 1 km in only one bank of the main channel was selected for point count. The observer stood at an observation point for 10 min and recorded all the odonates that passed within ~ 5 m of the sampling point.

A total of 37 species of odonates under 26 genera and 6 families were found, of which 24 species were dragonflies (Anisoptera) and 13 species were damselflies (Zygoptera). Maximum numbers of species were observed from the dragonfly family Libellulidae (21 species under 15 genera) followed by damselfly family Coenagrionidae (10 species under 5 genera). The river stretch between Haridwar to Narora (which also includes Upper Ganga River Ramsar site) was found to be foremost in terms of species richness (27 species). The species richness and Shannon diversity index had significant ($p < 0.05$) linear relationship with pH, total dissolved solids (TDS), specific conductivity and salinity. Indicator species analysis (IndVal) showed 9 species of odonates as bioindicator for 7 water quality parameters [pH, dissolved oxygen, TDS, specific conductivity, nitrate, ammonium and salinity].

The study suggests a rich diversity of odonates and their usefulness as bioindicators of water quality parameters, which in turn provide baseline conditions for planning aquatic species restoration in river Ganga.

Keywords: Odonata, Species richness, Bioindicator, Water quality

Project Title : Component 2: Planning Aquatic Species Restoration for Ganga River

Principal Investigator(s) : Pls: Dr. V.P. Uniyal and Dr. J.A. Johnson Co-ordinators: Dr. J.A. Johnson and Dr. S.A. Hussain

Researcher(s) : Kritish De (Project Fellow), Dr. Rohitshva Shukla (Project Associate), Sk. Zeeshan Ali (Project Associate)

Funding Agency : Ministry of Water Resources, River Development and Ganga Rejuvenation

Project Duration : 2016-2019

Fish assemblage structure along the middle reaches of the Ganga River

-Rahul Rana

The Ganga harbours rich freshwater fish biodiversity in spite of being the most populated river basin of the world. Loss of connectivity due to barriers, dams, illegal fishing and pollution are the major threats to the fish diversity in the Ganges. Understanding the status and distribution patterns of fishes for monitoring the impacts of these threats is required; therefore, this study was conducted to examine the diversity among the assemblages in the middle reaches of the Ganga River.

The study was conducted along the middle reaches of the River Ganga (from Bijnor to Sahibganj).

We selected 20 sites (5 km long stretch at an interval of every 75 km) and applied an average of 4.5 hrs of sampling effort using gill nets of different mesh sizes for the fish collection.

Data analysis revealed 1941 individuals of 103 species belonging to 70 genera and 27 families. Species richness (SR) and Shannon diversity (SD) were highest for site Bijnor (SR=86, SD=4.24) followed by site Narora (SR=29, SD=4.16) and Tigrighat (SR=68, SD=4.05). Diversity values were the highest for zone 2 (Bijnor to Narora, SR= 89, SD=4.15±0.09). Relative abundance showed the dominance of small sized indigenous species such as *Salmostoma bacaila* (5.26%) being the most dominant followed by *Cabdio morar* (4.84%), and *Macrogathus pancalus* (4.74%). Miscellaneous species viz. *Cirrhinus reba*, *Puntius sophore*, *Pethia conchonius*, *Mystus cavasius*, *Xenentodon cancila*, *Channa punctatus*, *Mastacembalus armatus* and *Macrogathus aral* were the most widely distributed species. A total of seven exotic species were recorded. Results of NMDS showed the significant zone-wise clustering patterns ($R^2=0.52$, $P<0.05$) among the assemblages. Fish communities of zone 2 (Bijnor to Narora) showed a clear compositional differences with other zones (3, 4 and 5).

The present findings provide the baseline information for the current diversity status along the middle stretch of the Ganga River and offer a template for future efforts to guide researchers, government agencies and different stakeholders involved in management and conservation of fishes.

Keywords: Fish, Ganga River, Fish assemblage, Species richness, Diversity

Project Title	: Planning Aquatic Species Restoration for Ganga River (Component-2) NMCG
Principal Investigator(s)	: PI(s)- Dr. J. A. Johnson, and Dr. K. Sivakumar (Project Coordinator- Dr. J. A. Johnson and Dr. S.A. Hussain)
Researcher(s)	: Rahul Rana / Wildlife Biologist , Arvind Kumar Dwivedi / Research Associate, Rohitashva Shukla/ Research Associate.
Funding Agency	: National Mission for Clean Ganga
Project Duration	: 2016-2019

An overview of anuran and squamate reptile diversity along Ganga and Alaknanda Rivers, India

-Bitupan Boruah

Though herpetofauna form key components of vertebrate biomass in aquatic ecosystems, they remain relatively little known. Diversity and distribution information of herpetofaunal species along Ganga River is scanty which hinder conservation priority. To fill up this gap in knowledge, we conducted survey at 30 sites along Ganga and Alaknanda River during May 2017 and September 2018.

We employed Nocturnal Visual encounter survey (NVES) to document species richness along with opportunistic observations in our study. Study area was divided into three zones- Alaknanda, Middle Ganga and Lower Ganga. Species encountered in NVES were considered for statistical analysis.

Thirty seven species of herpetofauna belonging to 29 genera and 17 families were recorded. Dicroglossidae was the most dominant family with 16.23% species. Species accumulation curves in most of the study sites reached asymptote. Encounter rates of amphibian and reptiles varied between 27.83-3.24 individuals. *Euphlyctis cyanophlyctis* was the most abundant with the encounter rate of 9.79 individuals/hour. Coefficient of biogeographic resemblance among the three zones varies between 0.35-0.44. Significant records of species from the families Homalopsidae, Microhylidae, Colubridae and Natricidae are discussed.

Considering the paucity of knowledge on diversity and distribution of the herpetofauna in the region, the present study assumes significance and has a huge scope for future studies on integrative taxonomy, ecology and reproductive biology of the herpetofauna across the region.

Keywords: Herpetofauna, natural history, survey, northern India.

Project Title : Planning Aquatic Species Restoration for Ganga River (Component-2) NMCG
Principal Investigator(s) : PI- Dr. Abhijit Das, Co-PI- Dr. J.A. Johnson
Researcher(s) : Bitupan Boruah/Project Fellow
Funding Agency : National Mission for Clean Ganga
Project Duration : 2016-2019

Ecological Appraisal of Potential Release Sites for Chelonians along Ganga River: An Elemental Conservation Need

-Akshay Bajaj

Rescue centers receive animals by way of confiscation, as accidental bycatches and animals that require intensive management. Restoring the animal's health and subsequent rehabilitation in native habitat is the primary concern for success of any such program. To cater to rescue needs of Chelonians inhabiting the Ganga River, the Ganga Aqualife Rescue and Release Centre (GARRC), Narora and the Kachua Punarvas Kendra (KPK), Sarnath have been operationalized under the WII-NMCG Ganga rejuvenation and Biodiversity conservation project in collaboration with the Uttar Pradesh Forest Department and Nuclear Power Corporation of India Limited. An elemental component of a recovery program is the identification of species-appropriate rehabilitation sites. The present ecological appraisal was aimed at identifying potential rehabilitation sites for chelonians along the Ganga River.

Surveys were carried out in the proximity of the currently operational rescue centres and included 25 sites up and downstream of the main Ganga River to cover range of habitats to accommodate varied species. Field surveys near Sarnath (14 sites) were carried out at six locations on the main river, two locations on the two tributaries and six ponds, whereas surveys near Narora were conducted at 11 sites with five locations on the main river, four along lakes, two along ponds and one along canal.

Direct sightings, indirect evidence for animal presence/absence (visual survey), presence of sandbanks and associated aquatic vegetation, width of the channel and anthropogenic pressures (fishing, riparian agricultural practices and boat traffic) formed the basis for site appraisal. Secondary information about the species noted from the area and also ecological information from Ganga Praharis in nearby vicinities of these sites was taken into account.

The appraisal revealed that 19 of the 25 potential sites had attributes to support fresh water turtle species as these sites offered sandbanks for basking and nesting; aquatic vegetation for natural refugia; variety of fish species to support nutritive needs and had minimal anthropogenic activities. The findings suggest the suitability of 11 sites in proximity of the KPK of which six are part of the main river course, while five are ponds. At Narora, eight potential sites were identified and three sites along the main course of river, three along lakes, one along a pond and one on a canal.

The identified sites offer potential release sites for recovered turtles that can accommodate ecological needs of the turtle species that are being received at Sarnath and Narora.

Keywords: Rescue, rehabilitation, anthropogenic, turtle

Project Title	: Biodiversity Conservation and Ganga Rejuvenation (Component IV)
Principal Investigator(s)	: Dr Parag Nigam, Dr Pradeep K Malik, Dr Suresh Kumar, Dr. S.A. Hussain
Researcher(s)	: Mr. Akshay Bajaj (Project Fellow), Dr. Animesh Talukdar (Veterinary Officer), Dr Gowri Mallapur (Subject matter Specialist)
Funding Agency	: National Mission for Clean Ganga
Project Duration	: 2016-2019

Insights into freshwater turtle diversity of the river Ganga and perceived threats

-Anuja Mital

The Ganga River supports 15 species of freshwater turtles including nine that are threatened. Despite being a 'Global Turtle Hotspot', this region lacks baseline information on the status and distribution of turtles.

The study aimed to document the distribution, local diversity pattern of turtles and assess threats at 29 representative sites from Haridwar in Uttarakhand to Ganga Sagar in West Bengal, each spanning 5 km. Visual Encounter Surveys (VES), Gill Net (GN) sampling and interviews with local fisherman were carried out during post-monsoon (October – November 2017) and summer (May-June 2018) seasons.

The rapid survey resulted in recording a total of 11 species (n= 161) of turtles across the Ganga and *Pangshura smithii* was recorded the most abundant. The Endangered *Batagur dhongoka* and *Chitra indica* were encountered at three sites indicating select regions to be important turtle conservation priority areas. Shannon diversity indices were highest in sites Brijghat to Narora in the middle stretch of river Ganga. 80% of respondents who were expert fishermen with considerable ecological knowledge of turtles identified a minimum of five species from photographs. Accidental capture in nets was identified as the biggest threat, followed by intentional hook line captures for consumption, and then turtle nest predation primarily by feral dogs.

Additionally a site-specific estimation of turtle populations was carried out at Narora, Uttar Pradesh through a mark-recapture study during post-winter and summer season of 2018, within a 25 km stretch on either side of the Narora Barrage. At the Narora site, 11 species (n=549) were encountered from 198 trap efforts. Two distinct sub-species of *Pangshura smithii* (n=331) were captured, *P. s. pallidipes* and *P. s. smithii*. The population of *P. smithii pallidipes* was significantly female biased ($\chi^2 = 10.77$, $P = 0.002$).

More systematic efforts are required to learn about turtle assemblage patterns at local scales, their habitat affinities and responses to anthropogenic activities along the river Ganga.

Project Title : Planning Aquatic Species Restoration for Ganga River (Component-2) NMCG

Principal Investigator(s) : PI- Dr. R. Suresh Kumar, Co-PI's- Dr. J.A. Johnson, Dr. S.A. Hussain

Researcher(s) : Anuja Mital (Project Fellow)

Funding Agency : National Mission for Clean Ganga

Project Duration : 2016-2019

Rapid assessment of abundance and distribution of crocodiles and freshwater turtles in Ganga River

-Saurav Gawan

Crocodiles and freshwater turtles are key aquatic reptiles of the Ganga River and were identified as priority species by National Mission for Clean Ganga. The study aims to assess the relative abundance and distribution of these species in the mainstream of the Ganga River.

The assessment was carried out at 54 districts of 5 Ganga River States covering approximately 2200 km from Devprayag in Uttarakhand to Nulpur in West Bengal. A linear boat-based survey was conducted along the river during the month of May to June 2018, using an inflatable rubber boat driven by 40 HP Outboard Engine, travelling downstream at a constant speed of 8-10 km/hr and covering about 25–30 km per day. Visual encounter method was adopted to gather information on distribution and relative abundance of crocodiles and turtles, habitat characteristics and threats to the species and their habitat.

Gharials were sighted near Rajaji National Park and at Ramsar site near downstream of the Bhimgoda Barrage. Individuals of mugger were sighted near Bijnor and at Malda, upstream of the Farakka Barrage. Nine species of freshwater turtles were sighted and major congregations were encountered near Hastinapur Wildlife Sanctuary, between Makdumpur and Narora, and between Farrukhabad and Kanpur. Poaching, accidental killing in fishing gears, conflict and habitat destruction by sand mining, river-bed agriculture were identified as major threats to these species.

It is evident from the results that creation of protected areas positively support species conservation.

Keywords: Crocodiles, conservation, poaching, priority species, sand mining, turtles

Project Title : Biodiversity Conservation and Ganga Rejuvenation
Principal Investigator(s) : S.A. Hussain and Ruchi Badola
Researcher(s) : Saurav Gawan, Aftab A Usmani, Goura Chandra Das, Aishwarya Ramachandran, Niladri Dasgupta
Funding Agency : National Mission for Clean Ganga
Project Duration : 2016-2019

Diversity of Waterbirds along the Mainstem of Ganga River

-Anita Devi

Ganga basin has several seasonally flooded wetlands, permanent lakes and marshes, which serve as waterbird habitats. Waterbirds are effective bioindicators of the healthy ecosystem. The information on occurrence and diversity of waterbirds along the Ganga River would thus be crucial for determining the health of the River. With this background, a study was undertaken to assess the diversity, distribution, and threats to the migratory and resident island breeding waterbirds of the Ganga River.

The study was conducted in the Mainstem of Ganga River covering five Ganga River States viz. Uttarakhand, Uttar Pradesh, Bihar, Jharkhand and West Bengal.

Literature review and Rapid Biodiversity Assessment (RBA) were undertaken to assess the diversity and occurrence of avifauna along the mainstem of the Ganga River. Boat survey was carried out in 2200 km stretch of the River from Rishikesh, Uttarakhand to Nulpur, West Bengal during pre-monsoon 2017 and 2018. Point count method was used for survey of migratory waterbirds in six reservoirs during winter months.

Literature review revealed that mainstem of the Ganga River supports 140 birds including 129 waterbirds and wetland obligate species belonging to 27 families. While, during the RBA 114 waterbirds and wetland obligate species, belonging to 26 families were recorded. 92 waterbirds and wetland obligate species belonging to 22 families were recorded from six reservoirs. Generally, the members of the Family Anatidae dominated. Of 114 species recorded during RBA, 24 species belonged to the Rare, Endangered and Threatened (RET) categories of IUCN Red List. The surveys revealed that the sandy islands and sand banks of the Ganga River were used for roosting by the migratory waterbirds and for breeding by resident waterbirds.

The mosaic of habitat resulting from geomorphological processes of the Ganga River might be responsible for waterbird diversity. Reduction in water flow of the Ganga River, water pollution, extensive agriculture in sandy islands and poaching of waterbirds affect waterbird occurrence as well as abundance. Maintaining the habitat heterogeneity and reduction in human pressure would be the key to conservation and restoration approaches.

Keywords: Waterbirds, Migratory, Ganga River, Habitat heterogeneity

Project Title	: NMCG-WII Biodiversity Conservation and Ganga Rejuvenation
Principal Investigator(s)	: Dr. S.A.Hussain & Dr. Ruchi Badola
Researcher(s)	: Goura Chandra Das, Aftab Usmani, Zeeshan Ali (Project Associate); Saurav Gawan, P. Gangaiamaran, Ajay Rawat (Project Fellow); Umar Saeed, Mujahid, Megha Shruti, Rahim Shaikh (Project Assistant)
Funding Agency	: National Mission for Clean Ganga (NMCG), Ministry of Water Resources, River Development and Ganga Rejuvenation, Government of India
Project Duration	: 2016-2019

Breeding Status and Distribution of Indian Skimmer *Rynchops albicollis* in the Ganga River, Uttar Pradesh, India

-Ajay Prakash Rawat, P. Gangaianaran and Arkojyoti Sarkar

The Rapid rate of change in Indian riverscapes poses a major challenge to our efforts to understand and predict the consequences of such changes on aquatic biodiversity. The vulnerability of species, especially of riverine birds to such changes is likely to be mediated by multiple factors. The current distribution of the Indian Skimmer *Rynchops albicollis*, a vulnerable riverine species, is only a small fraction of its historical range and continues to decline due to the multiple threats across its range. Lack of empirical information on ecology of this species impedes the conservation and management of the species and their habitat. To evaluate the likely potential of River Ganga to support the Indian skimmer breeding population we: 1) developed a field survey protocol 2) documented the key breeding sites and 3) investigated threats to the Indian skimmers.

The Uttar Pradesh stretch of the River Ganga, downstream of Bijnor to Ballia was selected for the study.

1380 km river stretch of Uttar Pradesh between April and May 2018 was surveyed on a motorboat. All the encountered river islands and riverbanks were surveyed on foot to identify nesting sites of the Indian Skimmer.

428 individuals of Indian Skimmer in eight nesting islands having 104 nests with a mean clutch size of 2.46 ± 1.26 (range = 1-6) were recorded during the survey. Most number of individuals observed on an island was 120 individuals. The most number of Indian Skimmers nests was recorded on an island was 26 nest with a mean clutch size of 3.26 ± 1.19 (range = 1-4) followed by 20 nest and 18 nest with a mean clutch size of 2.4 ± 1.14 (range 1-6) and 2.33 ± 1.34 (range = 1-4) respectively.

In summary we found multiple breeding sites for the Indian Skimmers in our study area. However, we also recorded potential disturbances in the habitat. Our survey indicates that there might be new breeding sites for this bird in other stretches of the Ganga River but more further surveys are required to ascertain their status.

Keywords: Riverscape, Aquatic biodiversity, Riverine species

Project Title	: Planning Aquatic Species Restoration for Ganga River (Component-2) NMCG
Principal Investigator(s)	: Principle Investigator: Dr. Gopi GV. and Dr. S.A. Hussain Component Co-ordinator: Dr. J. A. Johnson
Researcher(s)	: Ajay Prakash Rawat (Wildlife Biologist), P. Gangaianaran (Project fellow), Arkojyoti Sarkar (Project Assistant). Rahim Shaikh (Project Assistant). Kumar Ankit (Project Intern). Aishwarya Ramchandran (Project Fellow)
Funding Agency	: Ministry of Water Resources, River Development and Ganga Rejuvenation
Project Duration	: 2016-2019

The past and present distribution of aquatic and semi-aquatic mammals of the Ganga River basin

-Sayantika Banerjee & Goura Chandra Das

Baseline data on the historical and present distribution provides crucial information on factors affecting distribution of species and helps in identification of approaches for ecological restoration. Thus it is necessary to consolidate available literature on historical as well as present distribution of aquatic and semi-aquatic mammals, in the Ganga River. This information was strengthened by conducting survey along mainstem of the River, to assess the current distribution and occurrence.

Based on review of literature, an inventory of aquatic and semi-aquatic mammals found in the River was made. Information obtained from literature review and rapid biodiversity assessment was used to know the historical and present distributions of these aquatic mammals.

Literature suggests that five species of aquatic and semi-aquatic mammals occur in the Ganga River viz., Gangetic river dolphin (*Platanista gangetica*), Irrawady dolphin (*Orcaella brevirostris*), Smooth-coated Otter (*Lutrogale perspicillata*), Asian small-clawed otter (*Aonyx cinereus*) and Eurasian otter (*Lutra lutra*).

The Gangetic river dolphin is one of the four exclusive freshwater dolphins present in the world. Once distributed from Haridwar downstream, in the mainstem Ganga River and its tributaries, its range has now reduced to the deeper parts of the river downstream of Bijnor barrage. Historically, Eurasian otter and Asian small clawed otter were found in the Himalayan stretch of the Ganga River, whereas Smooth coated otter occurred throughout the Ganga River. During the rapid biodiversity assessment Smooth coated otter were observed near Devprayag, Rajaji National Park in Uttarakhand and Vikramshila Gangetic Dolphin Sanctuary in Bihar.

It is evident from the literature that construction of dams and barrages, unsustainable water abstraction, reclamation of wetland habitats for human settlements, agriculture and reduction in prey base, have led to decline in populations of these species. Partial information on the occurrence and distribution of these species, especially otters, limits ecological restoration process. Thus there is need for intensive studies to assess the current distribution of otter species in the Ganga River basin.

Keywords: Ecological restoration, Gangetic River Dolphin, Otters, Rapid biodiversity assessment

Project Title	: Biodiversity Conservation and Ganga Rejuvenation
Principal Investigator(s)	: Dr. S.A.Hussain & Dr. Ruchi Badola
Researcher(s)	: Aftab Usmani, Zeeshan Ali (Project Associate); Saurav Gawan, P. Gangaiamaran, Ajay Rawat (Project Fellow); Umar Saeed, Mujahid, Megha Shruti, Rahim Shaikh (Project Assistant)
Funding Agency	: National Mission for Clean Ganga
Project Duration	: 2016-2019

GACMC – A centre to spearhead science based conservation planning and information dissemination

-Shivani Barthwal

Scientific information on the biodiversity of the Ganga River is scattered and hence not readily available for the policy planners. To overcome this lacuna the Ganga Aqualife Conservation Monitoring Center (GACMC) has been established to promote, design and implement science-based restoration of aquatic wildlife in the Ganga River by propagating knowledge and involving relevant stakeholders in species restoration planning. The project is being implemented in the five Ganga River States viz. Uttarakhand, Uttar Pradesh, Bihar, Jharkhand and West Bengal. Systematic conservation processes has been initiated through extensive review of literature, rapid biodiversity assessment, information dissemination, stakeholder consultations and policy review. Rapid biodiversity assessments were undertaken along the river from Devprayag to Nurgpur to determine occurrence and distribution of species of conservation concern. GACMC is disseminating scientific information through a range of tools including multimedia and social networking. Information on the significance of the Ganga River, its biodiversity and the issues related to biodiversity loss have been published and distributed in various platforms. Publications in the form of books, booklets, brochures and scientific reports are being published regularly under the 'Vibrant Ganga' series. The publication 'Macro fauna of Ganga River – status of species of conservation concern' incorporates the findings of the extensive literature review and rapid biodiversity assessment. It reveals that the river, although rife with issues, is thriving with life. Stakeholder analysis reveals that building alliances and networks, strengthening informal institutions and transparency in the formal networks is key to achieving coherence. Policy review suggests the need for sectoral coherence, since some of the policies have exploitative effects on rivers and are thus contradictory to river conservation. The progress of the works of GACMC is regularly monitored through audit, scrutinizing visits from NMCG officials and the Monitoring Committee.

Keywords: Aquatic diversity, Vibrant Ganga, Restoration, Stakeholders, Policy

Project Title	: Biodiversity Conservation and Ganga Rejuvenation
Principal Investigator(s)	: Dr. Syed Ainul Hussain, Dr. Ruchi Badola
Researcher(s)	: Dr. Niladri Dasgupta (Project Scientist); Michelle Irengbam, Anita Devi, Aishwarya R. Chandran, Sayantika Banerjee, Saurav Gawan (Project Fellows), Ravindra Nath Tripathi (Database Operator), Shatakshi Sharma, Dipak Anand (Project Assistant)
Funding Agency	: National Mission for Clean Ganga
Project Duration	: 2016-2019

GIS in conservation planning of the Ganga River : 'River-map of Ganga-life'

-Aishwarya R. Chandran

Rejuvenating the Ganga River from the biodiversity perspective requires a multi pronged approach which includes generation of information on its biodiversity and the impedance to restoration of the ecosystem as a whole. These data when incorporated into the GIS domain serves as an excellent visualisation tool that enhances decision support. In the first phase of the project, the aim was to generate spatial information related to Ganga River, its biodiversity and the human influences in the flood plain. The current work show cases field information collected along the entire length of the Ganga River from 2017. A lot of other information such as land use land cover, habitat information, demographic, administrative details, and climatic phenomena were generated or procured and incorporated with the field data. Finally, the spatial database was prepared containing data relating to the presence of aquatic species, river parameters like depth, water quality, drains, river habitat information and observation of anthropogenic pressures. The data was analysed to demarcate high threat zones and stretches of conservation priority. Distribution maps for select priority species integrating secondary information from relevant websites and historic literature were prepared. Species specific maps were prepared for a status report on the macro fauna of Ganga. High biodiversity stretches were identified and delineated. The spatial analysis can be further used to prioritise stretches of very high conservation value. GIS technology is also useful in planning for field works, identifying lacunae and tracking the coverage of training and sensitisation activities. Thus GIS not only helps in effective visualisation of a variety of related parameters to support strategic planning and judicious decisions but it also enables continuous monitoring and there by bringing about transparency, easier data sharing, better communication and even people's participation which are crucial for the success of such research based, action driven projects.

Keywords: Spatial database, modelling, remote sensing, spatial ecology

Project Title	: Biodiversity Conservation and Ganga Rejuvenation
Principal Investigator(s)	: Dr. Gautam Talukdar, Dr. S.A.Hussain
Researcher(s)	: Aishwarya R. Chandran
Funding Agency	: National Mission for Clean Ganga, Ministry of Water Resources, River Development and Ganga Rejuvenation
Project Duration	: 2016 - 2019

Digital repository for conservation planning and sensitization

-Ravindra Nath Tripathi

Managing large scale diverse sources of data and incorporating them in a single platform is a major challenge in the field of Biodiversity informatics and it requires a robust digital repository. Large amounts of data is being generated in the project Biodiversity Conservation and Ganga Rejuvenation and it is the need of the hour to facilitate access, search, visualize and interpret this data in a secure environment.

A relational database in SQL Server has been created which includes ecological information about the priority species of the Ganga River. Information from ecological assessments related to their distribution, human-induced threats and habitat characteristics which include data on physio-chemical characteristics of water, state of persistent pollutants. The database also incorporates human dimensions and associated information about Ganga Prahari, village level data from socio economic surveys and information related to capacity building programs for various stakeholders. The database comprises of multiple tier architectural designing, conceptual schema and process management for capture, storage and retrieval of data. To access those data on web, an online spatial visualization prototype is under development using a combination of open-source geospatial packages and Microsoft .NET platform. For online data capture and retrieval, Android based mobile prototype app for field surveys is under testing. Data interoperability in mobile app and website will be achieved through integrated Restful Web services of distributed computing environment.

The digital database infrastructure facilitates defining implementing and ensuring security and privacy of the data in the database. Information provided by this digital repository will contribute in strengthening the decision-making processes, strategic planning, and policy formulation towards conservation of the Ganga River. Live dashboards are planned in near future to display and get a near real-time summary of the data from the project, which will help to achieve goals of NMCG.

Keywords: Relational Database, Ganga river, Geospatial package, dashboard, conservation

Project Title	: Biodiversity Conservation and Ganga Rejuvenation
Principal Investigator(s)	: Dr. Gautam Talukdar, Dr. S. A. Hussain
Researcher(s)	: Dr. Niladri Dasgupta, Dr. Shivani Barthwal, Michelle Irengbam, Anita Devi, Aishwarya R.Chandran, Ravindra Nath Tripathi, Sayantika Banerjee, Shatakshi Sharma
Funding Agency	: National Mission for Clean Ganga (NMCG), Ministry of Water Resources, River Development and Ganga Rejuvenation, Government of India
Project Duration	: 2016-2019

Multimedia Platform: Information dissemination amongst stakeholders

-Shatakshi Sharma

The project 'Biodiversity Conservation and Ganga Rejuvenation' aims at science based aquatic species restoration plan for Ganga River by involving multiple stakeholders. To elicit participation and promote synergistic alliances with the stakeholders, Ganga Aqua life Conservation Monitoring Centre (GACMC), a knowledge partner of National Mission for Clean Ganga (NMCG) established under this project, aims to disseminate the information regarding the Ganga river and its biodiversity to stakeholders through printed and electronic medium.

The information on concerned species for conservation of the Ganga River are generated through literature review and rapid biodiversity assessments. The information was refined according to various target groups from all the five Ganga River states, viz. Uttarakhand, Uttar Pradesh, Bihar, Jharkhand and West Bengal, even targeting global audience through internet.

GACMC is using multidimensional tools & media for creating awareness among stakeholders. An informative webpage about the project and its activities are established under the domain of WII website (<http://wii.gov.in>). Social media pages were created to highlight project activities and have generated a large number of followers. Awareness materials such as species information brochures, Wings of Ganga, Glimpses of Ganga are published under 'Vibrant Ganga' Series. Scientific reports such as 'Macrofauna of the Ganga River: Status and Conservation of select species' and 'Ganga at a Glance' are published and distributed to the policy makers and scientific community. Species information exhibit panels are displayed at various key locations. Information standees, posters, banners are displayed at training and sensitization workshops and exhibitions organized on the occasion of World Environment Day, International Biodiversity Day, World Crocodile Day. "Ganga ki Baat", a series of talk shows on Ganga River's aquatic diversity is being broadcasted on All India Radio (FM 100.5 MHz), Dehradun, with the aim of reaching to the masses.

These printed and electronic resource material are widely appreciated and playing an important role in creating awareness among the masses. GACMC will continue to disseminate information about the importance of the Ganga River and its biodiversity through scientific study and outreach.

Keywords: Stakeholders, Conservation, Multimedia

Project Title	: Biodiversity Conservation and Ganga Rejuvenation
Principal Investigator(s)	: Dr.S.A.Hussain & Dr.Gautam Talukdar
Researcher(s)	: Dr. Niladri Dasgupta (Project Scientist); Michelle Irengbam, Anita Devi, Aishwarya R. Chandran, Sayantika Banerjee, Saurav Gawan (Project Fellows), Ravindra Nath Tripathi (Database Operator), Dipak Anand (Project Assistant)
Funding Agency	: National Mission for Clean Ganga
Project Duration	: 2016-2019

Livelihood and Biodiversity: Two sides of the same coin

-Hemlata Khanduri

Balancing livelihood aspirations of local people and conservation goals is important yet challenging. The aim of this study is to develop need based alternative livelihood opportunities for local communities to ensure their participation in biodiversity conservation of Ganga River.

Regular meetings, focus group discussions and consultation with community, members of Gram Panchayat, District and Block administration were organised in villages located along the Ganga River in Uttarakhand and Uttar Pradesh, to assess the dependence on Ganga River and need for alternate livelihoods.

Six livelihood centres have been established along the Ganga River at village Matli in Uttarakhand, villages Rajghat, Udaygarhi, Dhaka, Tatepur and Rampur in Uttar Pradesh, to develop alternate livelihood skills of the local communities. Presently, around 237 participants have been trained in different skills namely sewing and stitching, biodiversity based tourism, prasad and incense stick making, health and wellness, handicrafts and nursery development. These training centres not only provide skill enhancement training but are also the focal point to discuss on biodiversity of Ganga River, its threats, conservation and importance of a clean Ganga ecosystem.

The trainees regularly conduct cleanliness and plantation drives and awareness programmes. They have also been actively reporting distressed aquatic fauna in their area for their rescue and rehabilitation.

In areas with heavy dependency on natural resources and few livelihood opportunities due to lack of human capital and economic development, livelihood intervention via capacity building can prove to be an effective tool to garner community support in conservation activities.

Keywords: Alternate livelihood, Ganga River, community, skill enhancement.

Project Title	: NMCG -WII Biodiversity Conservation and Ganga Rejuvenation
Principal Investigator(s)	: Dr. Ruchi Badola
Researcher(s)	: Dr. Pariva Dobriyal (Project Scientist), Hemlata Khanduri (Ecodevelopment Officer), Sunita Rawat (Community Officer), Shashi Joshi (Community Officer)
Funding Agency	: National Mission for Clean Ganga
Project Duration	: 2016-2019

Role of Panchayati Raj system in Ganga Conservation

-Vipul Maurya

Panchayati Raj is the system of local self-government constitutional amended in the year 1992 by which gram panchayats are the local basic units for village development. These bodies are responsible for maintenance assets like ponds, lakes, roads, cleaning, and plantations. Wasteland can be put to use by these bodies. To ensure grass root level support from these bodies for the species conservation and restoration along the bank of river Ganga must be needed.

These 155 villages are located along the Ganga River in Uttarakhand, Uttar Pradesh, Bihar and Jharkhand.

Memorandum of agreement (MoAs) have been signed with 155 village Panchayats to ensure their active participation and continuous support in activities related to biodiversity conservation and Ganga rejuvenation. MoAs have been signed in Uttarakhand (n=34), Uttar Pradesh (n=113), Bihar (n=4) and Jharkhand (n=4). Pradhans and other members of Panchayat from these villages facilitate the project activities in there and act as entry point for the project team. These panchayats are regularly conducting activities such as awareness, plantation and cleanliness drives and contributing to the conservation of Ganga River.

Gram Panchayat is the local government and its involvement in conservation efforts has ensured sustainable efforts towards Ganga aqualife conservation. Gram Panchayat has provided continuity to this initiative, through their continuous support. The impact of this involvement has been in the form of rising contribution of locals towards rescue, rehabilitation, networking and information sharing.

Project Title	: Biodiversity conservation and Ganga Rejuvenation
Principal Investigator(s)	: Dr.S.A. Hussain Dr. Ruchi Badola
Researcher(s)	: Vipul Maurya (Project Associate), Rahil Khan (Project Assistant) , Rajeev Chauhan (Conservation Officer).
Funding Agency	: National Mission for Clean Ganga
Project Duration	: 2016-2019

Achieving coherence in diversity: Stakeholders for Ganga aqualife conservation

-Michelle Irengbam

The multiplicity and diversity of stakeholders within the Ganga river system and the conflicting use of its resources makes it one of the most dynamic and challenging river systems for conservation planning. Thus, the aim of this study was to identify and categorize these stakeholders and outline strategies to strengthen stakeholder networks. This was done to optimize the trade-offs between network structures and balance resource use and conservation.

The stakeholders were identified through a brainstorming process. Central and state government department websites were accessed to identify focal points for each stakeholder group. A range of tools such as questionnaires and multi-stakeholder dialogue were used to assess stakeholders' roles, interests and power. Through this, levels and patterns of interactions of stakeholders with the river were recognised. A network perspective was used to study the effects of socio-political systems on the riverscape.

Stakeholders were categorized into five groups, based on the type and level of power they hold and their interest in biodiversity conservation, viz., Key players, Context setters, Subjects, Crowd and Fence sitters. Key players are the change makers, those who are actively involved in planning or execution and include MoWR, NMCG, CPCB, etc. Context setters have high levels of power but low interest and include MoP, MoS, etc. Subjects are the victims, with high levels of interest but low power and include the local communities. Crowd are bystanders, and includes MoRTH, MoYA&S etc. Fence sitters are neutral, with high power but no commitment; hence, their interests are flexible and include the media, tourists, NPCIL etc. These stakeholders through their individual and cumulative actions either positively or negatively affected the river system and its biodiversity. On the other hand, the interactions between the various stakeholders through - exchange of information and/or resources, collaborations and disagreements contribute to shaping the riverscape dynamics. Identifying the type of interaction helped pinpoint conflicting areas where consensus needs to be brought.

Mobilizing capacities by building alliances, strengthening informal institutions by building chains of accountability and bringing clarity and transparency in formal networks through dialogue and advocacy is key to achieving coherence.

Keywords: Conflict, power dynamics, institutions.

Project Title	: Biodiversity Conservation and Ganga Rejuvenation
Principal Investigator(s)	: Dr. S.A. Hussain & Dr. Ruchi Badola
Researcher(s)	: Dr. Niladri Dasgupta (Project Scientist), Dr. Shivani Barthwal (Project Associate), Michelle Irengbam, Anita Devi, Aishwarya R.Chandran, Ravindra Nath Tripathi, Sayantika Banerjee (Project Fellows), Shatakshi Sharma (Project Assistant)
Funding Agency	: National Mission for Clean Ganga (NMCG), Ministry of Water Resources, River Development and Ganga Rejuvenation, Government of India
Project Duration	: 2016 - 2019

Digital Microplans for Linking Conservation and Development at the Grassroots Level

-Aditi Dev

Microplans represent Participatory Planning Model that facilitates the integration of conservation and development. Digitalizing microplans for biodiversity conservation of the Ganga River and sustainable development of the village is an effort to provide a platform for enhanced, innovative and sustainable initiatives involving multiple stakeholders. The aim of this study is to create digital repository of microplans for villages located along the Ganga River.

The study is being carried out in selected villages of the five Ganga states viz. Uttarakhand, Uttar Pradesh, Bihar, Jharkhand and West Bengal.

Extensive literature review was carried out for developing microplan guidelines and digital microplan format. Questionnaire based formal interactions, stakeholder meetings and participatory rural appraisal were conducted to collect information on social-ecological conditions. A national level workshop was conducted with representatives from 15 institutions and guidelines were reviewed. Suggestions and comments were incorporated to finalize the guidelines.

Nine strategic themes have been identified for the digital microplan. Six themes i.e. awareness, livelihood and skill development, hygiene and sanitation, community based institutions, renewable energy and biodiversity conservation, are common to all villages, while, three themes i.e. agriculture, animal husbandry and fisheries, are site specific based on socio-economic profile and resource dependency of the village. All strategic themes have 18 parameters, with their representative indicators, that specify the interrelationship between common and site specific plans. Information generated will form a relational database (SQL Server) depicting nested inter-linkage, data tables and schema to develop strategies for biodiversity conservation and sustainable development of Ganga River.

Digitalization of village microplan will contribute in cross sectoral coordination towards implementation and monitoring of various programmes and schemes provided by government, non-government organizations at ground level. It will broaden the future possibilities of policy interventions, regional planning and decision making processes pertaining to biodiversity conservation and sustainable development through participation from local communities.

Keywords: Microplanning guidelines, sustainable development, community participation, Ganga River, relational database, web based platform.

Project Title	: Biodiversity Conservation and Ganga Rejuvenation
Principal Investigator(s)	: Dr.Ruchi Badola and Dr. S.A. Hussain
Researcher(s)	: Dr.Pariva Dobriyal (Project Scientist), Dr.Deepika Dogra & Vipul Maurya (Project Associates), Ms Hemlata Khanduri (Ecodevelopment Officer), Sunita Rawat & Shashi Joshi (Community Officers), Amanat K. Gill, Ekta Sharma & Ravindra Nath Tripathi (Project Fellows)
Funding Agency	: National Mission for Clean Ganga, Ministry of Water Resources, River Development and Ganga Rejuvenation
Project Duration	: 2016-2019

Evaluating the ecosystem services of Ganga River: A framework

-Amanat Kaur Gill

Ganga River provides a host of ecosystem services to myriad stakeholders, whose wellbeing is contingent upon her ecological health. The current resource use/river management scenario is not only inequitable and unjust, but it has resulted in a deteriorating ecosystem with declining benefits. The present study aims to identify the ecosystem services provided by the Ganga River, and develop a framework for evaluating these services.

On the basis of previous studies, the mainstem of Ganga was divided into three stretches, upper (Gaumukh to Haridwar), middle (Haridwar to Varanasi) and lower Ganga (Varanasi to Ganga Sagar), to reflect the variations in geology, geomorphology, soil type, climate, flora and fauna, and social and economic issues. The ecosystem services have been examined stretch-wise.

Ecosystem services, including their extent, and the framework for their evaluation was designed based on an extensive literature review, field surveys and stakeholder perception. Stakeholders were identified through secondary literature and the snowball technique. Stakeholder perception regarding the extent of benefits received from Ganga was ascertained via a semi-structured questionnaire survey. A total of 324 stakeholders from 19 stakeholder groups were interviewed.

22 key ecosystem services were identified for the entire stretch; 11 provisioning, seven regulating and maintenance, and four cultural services. The criteria for selecting ecosystem services for further valuation includes stakeholder perception regarding contribution to human wellbeing, extent and economic importance, and the resource requirements of conducting an evaluation. Five ecosystem services: water for power generation, riverbed material, waste management, recreational and religious/spiritual services will be evaluated for the entire stretch. Water for drinking and domestic use and benefits to agriculture from middle Ganga, and water for transportation and provision of fish from lower Ganga will be evaluated. A methodology has been developed for each of these ecosystem services based on the resources required to execute the methods in terms of financial capital, time and human capital, and accuracy of results.

This evaluation will provide information to assist in policy planning and implementation of strategies for sustainable and equitable resource allocation.

Keywords: Valuation; Stakeholder perception; Sustainability; Equity

Project Title	: Biodiversity Conservation and Ganga Rejuvenation
Principal Investigator(s)	: Dr. Ruchi Badola, Dr. Syed Ainul Hussain
Researcher(s)	: Pariva Dobriyal (Project Scientist); Hemlata Khanduri (Ecodevelopment Officer); Deepika Dogra, Vipul Maurya (Project Associates); Amanat Kaur Gill, Aditi Dev, Ekta Sharma (Project Fellows)
Funding Agency	: National Mission for Clean Ganga
Project Duration	: 2016-2019

Pathway for community mobilization in Biodiversity Conservation and Ganga Rejuvenation: Case Studies from Bihar, Jharkhand and West Bengal

-Ekta Sharma & Manisha Mallick

Ganga- the lifeline to millions of Indians is degrading rapidly, marked by deteriorating quality of water and depleting aquatic biodiversity. This calls for an inclusionary approach involving the communities living along its banks towards its revival. Our study aims to examine the potential of local communities in river conservation and outlines a pathway to foster their participation.

The study was carried out in Bhagalpur (Bihar), Sahibganj (Jharkhand) and Nadia (West Bengal).

We conducted training and capacity building sessions (n=5), awareness workshops (n=9), focused group discussions (n=12), interviews (n=36), cultural activities (n=4) and painting competitions (n=2) to sensitize various stakeholder groups of villages in which 1156 participants marked their presence.

Post sensitization, the angler community in Bhagalpur was convinced about the alarming need to stop polluting the river, as a result of which, they installed water-bins to prevent religious litter from making its way into the Ganga. Rescue and rehabilitation efforts (n=5) were reported from Bhagalpur and Sahibganj. The residents of Nadia district provided active cooperation to our ecological survey and monitoring team. Engagement with villagers resulted in a trickle-down effect within their respective communities, where motivated individuals became Ganga Praharis to mobilize people further and oppose actions, which threatened the river. River conservation activities such as plantation drives (n=18), cleanliness drives (n=26), sensitization programs (n=23), and awareness campaigns (n=2) were also conducted by them.

Our study suggests that community mobilization can be an effective tool to achieve large-scale coordination for the conservation of the Ganga River in a relatively brief time provided sensitization, capacity building and livelihood options are adequately facilitated.

Keywords: Local communities, mobilization, Ganga conservation

Project Title : Biodiversity Conservation and Ganga Rejuvenation

Principal Investigator(s) : Dr. Ruchi Badola

Researcher(s) : Ekta Sharma (Project Fellow) & Manisha Mallick (Project Assistant)

Funding Agency : National Mission for Clean Ganga

Project Duration : 2016-2019

"Women's contribution in Ganga Rejuvenation"

-Ms. Sunita Rawat and Ms. Shashi Joshi

The aim of our study is to evaluate the level of women's participation and contribution towards biodiversity conservation and Ganga river rejuvenation.

The study is based upon the project activities carried out in 18 villages of Varanasi and 16 villages of Bulandshahr during the year 2017-2018.

To mobilize the women in the study area various sensitization and orientation activities including awareness sessions (n=54), training workshops (n=55), sensitization workshops (n=85) and consultative meetings (n=104) and plantation drive (n=41) were conducted. Need assessment and market survey was conducted to assess their socio-economic profile to develop site-based livelihood strategies.

More than 3000 women were approached, out of this 892 women participated in various project activities at Varanasi (n= 580) and Bulandshahr (n= 312). After consecutive input sessions, a significant headway in their attitudes towards the importance of river conservation was observed in the successive meetings. Thereafter, 112 women in Varanasi and 60 women in Bulandshahr, volunteered to become Ganga Praharis. In six livelihood centres 125 women Ganga Praharis are being trained for alternative livelihood such as stitching, designing and green skills. 220 women from Varanasi and 277 women from Bulandshahr volunteered for river-conservation actions such as awareness meetings (n= 10), cleanliness drives (n=28), rescue and rehabilitation (n=02), and river-side plantation drives (n=21).

The perspectives of women are often overlooked due to gender-power relationships and they aren't counted as agents of change. But, women residing along the Ganga engage in various river-dependent activities to earn livelihoods and simultaneously engage in daily activities and religious rituals which affect the Ganga River. This makes them important stakeholders in river conservation. Women also tend to exhort their family members to take up conservation activities. Participation of women in Ganga revival activities in Varanasi and Bulandshahr presents a pathway to enhance the cumulative output of community based river conservation activities in the long run.

Keywords: Gender; stakeholders; Ganga conservation; livelihood

Project Title	: Biodiversity Conservation and Ganga Rejuvenation
Principal Investigator(s)	: Dr. Ruchi Badola
Researcher(s)	: Ms. Sunita Rawat, Community Officer and Ms. Shashi Joshi, Community Officer
Funding Agency	: National Mission for Clean Ganga
Project Duration	: 2016-2019

Spearhead team: A sustainable approach to capacity building in different aspects of biodiversity conservation

-Monika Sharma

Biodiversity conservation approach will require development of human capacities for different stakeholders. Constitution of Spearhead teams from Ganga states is one of the important task under the project. The goal of establishment of Spearhead teams is to create in-house capacity in the State forest departments for biodiversity monitoring as well as conservation and management of the riverine species along the Ganga. The objectives are to (i) train the Spearhead teams for each of the Ganga states in the areas of aquatic biodiversity monitoring for practical and action-oriented implementation of science-based research (ii) create a pool of trainers within the state, who will be the future trainers for other staff, for successful biodiversity monitoring and restoration of the river and carry forward the activities after the completion of the project.

The spearhead teams have been constituted from Ganga states i.e. Uttar Pradesh, Bihar, Jharkhand and West Bengal and imparted training in different aspects of biodiversity conservation. For the constitution of spearhead team, a process of consultations, communications and meetings were carried out with the forest departments of five Ganga states.

The spearhead teams consisting of forest officials have been established in four Ganga states. A spearhead team comprises of 7-13 members which has one leader, in the post of Chief Conservator of Forest or Divisional Forest Officer, 2-3 Range Officers, 2-3 Deputy Range Officers, 2-3 Foresters, 3-4 Forest Guards respectively. A total of 36 forest officials of Ganga states has been imparted training during first "National Training Workshop for spearhead teams" on different aspects of Biodiversity conservation in 2017. These trained spearhead teams have mobilized various stakeholders (viz. frontline staff, representatives of NGOs, local people, youth, religious groups) and carried forward the training and sensitization programmes independently at West Bengal (N= 5) and Jharkhand (N= 6).

The constitution of spearhead teams has generated a pool of trained cadre of forest-officials. The three levels of spearhead team viz. policy, implementation and execution levels are expected to carry forward the activities of aquatic biodiversity monitoring and conservation of Ganga River.

Keywords: Capacity building, Spearhead team, Stakeholders, Mobilization

Project Title	: NMCG-WII Biodiversity Conservation and Ganga Rejuvenation
Principal Investigator(s)	: Dr. Ruchi Badola
Researcher(s)	: Dr. Sangeeta Angom (Project Scientist), Monika Sharma (Project Fellow) & Monika Mehralu (Junior Training Coordinator)
Funding Agency	: National Mission for Clean Ganga (NMCG), Ministry of Water Resources, River Development and Ganga Rejuvenation, Government of India
Project Duration	: 2016 - 2019

Mobilizing youth for Biodiversity conservation and Ganga Rejuvenation

-Ms. Monika Mehralu

Biodiversity conservation approach will require mobilization of youth for sustainable conservation of biodiversity of the Ganga River. We attempted to mobilize and sensitized a pool of youth to make them aware of the river and its biodiversity and motivate them to conserve and rejuvenate Ganga River.

The work was conducted along Ganga river in five states viz. Uttarakhand, Uttar Pradesh, Bihar, Jharkhand and West Bengal respectively.

Mobilization activities have been designed and implemented in four modules: Wetland and River management, Ecological survey, Participatory management and Conservation awareness.

A pool of 642 young people has been trained on various methodology of baseline survey of indicator species, eco-development activities and conservation education over a period of two years. The trained youth has been deployed at field stations to assist the project team and were used for piloting the training programmes at the five Ganga states from May 2017 onwards. The trained cadre in different aspects of biodiversity conservation assists at various activities such as sensitization programmes, plantation drives and conservative awareness. A total 3264 school children were sensitized in key biodiversity species found in Ganga and different level of pollution in Ganga River. These youth are also sensitized and updated with the latest information on Ganga aqualife through celebrations of national and international days of importance with special reference to aquatic fauna. A total of 22 workshops have been conducted in 20 schools and 12 colleges.

The trained individuals are now capable of assisting various survey teams, interested individuals are being attached to the research and training institutes (especially those working in conservation of Ganga River) of their choice as per their qualification.

Keywords: Conservation awareness, Ganga states, stakeholders, sustainable conservation

Project Title	: Biodiversity Conservation and Ganga Rejuvenation
Principal Investigator(s)	: Dr. Ruchi Badola
Researcher(s)	: Dr. Sangeeta Angom (Project Scientist), Monika Sharma (Research Fellow), Monika Mehralu (Assistant Training Coordinator)
Funding Agency	: National Mission For Clean Ganga, Ministry of Water Resources, River Development and Ganga Rejuvenation, Government of India
Project Duration	: 2016 - 2019

Ganga Aqualife Rescue and Rehabilitation Centre Narora: Story of a unique partnership

-Aftab Alam Usmani

The project aims to assist NMCG in establishing the rescue and rehabilitation centres for endangered fauna of the Ganga River at select sites by developing human resources and infrastructure with support from the Forest and Veterinary departments. The Ganga Aqualife Rescue and Rehabilitation Centre (28° 12' 10.28" N and 78° 22' 49.24" E) is located in the township of Narora Atomic Power Station (NAPS), Narora in Bulandshahar, Uttar Pradesh. The Centre is being managed and run under the supervision of expert veterinarians and serves as an apex centre in the Upper Ganga River for rescue, rehabilitation and husbandry of aquatic higher vertebrate fauna under stress. A total of 158 individuals of turtles belonging to nine species and one Mugger (*Crocodylus palustris*) were rescued so far, and released upstream of Narora barrage. A rapid response team is in place to address emerging situations. The centre is currently holding 18 turtle individuals belonging to five species in its two husbandry ponds. Most of the individuals are kept for veterinary care and as type specimen for education, awareness. Capacity building programmes were organised for Rescue staffs at NAPS, veterinarians and frontline forest staffs. Networks of trained local volunteers were created to carry out rescue operations and are enrolled as "Ganga Prahari" under the project. The Centre is also serving as a awareness centre for local communities and school children and addressing issues related with the Ganga River and its biodiversity. The Centre is often visited by Minister, WRRD&GR, NMCG Officials and NAPS representatives and the husbandry practices are reviewed periodically.

Keywords: Aquatic fauna, Confiscation, Veterinary, Husbandry, Training

Project Title : Biodiversity Conservation and Ganga Rejuvenation
Principal Investigator(s) : Dr. S. A. Hussain, Dr. P. K. Malik, Dr. Parag Nigam
Researcher(s) : Aftab Alam Usmani (Project Associate), Aditi Dev (Project Fellow)
Funding Agency : National Mission for Clean Ganga
Project Duration : 2016 - 2019

The Ganges River Dolphin (*Platanista gangetica*): Evaluating their occurrence in Uttar Pradesh

-Rahim Shaikh

The first step in planning a conservation strategy for an endangered species is to gain an understanding of where it occurs and the type of habitat it occupies. The Ganges River Dolphin is among highly endangered freshwater mammals and commonly known as “Soons” in Uttar Pradesh. The species inhabits freshwater river systems of Ganges, Bramhaputra, Karnaphuli-Sanghu, Meghna and prefers deep water channels.

We conducted intensive surveys to assess their occurrence, habitat features and the degradative anthropogenic factors. An intensive survey was conducted in winter (November 2017) and pre-monsoon (May 2018) seasons for dolphin monitoring in Uttar Pradesh. A total of 15 sampling sites were surveyed (Stretch of 5 km each) which lies between Bijnor to Ballia. Boat-based visual encounter method for dolphin survey and YSI Professional Kit were used for water quality testing. Each sampling site was surveyed from 7:00 hrs to 11:00 hrs. The mechanized inflatable boat travelled downstream at a constant speed of 6-8 km/hr irrespective of weather condition. Survey team consisted of four members: two forward-facing observers; one rear-facing observer and one data recorder. Habitat data were recorded for each 5 km stretch with disturbance factors simultaneously and dolphin with their GPS locations.

Out of 15 sampling sites, dolphins were recorded in S6 (Tigri), S7 (Narora), S8 (Kachla), S18 (Gangabarar) and S19 (Ballia). The individuals were classified into adult, sub-adult, and calf on the basis of their body sizes. Total 15 dolphin individuals were encountered in 7 different groups. Major disturbances were observed to be fishing 31.82%, boating 31.82% followed by riverbed agriculture 22.73%, sand mining 9.09% and religious activities 4.55%.

This study provides data on the occurrence of dolphins, associated habitat characteristics and anthropogenic disturbances along the sampling sites. We can suggest awareness amongst local people and fishermen for sustainable use of Ganga River. The presence of dolphins in this sites calls for conservation need of such sites. We need more sampling efforts in future to make some conclusive remarks for dolphin occurrences and their association with habitat quality.

Keywords: Ganga River, Ganges River Dolphin, Aquatic species

Project Title	: Biodiversity Conservation and Ganga Rejuvenation, Component-2(Planning Aquatic Species Restoration for Ganga River)
Principal Investigator(s)	: Dr. S.A. Hussain, Dr. J.A. Johnson
Researcher(s)	: Rahim Shaikh (Project Assistant), Goura Chandra Das (Project Associate), Aftab Usmani (Project Associate), Saurav Gawan (Project Fellow), P. Gangaiamaran (Project Fellow).
Funding Agency	: National Mission for Clean Ganga
Project Duration	: 2016-2019