2nd BIODIVERSITY AND GANGA CONSERVATION SEMINAR

Wildlife Institute of India
Suggested citation for abstracts:

# Programme

## 2nd BIODIVERSITY AND GANGLA CONSERVATION SEMINAR

**Thursday, 22nd August 2019**

### INAUGURAL SESSION

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### TECHNICAL SESSION – I

#### GANGLA RIVER ECOLOGY AND MANAGEMENT

**Chair**: Shri Sanjay Shrivastava, APCCF, Uttar Pradesh  
**Co-chair(s)**:  
- Dr. S. Kulandaivel, Joint Director, Sundarbans Biosphere Reserve  
- Dr. S.A. Hussain, Scientist G, WII

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<td><em>SK. Zeeshan Ali</em></td>
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<td><em>Ajit Kumar</em></td>
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<td><em>Ruchika Sah</em></td>
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AQUATIC SPECIES CONSERVATION

Chair : Shri Kalyan Das, CCF, West Bengal
Co-chair(s) : Dr. Manisha Thapliyal, Scientist E, Forest Research Institute
              Dr. J.A. Johnson, Scientist E, WII

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<td>1220 – 1235 h</td>
<td>Distribution ecology of fishes and odonates in the Ganga River</td>
<td>Dr. Rohitashva Shukla Project Associate</td>
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COMMUNITY PARTICIPATION, NATURE INTERPRETATION AND AWARENESS

Chair : Shri A.K. Nema, Executive Director, NPCIL
Co-chair(s) : Shri Neeraj Kumar, CF, Uttar Pradesh
              Dr. Ruchi Badola, Scientist G, WII

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Ecological health assessment of the Ganga river

-Dr. Shivani Barthwal

Assessing river health with ecological objectives offers a scientific basis for prioritizing stretches and coordinating focused conservation efforts. This study aimed to develop a river ecological health assessment framework and applying it to evaluate health of Middle and Lower Ganga River.

The study included Ganga River from Haridwar to Nurpur covering a distance of 2070 km in five Ganga River states.

A multi-perspective approach was adopted to develop River Ecological Health Assessment Framework for the Ganga River. Three broad criteria viz. Habitat condition, Biotic integrity and Anthropogenic influence, which included 31 indicators were assessed through field observations and secondary information, in 192 and 222 basic evaluation units (BEUs, 5 km X 2 km) in the Middle and Lower Ganga, respectively. Ecological health scores were derived as mean score of representative BEUs.

The Middle Ganga showed “Good health” (score 51.7 ± 2.7). Fair habitat condition score (16.7 ± 0.2) resulting from fair habitat diversity score (9.7 ± 0.1), along with lower anthropogenic influence score (10.8 ± 0.2) enabled higher biotic integrity score (29.2 ± 1.1). It was significantly contributed by higher species richness (2.5 ± 0.1), dolphin abundance (2.4 ± 0.3), turtle abundance (3.7 ± 0.3), breeding bird nest (0.6 ± 0.2) and waterbird abundance scores (9.1 ± 0.3). The Lower Ganga showed “Fair health” (score 31.2 ± 1.5). Good habitat condition score (21.3 ± 0.2) was due to high habitat diversity (12.3 ± 0.2) and riparian cover scores (1.1 ± 0.04). Although, the higher anthropogenic influence (12.8 ±0.2) due to high built-up area (1.9 ± 0.1), fishing (1.5 ± 0.1) and mining scores (0.9 ± 0.1) lowered the biotic integrity score (17.9 ± 0.8), with low species richness (1.1 ± 0.1), dolphin abundance (1.2 ± 0.3), turtle abundance (0.02 ± 0.01), breeding bird nest (0.03 ± 0.02) and waterbird abundance scores (1.3 ± 0.1).

The health scores provided fine-scale insights on ecological status of the river stretches which could be prioritized either for protection, conservation or for restoration. The framework can be used as a tool to aid policy design and basin-level water resource management.

**Keywords:** Conservation, prioritization, indicator

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**Project Title:** NMCG-WII Biodiversity and Ganga Conservation  
**Principal Investigator(s):** Dr. S.A. Hussain & Dr. Ruchi Badola  
**Researcher(s):** Dr. Shivani Barthwal and Ganga Team  
**Funding Agency:** National Mission for Clean Ganga  
**Project Duration:** 15/07/2016 to 31/12/2019
Simulation of river discharge scenario in regulated river system: A case study from the Ganga river

-Sk Zeeshan Ali

Aim: Water is the key requirement for sustainability of river and its biological diversity. River provides fertile alluvium in its course to nurture biogeochemistry and to sustain ecosystem services. The objective is to develop a geospatial model for estimation of seasonal discharge and its relation with formation of river geomorphological features to conserve its biodiversity.

Location: The study was carried out along middle and lower stretch of the Ganga river from Bhimgoda Barrage, Haridwar Uttarakhand to Rupnarayan river confluence, Noorpur West Bengal.

Methods: Water discharge was calculated at 42 stations along the river to identify base flow in dry and wet seasons as well as the seasonal change in discharge. Simulation of water discharge was done using time series interpolation method. Multi semivariogram interpolation was used between each sampling units considering factors i.e. tributary confluence, barrages and irrigation canals. Cluster analysis was done among river segments using covariates i.e water discharge, sand bars and braided channels to identify potential habitats for biodiversity conservation.

Result: Two model i.e. “Circular” and “Exponential” were resulted best fit ($\kappa=0.85$ and $\kappa=0.82$) respectively to interpolate discharge including upstream and downstream of tributary confluence and barrage. Result was validated with 10 percent of randomly selected data along the river and tributary. Longitudinal depth is Seasonal discharge is significantly correlated with formation of river morphological structures i.e. sand bars and braided channels in middle stretch ($r=0.78$) and lower stretch ($r=0.74$) of river. Correlated stretch clusters with moderate water flow and higher frequency of sand bars and braided channels were present in middle Ganga due to water regulation by large dams.

Conclusion: The variation in river water discharge resulted in formation of braided channels, sand bars at downstream of barrages, major human settlements and agricultural areas mainly along middle stretch of river. This scenario has decreased with water release of water by dams which lead the river system for sustaining ecological diversity. The simulation method will be useful for decision support system and scenario analysis for river habitat management plan along the river in future.

Keywords: Alluvial, biogeochemistry, ecosystem, semivariogram, habitat

Project Title: Biodiversity and Ganga Conservation (Component 1: Ganga Aqualife Conservation Monitoring Centre)
Principal Investigator(s): Dr. S. A. Hussain and Dr. Ruchi Badola
Researcher(s): Sk Zeeshan Ali (Spatial Analyst)
Funding Agency: National Mission for Clean Ganga
Project Duration: 2016-2019
Evaluation of the effect of longitudinal connectivity in population genetic structure and gene flow among selected aquatic species of Ganga River

-Dr. Ajit Kumar and Dr. Prabhaker Yadav

Aim: In many aquatic species, alteration of habitats and human-induced barrier shape the population genetic structure in rivers with longitudinal connectivity. Some species were observed with shift in their distribution ranges and many freshwater species are listed in CITES and Wildlife (Protection) Act 1972. Unregulated and arbitrary fishing would lead overexploitation of natural fish stocks subsequently stock depletion. Therefore, in this study, we investigated the genetic diversity, population genetic structure, gene flow and demography of the golden mahseer (Tor putitora) and giant river catfish (Sperata seenghala) in Ganga river.

Study Site: To assess the genetic study, the samples of T. putitora were collected from Bhagirathi, Alaknanda, Ganga and Yamuna River, and for S. seenghala samples were collected at 10 different locations from middle and lower stretch of river Ganga.

Methods: To understand the genetic makeup of T. putitora, we examined a total of 201 samples based complete mtDNA cytochrome b gene sequencing and microsatellite genotyping. To detect intra-specific variations among S. seenghala, a total of 103 samples were investigated based on mtDNA control region gene.

Results: Tor putitora: The results showed overall high mtDNA diversity coupled with low nucleotide diversity in all T. putitora populations. We also found moderate levels of allelic diversity (ranging from 0.542 to 0.615), with three genetic clusters. The FST values and migration rate result suggested that there were close genetic relationships between the Bhagirathi and Ganga populations; these were significantly differentiated with Alaknanda and Yamuna populations. A star-like haplotype distribution, unimodal graph, and results of the neutrality test indicated the sign of recent population growth.

Sperata seenghala: The results revealed high haplotype diversity (0.89±0.045) with high gene flow among the Ganga populations. Analysis of haplotype distribution and geneflow showed no significant genetic differentiation among Ganga populations. The patterns of haplotype networks and neutrality test suggested a historical influence on the genetic structure of S. seenghala populations.

Preliminary findings: The genetic results indicated that both T. putitora and S. seenghala indicates the sign of recent population growth. However, the golden mahseer experienced far bottleneck, followed by recent population expansion. The results of genetic diversity and geneflow pattern is crucial to propose an effective conservation plan for the management of both species.

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Project Title: Biodiversity Conservation and Ganga Rejuvenation – Planning Aquatic Species Conservation for Ganga River
Principal Investigator(s): Dr. S. K. Gupta and Dr. S.A. Hussain
Researcher(s): Dr. Ajit Kumar (Project Associate) and Dr. Prabhaker Yadav (Research Associate)
Funding Agency: Ministry of Jal Shakti
Project Duration: Three Years
An ecotoxicological perspective towards biodiversity conservation in Ganga River: A study on habitat contamination and potential risks

-Ruchika Sah

River Ganga is one of the largest river in India with huge cultural, socio-economic, and environmental value. The Ganga not only provides water for irrigation, drinking, industrial use and energy generation, but is also a home to rich and diverse fauna. However, high population density together with increasing agricultural and industrial activity has resulted in discharge of tons of toxic municipal sewage, agricultural run-off as well as industrial waste into the Ganga River thus making it a “sacred dumping ground” for toxic wastes. This incessant flow of toxic contaminants from point and non-point sources, and reduced flow have severely jeopardized the biodiversity fitness aquatic ecosystem of Ganga River.

Aquatic species are particularly at higher risk because exposure to these contaminants can be life-long and through multiple routes, thus bioaccumulation is frequent, that can ultimately affect the survival of aquatic species. Amongst these toxic contaminants, persistent pesticides and toxic metals are of prime concern due to their persistence and ability to induce harmful effects in the aquatic organisms thus endangering the health of aquatic flora-fauna.

In light of these facts, the present study aims to quantify the spatio-temporal distribution and possible contamination sources of persistent pesticides and toxic metals in entire Ganga River. In addition, the study also attempts to estimate the probabilistic risks of biodiversity loss posed by persistent pesticides and toxic metals to aquatic ecosystem.

Water and sediment samples were collected from 43 sampling locations across the entire river Ganga through two seasons viz post monsoon and post winter (2017-2018). Standard USEPA protocols were followed for collecting and preserving the samples and analysis was performed using GC-ECD (pesticides) and ICP-MS (heavy metals). Results will be interpreted against the estimated ecological risks and permissible aquatic life criteria to assess the impact on biodiversity and source of contamination will be reported for policy makers.

Keywords: Ganga, heavy metals, pesticides, source, ecological risks

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<td>Ruchika Sah (Project Associate), Apourv Pant (Project Fellow), Pooja Chaudhary (Project Intern)</td>
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<td>Funding Agency</td>
<td>NMCG</td>
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Understanding distribution patterns of the Gangetic river dolphin 
*Platanista gangetica* in Ganga river

-Goura Chandra Das

**Aim:** The aim of this study was to assess the distribution patterns and encounter rate of surfacing Gangetic River dolphin (*Platanista gangetica*) in the Ganga River.

**Location:** The study was conducted in the Ganga River between Bijnor barrage and Roop Narayan Confluence at Noorpur spanning over a length of 2100 Km.

**Methods:** Surveys were conducted using inflatable rubber boat (25 hp)/ country boat following thalweg (deeper part of the river) transects during pre monsoon (Apr-Jun 2018) and post monsoon (Oct-Nov 2018) seasons. Double observer method was adopted for estimating the dolphin encounter rate in the study area. The entire study stretch was stratified into 5 km segments and each segment was sampled for occurrence and habitat use pattern of dolphins. Occurrence of dolphins relative to hydro-geomorphic characteristics of the Ganga River such as water flow, channel depth and channel width, water quality, anthropogenic influences were measured. Group sizes of dolphin were recorded based on individual encounters using best, high and low estimates.

**Results:** The overall dolphin encounter rate was estimated to be 0.53 ± 0.04 individuals per km. The mean water depth of the study stretch was 5.86 ± 3.96 m and 6.31 ± 4.39 m during pre monsoon and post monsoon season respectively. Mean dolphin radial sighting distance was 109.37 ± 66.4 m and sightings often occurred at distances up to 500 m. The mean group size of dolphins was estimated to be 4.06 ± 4.96 and 3.18 ± 2.65 (paired t-test, p = 0.01) for pre monsoon and post monsoon season respectively. Channel Depth, fishing and religious activities are the most influential predictors affecting dolphin occurrence.

**Conclusion:** The findings of the study reinforce the idea that the long term viability of the National Aquatic Animal requires adequate water flow and water quality within their distribution range.

**Keywords:** Gangetic River dolphin, double observer, group size, encounter rate, distribution.

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

**Principal Investigator(s):** Dr. J.A. Johnson (Coordinator), Dr. S.A. Hussain (Co-Coordinator)

**Researcher(s):** Project Associate: Goura Chandra Das, Aftab A. Usmani; Project Fellow: Ajay Rawat, Kritish De; Project Assistant: Arkoyoti Sarkar

**Funding Agency:** National Mission for Clean Ganga

**Project Duration:** 2016 - 2019
Sacred salientia: Amphibians along river Ganges with natural history notes on endemic Terai Tree Frog

-Bitupan Boruah

Aim: To determine amphibian species richness along Ganga and Alaknanda river and generate hitherto unknown breeding behaviour of endemic frogs.

Location: 30 locations along three zones of Ganga and Alaknanda river basin.

Methods: We employed Nocturnal Visual Encounter Survey to document species. The three zones comprises Alaknanda, Middle Ganga and Lower Ganga. Acoustic search coupled with ad-libitum observations were made for reproductive studies. Breeding events were observed with the help of red light or low beam torch from a distance about 1 m in natural habitat. We actively searched for calling males, amplexus or a female until it engage in amplexus. Egg clutch and tadpoles were studied as per Gosner (1960).

Result: Seventeen species belonging to twelve genera and six families were recorded during the study period. The family Dicroglossidae was dominant with 29% species. Encounter rate of amphibian species across the study area was 27.83 individuals/hour. *Euphlyctis cyanophlyctis* was most abundant (0.35) with an encounter rate 9.79 individuals/hour. Species richness was found to be high Middle Ganga and Alaknanda zone respectively. The coefficient of biogeographic resemblance among the three study zones varies between 0.38 and 0.59. The breeding activities of rare and endemic Terai Tree Frog (*Polypedates taeniatus*) starts with the onset Monsoon (July). Male starts calling after 18:30 h from ground to a perch height of 23.24 ± 36.21 cm on grass blades. Unlike most other members of the genus *P. taeniatus* constructs terrestrial foam nests near accumulated water puddle and the female oviposited 220-308 unpigmented eggs. The free feeding tadpoles develops in water puddles among grassland. Herein, we also report first ever information on egg mass predation by Dipteran larvae from India.

Keywords: Amphibia, northern India, reproductive biology, conservation.

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Distribution ecology of fishes and odonates in the Ganga River

-Dr. Rohitashva Shukla

**Aim:** The adequacy of occurrence data is one major constrain in large scale ecological restoration processes of biological communities. The current study is designed to assemble the fish occurrence records from existing resources to understand the compositional heterogeneity among proposed habitat zones (HZ) along the Ganga River. This study also discusses the ecology and required conservation practices for some selected species of fishes and odonates of Ganga River.

**Location:** Main river course of Ganga River.

**Method-:** Beta diversity partitioning framework was used and LCBD (local contribution to beta diversity) indices were measured for each HZ as comparative indicators of ecological uniqueness for fish species composition, and its relationships were tested against biological and environmental correlates. Current distribution and abundance records were assessed to select fish and odonate species of conservation significance and to propose the management plans.

**Result:** Total 170 freshwater fish species belonging to 44 families were documented. UZ1 (Gangotri to Uttarkashi) was observed to be a zone of least fish diversity (species richness=7) and MZ1 (Haridwar to Narora) as the zone of highest fish diversity (SR=119). Fish richness along the HZs were strongly correlated with odonates ($r=0.8$, $p<0.05$) and bird diversity ($r=0.6$, $p<0.05$). HZs of upper (Gangotri-Haridwar), middle (Haridwar to Patna) and lower segment (Patna to Gangasagar) of the Ganga River exhibit strong clustering patterns in terms of species composition for total dissimilarity (ADONIS, $R^2=0.49$, $p<0.05$), replacement ($R^2=0.32$, $p<0.05$) and richness difference ($R^2=0.56$, $p<0.05$) components. HZs of upper and Upper-middle segment have shown the higher values of LCBD that are significantly predicted by temperature, altitude and disturbance variables. Lastly, fish species like *Tor putitora* and *Bagarius bagarius* and some odonate species have been selected for conservation prioritization.

**Conclusion:** The present study suggests the higher level of compositional heterogeneity among fish communities of Ganga River. Results also indicate towards the high level of niche differentiation along main stem of the Ganga River. HZ with high LCBD values (upper and upper-middle zones) should be conserved to maintain the ecological complexity among the biological communities of Ganga River.

**Keywords:** Beta-diversity, LCBD, habitat zone

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**Project Title:** Biodiversity conservation and Ganga rejuvenation (Component 2: Planning Aquatic Species Restoration for Ganga River)

**Principal Investigator(s):** Dr. J.A. Johnson, Dr. S. A. Hussain, Dr. V. P. Uniyal, Dr. K. Sivakumar, Dr. Gopi, G.V., Dr. Abhijit Das

**Researcher(s):** Dr. Rohitashva Shukla (Project Associate), Rahul Rana (Wildlife Biologist), Kritish De (Project Fellow), Sk Zeeshan Ali (Spatial Analyst)

**Funding Agency:** National Mission for Clean Ganga

**Project Duration:** 2016-2019
Conservation in action: Managing aquatic sentient in distress

-Dr. Animesh Talukdar

**Aim:** Turtles play crucial roles in the habitats they occupy and ensure stability of these habitats through bioturbation, seed dispersal and nutrient recycling. The Ganga basin is home to at least 14 species of chelonians; however, various factors such as consumptive exploitation, habitat perturbations and illegal trade are major drivers responsible for their decline. The animals are received in a poor state of health that warrant intensive intervention prior to rehabilitation in natural habitats. The aim of the study is to manage rescued turtles which includes the standardization of protocols for assessment of their well-being including those of nutritional and environmental enrichment.

**Location:** Confiscations of turtles in illegal trade in large numbers occur frequently. A large proportion of these confiscated turtles are received at Kachua Punarvas Kendra, Sarnath and Ganga Aqualife Rescue and Rehabilitation Centre, Narora.

**Method:** Body mass index, coprological examination, haemato-biochemical examination of adults and growth rate indices of juveniles hatched at the centre form basis of this health assessment. The animals are maintained in enclosures retrofitted to address species-specific requirements. Detailed health investigations are carried out to ascertain health status and well-being at the time of arrival and prior to their release.

**Results:** The outcomes of these efforts have been the establishment of baseline data for ascertaining health status and growth patterns of two critically endangered freshwater turtles of Ganga namely *Batagur kachuga* and *B. dhongoka*. Husbandry practices in captivity including nutritional and environmental enrichment based on species-specific requirements have been standardized at the centres. Sites for release of animals were identified during surveys and formed basis for rehabilitation. Besides, capacity building programs for forest and veterinary officials and communities have been organized for sensitizing on various facets of conservation and management of aquatic macro-fauna. These activities carried out at both the centres have formed basis for effective rescue and rehabilitation.

**Conclusion:** Key contributions to knowledge in managing rescued turtles include the standardization of protocols for assessment their well-being including those of nutritional and environmental enrichment. The outreach activities targeted at sensitizing personnel of Forest Department, community representatives and veterinary professionals have resulted in positive results.

**Keywords:** Chelonians, rescue, rehabilitation, husbandry

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<td>Dr. Animesh Talukdar (Veterinary Officer), Dr. Gowri Mallapur (SMS), Dr. Anupam Srivastav (SMS), Sh. Debaprasad Sengupta (Ex-situ Conservation Fellow), Sh. Akshay Bajaj (Project Fellow) &amp; Sh. Ashish K. Panda (Project Fellow)</td>
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Community engagement in Ganga conservation: An integrated approach

-Pariva Dobriyal

**Aim:** Participation of local communities and other stakeholders plays a crucial role in the success of conservation efforts as social and economic factors are increasingly seen as means to conservation success. The study aims to ensure community participation in Ganga conservation through aligning development concerns with conservation goals.

**Location:** Uttarakhand, Uttar Pradesh, Bihar, Jharkhand and West Bengal.

**Methods:** To mobilize stakeholders for Ganga conservation orientation and sensitization activities (n=2519) including meetings, workshops, and cleanliness and awareness rallies were conducted. Institutions like self-help groups, *Ganga Prahari* and *Pravasi Ganga Prahari* were established and strengthened through skill development trainings (n=76). To link local livelihoods with conservation, livelihood training centres (n= 11) were established. Literature review and field surveys were conducted to identify the ecosystem services of Ganga and interview-based questionnaire surveys were conducted to assess the key ecosystem services. Focused questionnaire surveys (n=30) along with focus group discussions (n=12) were conducted and information was collected on present status of natural resources and development activities in select village.

**Results:** Livelihood centres were established and 21 trainings designed based on the market availability and interest of local people were imparted. The Ganga Praharis trained at livelihood centres are emerging as "environmental entrepreneurs", successful model of this effort is *Jalaj* - a floating market at Varanasi. A larger audience was targeted through activities conducted by *Ganga Praharis* and *Pravasi Ganga Praharis* during special events such as Kumbh 2019, during which 149 *Ganga Praharis* made visitors aware about Ganga biodiversity and assisted in cleanliness and awareness drives, reporting and rescue of aquatic animals and guiding visitors to shelter and health camps. Linkages between local livelihoods and ecosystem services of river were evaluated to prioritize the areas for conservation and development efforts. Five village level digital microplans have been developed to promote sustainable development and mainstream ecosystem service based community participation in Ganga conservation.

**Conclusion:** Our study suggests that inclusive approaches lead to sustainable conservation solutions highlighting the need for pluralistic, partnership-based and dynamic approaches to conservation.

**Keywords:** Social-ecological systems, community participation, livelihood development, ecosystem services, digital microplan

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<td>Pariva Dobriyal, Project Scientist; Hemlata Khanduri, Ecodevelopment Officer; Deepika Dogra, Vipul Maurya, Project Associate; Aditi Dev, Amanat K. Gill, Ekta Sharma, Project Fellow; Sunita Rawat, Rahil Khan, Community Officer</td>
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Evaluating outcome and effectiveness of capacity building of stakeholders

-Dr. Sangeeta Angom

Aim: We aimed to measure the quality and effectiveness of the training imparted as part of NMCG-WII project and to analyze objectively the impact of capacity building program for Ganga biodiversity conservation.

Location: The capacity building programs were designed and implemented for stakeholders at 120 sites in five Ganga States viz. Uttarakhand, Uttar Pradesh, Bihar, Jharkhand and West Bengal respectively.

Methods: The evaluation was done using Kirkpatrick’s model through a random follow up e-questionnaire survey to examine the ‘after’ training effectiveness among the attendees of various training programmes during 2017-2019. Till date, 18 training and 109 sensitization programmes have been implemented in which 590 participants were trained and 10900 sensitized. 158 respondents were evaluated through a semi-structured e-questionnaire survey and the quantitative data were analyzed using standard descriptive statistics. The qualitative data elicited from open-ended questions were examined using a basic content analysis approach, with similar responses grouped together in summary categories.

Results: Outcomes were evaluated in terms of what actually happened as a result of training and it was found that almost every respondent (≈ 85%) has benefited from the trainings. Of the 158 respondents, 80% of trained participant had carry forwarded the activities in their respective states and 20% had self-implemented in their day-to-day life. KnightLab software was used to trace and map such success stories of stakeholders with an aim to propagate such activities either individually or at the institutional level. A training database at the WII-NMCG webpage has been developed as a single point source to disseminate training information to a wider audience.

Conclusion: The evaluation shed light on existent knowledge, awareness, attitudinal shift and motivation level about Ganga’s biodiversity in different target groups of stakeholders. Our efforts suggest that output and measurements of past training act as critical indicators while planning future activities to ensure efficacy and sustainability of the training imparted.

Keywords: Training impact, biodiversity, target groups, Ganga river

Project Title: Biodiversity and Ganga Conservation
Principal Investigator(s): Dr. Ruchi Badola and Dr. S.A. Hussain
Researcher(s): Dr. Sangeeta Angom (Project Scientist), Ms. Monika Mehralu (Assistant Training Coordinator), Mr. Keshav Kumar (Project Assistant Grade II), Mr. Ratish Singh (Project Assistant Grade II), Mr. Aakash Rawat (Project Assistant Grade II)
Funding Agency: National Mission For Clean Ganga
Project Duration: 2016 to 2019
Nature interpretation and conservation education as an efficient tool for communicating science about ‘the sacred’

-Ravi Sharma & Malvika Pandey

Effectiveness of awareness programs can be determined by assessing the growth in knowledge of people who are actively taking part in such activities. To fulfill the concept of think globally and act locally, organized communication activities are must for common people and students at grass root level both in rural and urban areas. Our objectives are communicating to the people about the value of aquatic biodiversity through the establishment of Interpretation centers and to educate public in the Ganga basin’s natural systems by creating a network of community based environmental education programs.

‘Ganga Darpan’ an interpretation centre and ‘Ganga Tarini’ a floating exhibition was open for public in February 2019. ‘Ganga Darpan’ and ‘Ganga Tarini’ have received a total of 876 and 2829 visitors respectively. To assess the impact of the awareness program, a pre and post questionnaire survey was conducted.

Conservation education programs for school students and teachers were conducted in 21 schools lying within 1 to 8 km distance of the Ganga River and its tributaries in two states namely Uttarakhand and Uttar Pradesh. A total of 1914 students of which 1275 were from the urban and 639 from the rural schools participated. In order to assess the knowledge of students about river Ganga and its biodiversity a questionnaire was administered with a total number of 1320 students before the start of the program. The same group of students was administered with the same set of questions for the post questionnaire to find out the knowledge gain and retention.

Results show 36.75% and 33.25% increase in knowledge amongst the visitors of Ganga Darpan and Ganga Tarini. Knowledge gain recorded amongst the students was 28.86%. A rise of 30.25% in knowledge gain in urban schools and 25.90% in rural schools was also observed.

Thus awareness through nature interpretation acts as a powerful tool for creating change in attitude and knowledge, conservation education programs are effective to inculcate interest amongst younger generation towards making them responsible citizen.

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), Malvika Pandey(Extension Officer), Mohit Kashyap(Project fellow), Taniya Trivedi(Project fellow), Anjali Pathak( Extension Ofiicer), Pragya Bhatt(Project fellow), Uttam Panwar(Project Assistant), Poonam Pal(Project Assistant)
Funding Agency: Ministry Of Water Resources, River Development and Ganga Rejuvenation
Project Duration: 2016 - 2019
Object based classification of riverine features using high resolution satellite imagery along the Ganga river

-Shatakshi Sharma

**Aim:** The Ganga River is one of the largest, ecologically diverse and densely populated river in Asia. It flows through various environmental regime. The river stretch classification using riverine geomorphological criteria is a primary factor to address riverine feature diversity. The riverine feature forms habitat for aquatic flora and fauna along the river. Climatic and geomorphic variability enrich the river to promote biological diversity. Object based image classification is a very useful method to extract riverine features to identify habitats for many aquatic species.

**Location:** Main stem Ganga River.

**Methodology:** We have carried out Object Based Image Analysis (OBIA) using multiple bands for multiresolution segmentation and classification. Our study addresses the object based method to delineate readily usable features from high resolution satellite imagery, which combines image processing and GIS functionalities in order to utilize spectral and contextual information for extracting features. The method involves hierarchical class structure to further subcategories. The concatenation of two trends has been used: a). advent of high resolution imagery, b) availability of powerful, off-the-shelf technology that combines to identify earth features. We have calculated indexes i.e., Normalized Difference Water Index (NDWI) and Normalized Difference Vegetation Index (NDVI) to extract surface water from Sentinel 2A satellite image.

**Result:** Our study evaluates the application of an unsupervised image processing using an object based classification tool for feature extraction. The OBIA methods are quite relevant to the progress towards a spatially explicit information extraction workflow, such as is required for spatial planning as well as for many monitoring programmes. River bank was delineated along with sand bar, mid river island and braided channels. Shallow and high depth areas was also identified using feature extraction method to address morphologically diverse segments along the river.

**Conclusion:** This image classification approach will contribute to the scientific community to identify selected sites for any aquatic conservation and management plan such as requirements of ecological monitoring, conservation goals, spatial planning enforcement and ecosystem-oriented natural resource management.

**Keywords:** Feature extraction, multiresolution segmentation, riverine features, index, object-oriented image analysis
Following the flow: Deriving the drainage network within Ganga basin

-Aishwarya R Chandran

**Aim:** Achieving ‘Aviral Dhara’ for the river Ganga demands inspection of ‘dharas’ or streams flowing into it. The Ganga River receives water from snow or glacial melt, monsoonal rains and aquifers which flows as thin network of streams, rivulets and even major rivers contributing to the water in Ganga. This study aims to trace the flow of water within the Ganga Basin.

**Location:** Ganga basin within India

**Significance:** The mandate of e flows and revival of water table levels demands that, water flows within the basin, through the landscape, slowly, with increased retention time. This can be ensured by adhering to a watershed based approach and undertaking soil moisture conservation activities from the ridge to valley. The digital elevation model and terrain hydrology plays a very important role in planning for such activities.

**Methods:** This study has used the ALOS DEM to derive the drainage networks through hydrological analysis. The dataset used is Japan Aerospace Exploration Agency’s (JAXA) Advanced Land Observing Satellite “DAICHI” that captures 30-meter resolution digital surface model based on stereo mapping from PRISM, which is one of the most precise free global-scale elevation data. The streams were then checked and compared with seasonal NDWI of sentinel and Landsat images in Google Earth Engine to understand their seasonality.

**Results:** The hydrological flow regime, stream length and stream order of various rivulets flowing into the Ganga have been calculated. These derived drainage networks have to be filtered out and classified in terms of their contribution and then their seasonal flow have to be inspected.

**Conclusion:** The results of this study can be used to identify the perennial, seasonal and drying streams and propose strategic action plans to rejuvenate the streams with a dual goal of achieving ‘aviral dhara’ and mitigating water scarcity within the basin.

**Project Title**  Biodiversity Conservation and Ganga Rejuvenation

**Principal Investigator(s)**  Gautam Talukdar, S. A. Hussain

**Researcher(s)**  Aishwarya R Chandran, Zeeshan Ali S.K.

**Funding Agency**  National Mission for Clean Ganga

**Project Duration**  2016-2019
Assessment of population genetic status of seven turtle species based on mtDNA and nuclear genes from river Ganga

-Dr. Prabhaker Yadav

Aim: The Ganges is the largest river in India and has rich diversity of aquatic fauna. Hydro-power development and construction of dams and barrages across the rivers has significantly affected the natural habitat, abundance, and population structure of aquatic animal species over the last 45–50 years. The barriers affect the movements of these species, creating separate sub-populations. When a species has adapted to a particular habitat, it often becomes restricted to a small patchy habitat, with limited gene flow. Understanding the genetic structure in continuous habitats is important for determining the effects of these barriers on the genetic diversity and gene flow in populations and developing appropriate conservation programmes. Therefore, our aim is to derive the current trend in genetic variability and gene flow of the endangered aquatic species which might have been disrupted due to fragmentation of the longitudinal connectivity of the river.

Study Site: This study was carried out from various locations of River Ganga River.

Methods: We have collected a total of 126 biological samples of seven turtle species from middle and lower stretch of River Ganga. Here, we report the geneflow pattern, genetic diversity, and population status of seven turtles spp. P.tecta (12), B.dhongoka (12), B. Kachuga (9), G. hamiltonii (17), N. gangetica (6), P. smithii (29), and L. punctata (41) based on mtDNA and nuclear gene sequence analysis.

Results: We have sequenced complete mtDNA Cyt b (1130bp) and Cmos nuclear gene (600 bp) from seven turtle species comprising Geoemydidae and Trionychidae family. The low pairwise genetic distance was observed within the studied turtle species. We have observed higher level of genetic diversity in P. tecta (0.758±0.093), B. dhongoka (0.758±0.093) and B. Kachuga (0.75±0.112); moderate level in G. hamiltonii (0.692±0.075) and N. gangetica (0.60±0.175), however it was low in P. smithii (0.47±0.10), and L. punctata (0.334±0.093).

Preliminary findings: High genetic differentiation was observed between the hard and soft shell turtles, however very close genetic relationship was observed within the studied turtle sp. using both the mtDNA and nuclear gene markers. Reasonable genetic diversity was observed in few species of turtles. The neutrality test indicated historical demographic influences within the various turtle sp. of Ganga. However, more samples and microsatellite analysis would be added from the other locations and analyzed for clear evidence of genetic structure, diversity, geneflow and migration pattern.

Project Title: Biodiversity Conservation and Ganga Rejuvenation – Planning Aquatic Species Conservation for Ganga River (Genetic)
Principal Investigator(s): Dr. S. K. Gupta and Dr. S.A. Hussain
Researcher(s): Dr. Prabhaker Yadav (Research Associate) and Dr. Ajit Kumar (Project Associate)
Funding Agency: Ministry of Jal Shakti
Project Duration: Three Years
Comparative study on vegetation diversity along river Ganga and its tributaries with reference to disturbance

-Dipti Dey

Aim: Characterizing the health of river vegetation with response to anthropogenic pressures and restoring the favorable habitat condition for natural vegetation is important for rejuvenating the river Ganga. The present study aims to assess the vegetation diversity patterns along river Ganga and its major tributaries with special reference to disturbance.

Location: The river Ganga and its major tributaries

Methods: The study was conducted in 12 major tributaries of river Ganga. A 5 km stretch of tributary from the confluence was sampled by laying quadrats (5, 5x5m for shrubs and 10, 1x1m for herbs) and presence of trees was recorded along with disturbance parameters. The data was analyzed for density, diversity and similarity within sites and tributaries.

Results: A total of 80 plant species belonging to 35 families were recorded. Asteraceae, Poaceae, Euphorbiaceae and Fabaceae were the dominant families. Majority of species were weeds and exotic in origin. The species diversity among the tributaries was in following order: Sone > Tamas > Ajay > Nayyar > Ramganga > Ghagha > Gandak > Jalangi > Yamuna > Gomti > Punpun > Kali. plant species diversity was found to be increased in tributaries where the disturbance increases as compared with the main river. The overall species richness showed < 45% similarity among all tributaries.

Conclusion: The study reveals that the high disturbance site supports high exotic species composition. The sites under zone VI (Farakka to Haldia) and zone V (Gangabarar to Sahibganj) need special management attention for rejuvenating natural vegetation.

Keywords: Exotic species, species richness, similarity, rejuvenation
Ecology of few selected conservation significance fishes of river Ganga

-Rahul Rana

River Ganga supports a rich diversity of conservation value including fishes. Habitat degradation and fishing pressures are the two major threats to the fish diversity of River Ganga. Therefore, the present study was focused to accentuate the importance of some fishes of conservation significance of River Ganga.

The study was carried out for a period of two years from March, 2017 to June, 2019 along all the 31 intensive monitoring sites covering all 4 types of habitat zones of River Ganga.

We sampled fish at all 31 sites (5km long stretch at an interval of 75kms) and an average of 4 hrs of net effort was applied using gill nets of varying mesh sizes, and cast net. Ecological parameters like river depth suitability, river velocity and river substrate and feeding behaviour were also recorded while sampling. Also, the habitat ecology of these fishes were examined.

A total of 6 fish species were selected based on ecological parameters analysis after consulting FISHbase. *Tor putitora*, *Cirrhinus reba*, *Cirrhinus cirrhosus*, *Bangana dero*, *Raiamas bola*, *Bagarius bagarius* prefers river velocity of 0.2 to 0.4mtrs/sec and depth upto 0.2 to 3.5mtrs. They inhabits montane and submontane high energy river system characterised by rapids and pools, clear streams, associated with swift and rocky beds.

The study revealed that 0.2 to 0.4mtrs/sec water velocity and 0.5 to 3.5mtrs depth was most preferred and rocky and sandy banks kind of substrate was the most suitable.

The present findings provide the baseline information for ecological and conservation significance status for future prospects.

**Keywords**: River Ganga, ecology, depth, velocity, substrate.

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**Project Title**: Biodiversity and Ganga Conservation (Component-2 Planning Aquatic Species Restoration For Ganga River

**Principal Investigator(s)**: Dr. J.A. Johnson, Dr. K. Sivakumar, and Dr. S.A.Hussain

**Researcher(s)**: Rahul Rana (Wildlife Biologist), Dr. Rohitashva Shukla (Project Associate)

**Funding Agency**: National Mission for Clean Ganga

**Project Duration**: 2016-2019
Distribution, sources and ecological risk assessment of Polychlorinated Biphenyls (PCBs) in Ganga river

-Apourv Pant

**Aim:** Ganga river serves as a lifeline for various developmental, agricultural, industrial and religious activities. It supports a vast majority of aquatic and terrestrial flora and fauna. However, the aquatic ecosystem of the Ganga river is in serious threat due to the industrial, agricultural, and domestic discharge of organic and inorganic pollutants. Among the organic contaminants, one of the significant pollutant is Polychlorinated biphenyls (PCBs), which poses a global concern to a freshwater ecosystem due to their persistent, bioaccumulative, and toxic nature. PCBs have also been declared as Persistent Organic Pollutant (POPs) at Stockholm Convention (2001), and India is a signatory to this convention. Due to their property of low water solubility and high Kow value, PCBs associate more with suspended particulate in river sediments. Remobilization of these PCBs from sediment sink due to natural or anthropogenic pressure makes them readily available for aquatic organisms. PCBs are also endocrine disrupters and exposure of these PCBs to the river organisms may cause a variety of toxic effects, including reproductive, immunological, and neurological problems. Chronic exposure to some congeners also affects the liver, kidney, gonads, etc. thus posing a severe threat to river biodiversity health. Therefore, in the present study, spatial distribution, sources, and potential ecotoxicological risk characterization of 11 highly toxic PCB congeners was performed in sediments of river Ganga

**Location:** 50 sampling sites were selected in the entire Ganga stretch of 2525km, and sediment samples were collected between October and November 2017. At each sampling site, a 5 Km stretch was covered, and samples were collected randomly at every 1 Km interval. The samples were then packed and stored in zip lock bags, and transported in an icebox to the lab for further analysis.

**Methods:** The samples were processed using standard USEPA protocol with suitable modifications.

**Results:** Results will be interpreted and presented against International sediment quality guidelines for aquatic life criteria.

**Conclusion:** Appropriate conclusion will be presented keeping in view the standard guidelines and aquatic life criteria.

**Keywords:** PCBs, sediments, spatial distribution, ecological risk, sediment quality guideline

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**Project Title:** Biodiversity Conservation and Ganga Rejuvenation (Component 2- Planning Aquatic Species Restoration for Ganga River)

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

**Researcher(s):** Apourv Pant (Project Fellow), Ruchika Sah (Project Associate), Riya Aneja (Intern), Pooja Chaudhary (Project Intern)

**Funding Agency:** NMCG

**Project Duration:** 2016-19
Selecting appropriate species distribution model for the Gangetic riparian zones: 
A comparative study using Aeshnoidea

-Kritish De

Aim: The spatial prediction of species distributions using survey data is a significant component for ecosystem-based conservation management approach. As there are several species distribution models (SDMs) available with their pros and cons, it is important to choose appropriate SDM for the species and area of interest. In the present study, we compared the performance of six SDMs to find suitable one for the Gangetic riparian zones.

Location: Stretch of middle Ganga river between Bhimgoda barrage and Kanpur barrage.

Methodology: We collected the coordinates of Aeshnoidea odonate presence locations from seven sampling sites. We performed a correlation analysis between nineteen bioclimatic variables (bioclim), then principal component analysis using significantly correlated bioclims to extract most relevant bioclims (n = 8) for the study area. We build six SDMs, namely Generalized boosted regressions model (GBM), Generalized linear model (GLM), Adaptive regression splines (MARS), Maximum entropy (MAXENT), Random forest (RF) and Support vector machines (SVM), using these eight bioclims, land use land cover types, forest cover and species presence data. We evaluated the performance of all these models by area under the receiving operating characteristic (ROC) curve (AUC) and Cohen’s Kappa coefficient. We did all the analysis in the R software environment for statistical computing and graphics.

Result: We found that AUC value was highest for RF (1.00) followed by GLM (0.99) and MARS (0.99), Cohen’s Kappa coefficient was highest for RF (1.00) followed by GBM (0.67) and GLM (0.54). The sensitivity and specificity was highest for RF (1.00 for each) followed by GLM (1.00 and 0.98 for each) and MARS (1.00 and 0.98 for each). Moreover, we found that RF was the only SDM that explains 100% of the model proportion.

Conclusion: Our study shows that the Random forest (RF) method is appropriate to build SDM for Gangetic riparian zones because of its high specificity, sensitivity, AUC and Kappa coefficient values, which will help in conservation management of the Gangetic riparian zones in future.

Keywords: Conservation planning, bioclimatic variables, Ganga, Odonata, SDM

Project Title: Biodiversity and Ganga Conservation (Component 2: Planning Aquatic Species Restoration for Ganga River)
Principal Investigator(s): Dr. V.P. Uniyal, Dr. J.A. Johnson and Dr. S.A. Hussain
Researcher(s): Kritish De (Project Fellow) and Sk. Zeeshan Ali (Spatial Analyst)
Funding Agency: National Mission for Clean Ganga
Project Duration: 2016-2019
Environmental considerations for rehabilitation of chelonians in and around Bhagalpur

-Akshay Bajaj

Turtles are an integral component of freshwater biodiversity and play a key role in regulating the habitats they inhabit. The Ganga basin is home to 14 species of freshwater chelonians and their populations are facing imminent threats due to various anthropogenic activities besides poaching for consumption and trade. Animals entering trade are frequently confiscated by enforcement authorities and placed in rescue facilities. A new facility has been developed at Bhagalpur under the aegis of the Forest Department, Govt. of Bihar. An integral part of any rescue effort is the successful rehabilitation of rescued animals in their natural habitats.

A survey was carried out in the areas in and around Bhagalpur to identify potential rehabilitation sites for turtles. The criteria used were based on habitat requirements viz. availability of basking sites, refugia, flow rate and depth of water and anthropogenic disturbance. Information on presence of turtles was carried out based on sign and questionnaire surveys.

A total of 17 sites (two lakes, six ponds and nine in the main river channel) were surveyed. Result based on the above criteria, only nine sites (two lakes, two ponds and five in the river stream) were found to be preferable for rehabilitation of chelonians. Requirement of vigilance before and after is essential. This survey will help in chelonian survival during rehabilitation programs in and around Bhagalpur, Bihar.

Keywords: Turtles, Ganga, rescue, rehabilitation

| Project Title | Biodiversity and Ganga Conservation (Component 4: Establishment of Conservation and Rehabilitation Centre) |
| Principal Investigator(s) | Dr. Parag Nigam, Dr. S. A. Hussain and Dr. Ruchi Badola |
| Researcher(s) | Akshay Bajaj (Project Fellow) |
| Funding Agency | National Mission for Clean Ganga |
| Project Duration | 2016-2019 |
Critical policy review for Ganga river conservation

-Michelle Irengbam

Rivers in large human-dominated landscapes are threatened by multiple stressors, which may be aggravated by climate change impacts. Answering to this requires policy commitment towards river conservation by identifying potential legislative or policy protection, developing management strategies and devising systematic conservation planning approaches for rivers. The extent of the Ganga River over a vast geo-climatic region coupled with the geopolitical and socio-economic structure necessitates robust science-based policies to address key issues and to ensure sustainability.

Considering this, national policies and other legislation hindering Ganga river conservation were reviewed using Grounded Theory approach. In the first stage, methodical gathering and analysis of policies and other legislation was carried out to identify gaps in river conservation. Ethnography version 6 software was used for coding qualitative information to facilitate categorization of policy issues into commercial focus of policies (market failure), inadvertence on connected nature of rivers (information failure) and lack of legal protection (failure of regulatory tools). Protected status of the Ganga river and its focal species were also evaluated to determine the role and extent of legal instruments in Ganga river conservation.

Union and sectoral policies were found to be incongruent and unsustainable with their prime focus on water allocation, pollution abatement and flood control with minimum emphasis on ecological needs of rivers. Connectivity, an essential component of rivers, is largely neglected through the construction of hydel dams as mandated by the Hydro Power Development Policy (1998). Although 50% of the river harbours significant populations of globally threatened species, only 9.16% of it is legally protected under the Wildlife (Protection) Act, 1972. This mis-match between degree of protection accorded to the species and their habitats serves as a roadblock to Ganga conservation. Recent efforts by the Union govt. have considered ecological requirements; however, these considerations should be in-sync with novel practices from river conservation science.

This review will aid in constructive policy design, which is inclusive of the ecological needs of the river system, codifies institutional relationships among states and delineates mechanisms for fostering cooperation.

Keywords: Water governance, sectoral cohesion, policy instruments, policy implementation, biodiversity conservation.

Project Title : NMCG-WII Biodiversity and Ganga Conservation
Principal Investigator(s) : Dr. S.A. Hussain and Dr. Ruchi Badola
Researcher(s) : Ms. Michelle Irengbam, Project Fellow (Ecology & Conservation biology) & Dr. Shivani Barthwal, Project Scientist.
Funding Agency : National Mission for Clean Ganga
Project Duration : 2016 - 2019
Spreading the wings: Ganga Prahari ensuring the sustainability of conservation efforts

-Deepika Dogra

Aim: Create and amplify the grassroot level force in ensuring sustainable efforts for conservation of Ganga aqualife.

Location: Uttarakhand, Uttar Pardesh, Bihar, Jharkhand and West Bengal

Methods: Ganga Praharis were motivated and trained during various site level meetings, one to one interactions, focal group discussions, consultation meetings and training workshops.

Results: Ganga Prahari is a cadre of trained and motivated volunteers from the communities residing along the Ganga River, as of now a total of 1113 volunteers have been successfully added to this program. Ganga Praharis are conducting cleanliness and plantation drives, mobilizing community members using innovative methods like storytelling, street plays and poems in their stretch of Ganga River. A successful display of their efforts was seen during the Kumbh Mela at Prayagraj, where, 149 Ganga Praharis participated in cleanliness drive, awareness campaign, they also reported of distressed animals to the concerned State Forest Department & NMCG-WII team and guided visitors to shelter and health camps. Ganga Prahari program has provided women of the rural households a unique opportunity to be in the forefront of conservation activities. Trained through various skill development workshops and training courses they have opted for an alternate source of livelihood, today. A successful model of this effort can be seen in the form of Jalaj- a floating market at Varanasi that has turned the Ganga Prahari into “environmental entrepreneurs”. Two new extended program of this initiative are Bal Ganga Prahari and Pravasi Ganga Prahari. A total of 64 schools have been identified and citizens from 15 different countries across the globe have joined in the efforts of Ganga Biodiversity conservation, respectively.

Conclusion: Ganga Prahari program has provided a platform that is guiding individual efforts towards sustainable conservation goals of Ganga River and its biodiversity.

Keywords: Bottom-up approach, environmental entrepreneurs, community empowerment, gender equality, natural resource and development

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Institutionalizing community participation in Ganga conservation through digital village microplans

-Aditi Dev

**Aim:** This study aims to institutionalize community participation and streamline activities of various departments for Ganga biodiversity conservation.

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

**Methodology:** For the development of microplans, a microplanning guideline was prepared and finalized after extensive literature survey, national and state level consultations, meetings and workshops with multiple stakeholders of various departments and line agencies. On digital platform, on the SQL server a relational database is created based on the microplan guideline. A digital framework was developed consisting of indicators for each theme. Scoring was done to assess the present status and impacts of the activities on the River. Nine strategic themes were identified out of which six themes i.e. livelihood and skill development, agriculture, animal husbandry, fisheries, renewable energy and community based institutions were under trust building category and three themes i.e. community awareness, hygiene and sanitation and biodiversity conservation were under generic category.

**Result:** Based on the data collected from Gram Panchayat members, local communities and other stakeholders, microplans were prepared for five villages. Digitally, these microplans depict a nested inter-linkage between the themes and institutions involved, thereby, contributing in development of strategies for biodiversity conservation of the Ganga River and sustainable development of the villages.

**Conclusion:** The digital underpinning for implementation of microplans will contribute in cross-sectoral and inter-departmental coordination and monitoring of various programmes and schemes provided by the government, non-government organizations. Information generated will broaden the future possibilities of policy interventions, regional planning and decision making processes through participation from multiple stakeholders.

**Keywords:** Microplanning guideline, village microplans, community participation, Ganga River, digital microplan

**Project Title** : Biodiversity Conservation and Ganga Rejuvenation

**Principal Investigator(s)** : Dr. Ruchi Badola and Dr. S.A. Hussain

**Researcher(s)** : Aditi Dev/Project Fellow Pariva Dobriyal/Project Scientist Hemlata Khanduri/Ecodevelopment Officer Deepika Dogra, Vipul Maurya/Project Associates Amanat K. Gill, Ekta Sharma, Ravindra Tripath Project Fellows Sunita Rawat, Rahil Khan/Community Officers

**Funding Agency** : National Mission fo Clean Ganga, Ministry of Jal Shakti, Government of India

**Project Duration** : 2016-2019
Data to decision: Role of database management and web technologies

-Ravindra Nath Tripathi

Aim: Data when utilized well can lead to informed decisions but most often-humongous data needs to be cured and managed to make it useful. Managing such a big scale is difficult without use of database and technologies. This is an attempt to demonstrate the application of Database management and Web Technologies for information dissemination.

Study Area: Mainly Ganga flowing states and also regions within the scope of the project.

Method: The initiative of WII-NMCG is a large scale project functioning under six different component fueled by more than 60 researchers and 15 knowledge experts involving thousands of people, more than 20 multidisciplinary stakeholders, forest officials and Ganga Prahari task force panning the five ganga flowing states. The relational database created provides for heterogeneous data support, accommodation of new type of data as they emerge, metadata registry, scalable and secure framework for dissemination on web pages. A schema for managing the records of events organised and stakeholders involved has been developed and hosted on server with features of querying and map based tasks. The methodology consists of six main components: Conceptual design, Data management, Software and Database, GIS platform, Web interface and portal development, and Security, Testing and Backup. pgAdmin version 4 Management tools for PostgreSQL and SQL server 2014 was used for database management as back-end support and Asp.net, C#, Drupal and HTML are used for Front end.

Results: With ensuring the security and privacy, three different webpages, an android version of mobile application for field data survey and Multiple Google forms for collecting various information have been created. A web site for the dissemination of facts, News and events, Knowledge products, Training Database and multimedia from different components have been developed. A additional web page with associated database has been developed for Ganga Prahari and Pravasi Ganga Prahari to seek and track the contributions of volunteers. Apart from all these a website is being developed for generating Microplan for villages based on data inputs. Schema, data input formats, standardisation and algorithms for data analysis are being modelled.

Keyword: Digital repository, database management, biodiversity conservation, web portal.

Project Title: Biodiversity Conservation and Ganga Rejuvenation
Principal Investigator(s): Dr. Gautam Talukdar and Dr. S. A. Hussain
Researcher(s): Ravindra Nath Tripathi Project Fellow, Shatakshi Sharma, Aishwarya Ramachandran, Dinesh Pundir, Ashish Mani
Funding Agency: National Mission of clean Ganga, Delhi
Project Duration: 2017-2019
Building the foundation: *Bal Ganga Prahari*

-Ms. Monika Mehralu-

**Aim:** Children one of the most vulnerable group of our society can be ambassador of *Aviral* and *Nirmal* Ganga. This utmost important stakeholder group is brought together by the Wildlife Institute of India-National Mission for clean Ganga initiative named as "*Bal Ganga Prahari*". This program was initiated to develop a knowledge sharing platform for school Children.

**Location:** The study is being carried out in five Ganga River States i.e. Uttarakhand, Uttar Pradesh, Bihar, Jharkhand and West Bengal respectively.

**Method:** The schools situated along the Ganga River were randomly selected and series of conservation awareness programs and sensitization workshops were carried with Principal, teachers and students.

**Result:** Till date, sixty four (64) schools have been identified under the *Bal Ganga Prahari* program and more than 7000 school students have been sensitized and trained on the various themes - Safeguarding Ganga River and its social, religious, economic and ecological aspect. Interactive awareness materials on species of Ganga River in the form of books, brochures, poems, and posters have been developed. Further, it is aimed that an awareness corner on Ganga and its biodiversity will be developed, in the identified schools for imparting knowledge to different batches of schools children.

**Conclusion:** This initiative will help to develop a scientific understanding and empathy among children for nature and natural resources.

**Keywords:** Ganga biodiversity, education, conservation, knowledge sharing, sustainability

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**Project Title**: Biodiversity Conservation and Ganga Rejuvenation

**Principal Investigator(s)**: Dr. Ruchi Badola and Dr. S.A. Hussain

**Researcher(s)**: Ms. Monika Mehralu (Assistant Training Coordinator), Dr. Sangeeta Angom (Project Scientist), Mr. Kehav Kumar (Project Assistant, Grade II), Mr. Ratish Singh (Project Assistant, Grade II), Mr. Aakash Rawat (Project Assistant, Grade II)

**Funding Agency**: NMCG

**Project Duration**: 2016-2019
Record-keeping in the modern day: Database for capacity building of various stakeholders

-Advaita Ravindran

**Aim:** Developing a retrievable database for each training program conducted is significant to keep track of the progress, and for maintaining the status of the training programs. The objective was to create a comprehensive, as well as accessible repository of information of the details of each training conducted.

**Location:** Trainings were conducted in each of the 5 Ganga states along the mainstem of the river including Uttarakhand, Uttar Pradesh, Bihar, Jharkhand and West Bengal.

**Methods:** For the fulfillment of capacity building, training and awareness workshops were conducted with various stakeholders all along the Gangetic stretch involving the forest officials, school children, youth, local communities, scientists, media personnel, local NGOs and other stakeholder groups. Process of developing the database consisted of conception, followed by formulation, creation and the final stage of uploading.

**Results:** The uploaded database contains the details of a total of 120 workshops, conducted in the 5 Ganga states at State and National levels since 2016. The database comprised of compilation of the details of all the training workshops conducted to date including the details of the participants, the resource persons and the team from WII, along with the compiled reports. The database also contains the locations of the various training and awareness workshops plotted with the help of ARC-GIS, as well as a media coverage repository.

**Conclusion:** The training database is an online repository provides a comprehensive and compiled summary of the work carried out under the project within the duration of 3 years, i.e. from 2016 to 2019, as well as the exact locations, groups and number of stakeholders trained. The training database is essential to maintain the robustness of the data, and to make it readily accessible to all the involved stakeholders and to a wider audience.

**Keywords:** Ganga biodiversity, Ganga states, training workshop, online repository.
Distribution of turtles in the Ganga river

-Saurav Gawan

Aim: Freshwater turtles are sensitive to environmental stressors and their abundance and distribution are indicators of status of river habitat condition. This study aims to assess seasonal distribution and relative abundance of freshwater turtles in Ganga River.

Study Area: Middle and Lower stretches of the Ganga River from Haridwar to Nurpur.

Methods: Linear boat surveys were conducted in 25–30 km of river stretch with a sampling of 3-4 segments points each day. Visual Encounter Method (VEM) used to assess diversity and distribution of freshwater turtles from April 2018 to May 2019. Bathymetric data was collected using depth sounder. Sightings and signs were pooled after completion of survey and encounter rates were reported.

Result: A total of 28870 individuals of freshwater turtles belonging to eight Genus were identified during the surveys. The Pangshura spp. was most abundant (95.23%) and most widely distributed as they are generalist in habitat selection. It was followed by Nilsonnia spp. (2.58%) and Batagur spp. (0.27%). The Pangshura and Bataguridae were distributed throughout the Middle Ganga till Sahibganj. However, their sightings were reduced from Buxar in Bihar till Farakka. Nilssonia gangetica was abundant in the middle stretch except in the Jahanabad and Pratapgarh region of Uttar Pradesh. Very few species were sighted in the Lower Ganga. Shallow pools, sandy banks, islands and low mining and fishing activities resulted in higher assemblages of turtles in the Middle Ganga. On the other hand, higher anthropogenic pressure such as poaching, mining, river island and river bank agriculture reduced the sighting of turtles in the Lower Ganga.

Conclusion: This study reinforces the synergies between species richness, habitat heterogeneity and anthropogenic pressure and provide with a biotic tool to prioritize conservation actions in select stretches.

Keywords: Disturbance, diversity, freshwater, ganga, turtle

Project Title : Biodiversity Conservation and Ganga Rejuvenation (Component-I: Ganga Aqualife Conservation Monitoring Centre)
Principal Investigator(s) : Dr. S. A. Hussain, Dr. Ruchi Badola
Researcher(s) : Saurav Gawan (Conservation Biologist)
Funding Agency : National Mission for Clean Ganga
Project Duration : 2016 - 2019
Using Body Measurements for Assessing Fitness of Select Turtles

-Debaprasad Sengupta

**Aim:** The body mass index (BMI), a measure of an individuals' overall condition has been effectively used to assess fitness of variety of animals including chelonians in captivity. Lack of scientific data has limited its use in free ranging populations. This study aims to develop a single mathematical formula for allometric equation to assess the animal's fitness based on bod measurements.

**Location:** Varanasi, Uttar Pradesh, India

**Method:** This study targets at the wild and confiscated turtles to assess their fitness prior to release in natural habitat. The identified animals were categorised based on the confiscation status and level of hydration as they were received and the body measurements formed basis for decision for release. A single mathematical formula for allometric equation was established for *N.gangetica* (*n=28*) based on length-weight relationship.

**Result:** Straight carapace length and estimated body weight for *N. gangetica* was 677.46±87.73 mm and 19129.17±799.17g respectively. The length and weight relationship was measured using $W= aSCL^b$, where SCL is the straight carapace length, ‘a’ is the rate of change of weight with length (intercept) and ‘b’ is the weight at unit length (slope). The study revealed the body weight to be significantly correlated ($R= 0.822; R^2= 0.676$) with SCL. The condition factor (K) was determined by using the equation, $K= 100W/SCL^b$; where W (estimated weight) is derived from the length-weight relationship equation, SCL is the total straight carapace length and ‘b’ is the value obtained from the length-weight relationship equation.

**Conclusion:** This equation indicates the health of a turtle in their natural habitat. Using conditioning factor (K), the health of the turtles was determined for assessing the body condition in their natural habitat.

**Keywords:** SCL, Estimated Body weight, Intercept, Slope, Allometric equation

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**Project Title**  | Biodiversity Conservation and Ganga Rejuvenation  
**Principal Investigator(s)**  | Dr. Parag Nigam, Dr. Pradeep K. Malik and Dr. S. A. Hussain  
**Researcher(s)**  | Debaprasad Sengupta (Ex-situ Conservation Fellow), Animesh Talukdar (Veterinary Officer), Dr. Gowri Mallapur (SMS), Dr. Anupam Srivastav (SMS), Akshay Bajaj (Project Fellow) and Ashish K. Panda (Project Fellow)  
**Funding Agency**  | NMCG  
**Project Duration**  | 2016-19
Growth pattern of three-striped roofed turtle (Batagur dhongoka) maintained under captive environment

-Ashish Kumar Panda

Aim: Cheloniens are an integral component of aquatic ecosystems and play a crucial role in maintaining stability in their habitats. The Ganga basin is home to 16 species of cheloniens that are currently facing threats to their survival due to various anthropogenic threats. One of the strategies adopted for addressing these population declines is the rescue of eggs from threatened nesting areas, hatching and rearing them in captivity and subsequent release in suitable habitats. Effective management of rescued eggs is based on a detailed understanding of the natural history of the species, its life history traits, spatio-temporal patterns of occurrence, behaviour, and growth rate. Limited knowledge on these aspects of the aquatic cheloniens of Ganga basin exists in literature. The aim of the study is to assess growth pattern of the juvenile turtles hatched in captivity.

Location: The Uttar Pradesh Forest Department collects eggs of Batagur dhongoka with the objective of subsequent release of adults for addressing population declines. The eggs are incubated in captivity at Kachua Punarvas Kendra and reared till they are of a size/age suitable for rehabilitation.

Method: Growth pattern of an even aged cohort of Three-striped roofed turtle (Batagur dhongoka) was recorded monthly by straight line caliper measurements of carapace lengths, carapace width, and plastron lengths (Morphometry), as well as measurements of total weights were recorded since hatching.

Result: Mean and standard deviation of carapace length, width, plastron length and body weights at 1.2 years was 7.93 ± 0.63, 6.27 ± 0.57, 7.20 ± 0.55 and increased to 79.71 ± 15.54 to 8.4 ± 0.63, 6.55 ± 0.55, 7.61 ± 0.60 and 98.95 ± 14.46 at 1.5 years respectively for 26 turtles. The result shows the growth rate to be 19.24% in the 3 month duration during which the study was carried out.

Conclusion: The data from this study provide new insights into the growth patterns of Batagur dhongoka. The outcomes of the present study can form basis for assessing the efficacy of husbandry practices adopted for the captive husbandry of cheloniens.

Keywords: Cheloniens, husbandry, hatching, rehabilitation, morphometry.

Project Title: Biodiversity Conservation & Ganga Rejuvenation, Component IV (Rescue and Rehabilitation)
Principal Investigator(s): Dr. Parag Nigam, Dr. Pradeep K. Malik and Dr. S. A. Hussain
Researcher(s): Ashish Kumar Panda (Project Fellow), Dr. Gowri Mallapur (Subject Matter Specialist), Dr. Anupam Shrivastav (Subject Matter Specialist), Dr. Animesh Talukdar (Veterinary Officer), Mr. Debaprasad Sengupta and Mr. Akshay Bajaj.
Funding Agency: National Mission for Clean Ganga
Project Duration: 2018-19
Functional role of water and water-associated birds in the Ganga river: A review

-Shuchismita Das

Aim: Waterbirds are one of the best studied groups, although their role in terms of providing vital ecosystem services is still largely overlooked. This study aimed to review the functional role of water and water-associated birds in the Ganga River.

Study area: The review included the water and water-associated birds found in the Ganga River.

Method: Peer-reviewed papers were searched using the search engines, Google Scholar, Harzing Publish or perish. The keywords related to supporting and regulating services provided by birds through their functional roles were used for literature search. Those papers with most relevance to Ganga River, in terms of similar species or genus were segregated for further in-depth study.

Results: The Ganga River and its associated wetlands are crucial habitat for approximately 128 species of birds including 52 species of migratory and 76 species of resident water and water-associated birds, which are indicators of the health of the fragile riverine ecosystem. A total of 154 peer-reviewed articles were collated and 53 research articles were found relevant for the evaluation. The functional role of the waterbirds determined through their feeding and behavioral pattern suggest that there is a close relation between the feeding guilds and the functions provided by different families. They have profound positive effect on aquatic biodiversity, contribute to biological pest control, act as indicators of conditions of freshwater ecosystems and help in nutrient influx from terrestrial to aquatic ecosystem and also contribute in waste removal and disease control.

Conclusion: The study suggests that the avian fauna play a crucial role in ecosystem functioning. However, the studies on functioning of the birds from India are sparse and calls for functional role specific studies.

Keywords: Waterbird, functional role, feeding guild, Ganga, habitat

Project Title: Biodiversity Conservation and Ganga Rejuvenation (Component-I)
Principal Investigator(s): Dr. S. A. Hussain, Dr. Ruchi Badola
Researcher(s): Shuchismita Das (Project Fellow)
Funding Agency: National Mission for Clean Ganga
Project Duration: 2016 - 2019
Building a common vision: Integrating the role of line agencies in biodiversity conservation

-Ekta Sharma

This study divulges the potential role of line agencies in Biodiversity and Ganga Conservation and outlines a proved method to foster their harmonization and participation for the sustained long-term vision.

The study was carried out in Uttarakhand, Uttar Pradesh, Bihar, Jharkhand, and West Bengal.

The site-specific active line Agencies (n=60) were identified through literature review and snowball sampling technique. To involve them in the project activities, the Consultative Meetings (n=530) were conducted to understand their agenda and discuss the possibilities of convergence to link it with conservation of the Ganga biodiversity. A collaborative approach was adopted to enhance the effectiveness of livelihood training programmes (n=25) and biodiversity conservation activities.

The concept of the study was that if local communities receive sufficient benefits from onsite active line agencies that depend on aquatic biodiversity of Ganga River, then they would act in support of Biodiversity conservation and counter internal threats. To give river conservation a common vision, we united different stakeholders through regular consultative meetings, education, and communication with each possible strata (n=2076) that resulted in a holistic support in the conservation efforts. These efforts resulted in collaboration of various Governmental and Non-Governmental organizations with riverside communities. Several activities in the interest of conserving the Ganga aqualife such as reducing the dependency on natural resources through alternate livelihood activities (n=142), Sensitization workshops (n=122), Boat Exhibition (n=1), Plantation drives (n=18) and Awareness Campaign (n=530). This approach brought together and analyzed expert’s knowledge to estimate the effectiveness of the conservation strategy and on ground implementation.

From the study, it was concluded that common vision approach by involving line agencies and developing linkages with community participation can help in providing maximum budget that is worth investing for river conservation and helps in building support to achieve large-scale and sustainable coordination for on ground implementation of conservation efforts.

Project Title : Biodiversity Conservation and Ganga Rejuvenation
Principal Investigator(s) : Dr. S.A. Hussain and Dr. Ruchi Badola
Researcher(s) : Ekta Sharma (Project Fellow), Pariva Dobriyal (Project Scientist), Hemlata Khanduri (Livelihood Officer), Deepika Dogra, Vipul Maurya (Project Associate), Aditi Dev, Amanat Kaur Gill (Project Fellow), Md. Rahil, Sunita Rawat (Community Officer), Sumit Nautiyal, Sonal Jain (Pro. Asst.)
Funding Agency : National Mission for Clean Ganga
Project Duration : 2016-19
Breeding status and distribution of four riverine bird species in the Ganga river, Uttar Pradesh, India

P. Gangaiamaran and Ajay Prakash Rawat

The Ganga River provides a mosaic of habitat, which harbour several riverine bird species to assemble and interact. Riverine birds are the good health indicator of the riverine ecosystem. Due to many natural and anthropogenic factors, these habitats are in serious threat, causing a decline in the population of these bird species. Considering these disturbances and the declining population of the riverine birds, this study was conducted in Uttar Pradesh along the Ganga River, as it is one of the major breeding grounds for these birds. The study aimed at identifying the breeding status and distribution of these birds along with the factors affecting their distribution.

1380 km river stretch of Ganga River Bijnor to Ballia was surveyed between April and May 2018 on a motorboat. All the encountered river islands and riverbanks were surveyed to identify nesting sites of the breeding birds. Of the 92 riverine bird species along Ganges 82 are found distributed in U.P. Of this, we selected four species of riverine breeding bird's viz. Little Pratincole Little tern, Indian Skimmer and River Tern; were monitored for total number of individuals, number of nests and clutch size.

A total of 3,230 individuals were identified of which 2024 of Little Pratincole with 323 nests, 702 of Little Tern with 247 nests, 304 of Indian Skimmer with 66 nests and 200 of River Tern with 27 nests. The mean clutch size of Little Pratincole was 1.67 ± 0.53, Little tern was 2.18 ± 0.78, Indian Skimmer was 2.12 ± 1.13 and River Tern was 2.48 ± 0.75.

The results indicate that this stretch of river is highly suitable as a breeding ground for these birds. However, the increasing disturbances might lead to the destruction of its habitat, for which continuous monitoring and further studies needs to be carried out. There might also be possibilities of new breeding sites for this bird in other stretches of the Ganga River, which will be surveyed in future.

**Keywords:** Aquatic biodiversity, river islands, breeding birds, clutch size

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**Project Title:** Biodiversity and Ganga Conservation (Component 2 - Planning Aquatic Species Restoration of Ganga River)

**Principal Investigator(s):** Dr. Gopi G.V., Dr. S.A. Hussain and Dr. J. A. Johnson

**Researcher(s):** P. Gangaiamaran and Ajay Prakash Rawat (Project Fellows)

**Funding Agency:** National Mission for Clean Ganga

**Project Duration:** 2016-19
Ganga Aqualife Rescue and Rehabilitation Centre, Narora: Success story of a unique partnership

-Aftab Alam Usmani

The project aims to assist NMCG in establishing 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 was established in the township of Narora Atomic Power Station (NAPS), in Narora, Uttar Pradesh in 2016. The Centre is being managed and run under the supervision of expert veterinarians and serves as an apex centre in the Upper Ganga Region for rescue, rehabilitation and husbandry of aquatic higher vertebrate fauna under stress.

A total of 142 individuals of turtles belonging to ten species and two Muggers (Crocodylus palustris) were rescued so far and released upstream of Narora barrage and in wetlands. A rapid response team is in place to address emergent 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 and awareness.

Capacity building programmes are frequently organised for rapid response team, 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 an awareness centre for local communities and school children in addressing issues related to the Ganga River and its biodiversity. The Centre is often visited by the Hon’ble Minister of Jal Shakti, NMCG Officials and NAPS representatives for periodic review.

Keywords: Aquatic fauna, confiscation, veterinary, husbandry, training

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Livelihood interventions for engaging local communities in Ganga conservation

-Hemlata Khanduri, Sunita Rawat and Sonal Jain

Aim: The aim of this study is to share the effectiveness of the livelihood interventions taken to ensure community participation in biodiversity conservation of Ganga River.

Location: The study is based on five sites situated along the Ganga River in Uttar Pradesh, Uttarakhand and Jharkhand state, where the livelihood trainings have been conducted.

Methods: To ensure seek community participation in conservation of the biodiversity of Ganga River, meetings, consultations and trainings were organized at villages situated along the Ganga River. After regular interaction it was felt that there is a need to create a platform to engage the community, especially women, in the conservation activities. After discussions livelihood centre/trainings came out as an agreed option. Presently 21 Trainings have been conducted in district, Varanasi and Bulandshahr in Uttar Pradesh, Uttarkashi and Yamkeshwar in Uttarakhand and Shahibganj in Jharkhand. 565 Participants attended these trainings provided in skills, like sewing and stitching, Prasad and incense stick making, Health and wellness, Fruit preservation, Bakery and Handicrafts etc.

Results: Women and young girls, who were not coming out from their homes, turn out in a big number in these livelihood centres. These centre have become a platform to create awareness about the importance of Ganga Biodiversity and it’s conservation, as regular awareness sessions and drives are conducted in these trainings. After attending the training large numbers of women registered themselves as Ganga Praharis and are participating actively in the Ganga conservation activities in their respective areas, and also motivating others for the same. Besides this their ownership to the program has also increased as their earning increased.

Conclusion: Livelihood interventions play an important role in establishing a link/connect between the program and the community. It can help communities by providing additional incomes, while protecting and maintaining resources and the environment.

Keywords: Community participation, biodiversity, consultations, awareness, skill
Ganga Prahari Kumbh Programme

- Mohd. Rahil, Rajeev Chauhan, Vipul Maurya and Mansi Bijalwan

**Aim:** The Kumbh Mela at Triveni Sangam in Prayagraj witnessed approximately 150 million visitors in 2019. This served as a huge platform for reaching out to the public and spread awareness. Present study conducted to mobilize Ganga Praharis in Kumbh 2019 for ensuring Ganga cleanliness and biodiversity conservation.

**Location:** Prayagraj, Uttar Pradesh

**Methods:** A dedicated team of Ganga Praharis were recognized, trained and positioned at various locations at the Mela to ensure a clean Kumbh. Prior to the commencement of the Kumbh, Ganga Praharis from six districts of Uttar Pradesh were selected, mobilized and trained in conducting awareness campaigns, cleanliness drives and rescue and rehabilitation operations. These Praharis were deputed at the Mela on a rotational basis and were deployed in the Mela premises viz., NMCG Pavilion, Parmarth Niketan, Sangam and Ghats of Ganga and Yamuna rivers.

**Result:** Ganga Praharis assisted the WII-NMCG team, Prayagraj Mela Authority and the Ganga Task Force in outreach activities such as awareness rallies in and around Kumbh Mela ground, guiding and helping visitors, performance of the street plays and distribution of awareness material among visitors and pilgrims, cleanliness and sanitation drives and biodiversity conservation efforts including rescue of stressed aquatic animals. Linkages and collaborations with other Government programmes and schemes working towards the similar goals were established. An aggregate of 2997 Ganga Prahari days were invested in various activities during the Kumbh Mela programme where a total of 128 awareness campaigns and 77 cleanliness drives were conducted at NMCG pavilion, Kumbh Mela ground and ghats respectively. One species of turtle (*Lissemys punctata*) and 37 bird species were recorded during the regular biodiversity surveys. Two rescues (one gull and one turtle) were done with the support from the veterinarians at sites.

**Conclusion:** We used a novel platform of demonstration how local people as Ganga Praharis can contribute for Ganga cleanliness, biodiversity conservation and rejuvenation.

**Keywords:** Community awareness, awareness, Kumbh, biodiversity conservation

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**Project Title** : Biodiversity and Ganga Conservation (Component 5- Community Based Conservation Programme)

**Principal Investigator(s)** : Dr. Ruchi Badola and Dr. S.A. Hussain

**Researcher(s)** : Community Officer

**Funding Agency** : National Mission for Clean Ganga

**Project Duration** : 2016-2019
Cover: Indian Skimmer (Rynchops albicollis).
The photo is clicked by Mr. Nilanjan Chatterjee

Online Submission
Sh. Dinesh Singh Pundir

Report Formatting & Design
Sh. Virendra Sharma

Cover Design
Dr. Bilal Habib