NMCG-WII GANGA
BIODIVERSITY CONSERVATION
INITIATIVE PHASE II

PLANNING AND MANAGEMENT FOR AQUATIC SPECIES CONSERVATION AND MAINTENANCE OF ECOSYSTEM SERVICES IN THE GANGA RIVER BASIN FOR A CLEAN GANGA

PROGRESS REPORT
JULY – DECEMBER 2022



नमामि गंगे

भारतीय वन्यजीव संस्थान
Wildlife Institute of India

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Progress Report
July – December 2022

Project Investigators
Ruchi Badola, Syed Ainul Hussain

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Shivani Barthwal, Anita Devi

Text Compilation

Component 1: Anupam Srivastav, Zeeshan Ali, Goura Chandra Das, Richika Sah, Aftab Usmani, Ajit Kumar, Neeraj Mahar, Ravindra Nath Tripathi, Umang Agnihotri

Component 2: Sangeeta Angom, Aakash Mohan Rawat

Component 3: Pariva Dobriyal, Hemlata Khanduri, Sandhya Joshi, Deepika Dogra, Ekta Sharma, Malvika Pandey, Mohit Kashyap, Nidhi Singh

Maps
Zeeshan Ali, Aishwarya R. Chandran, Srijani Guha, Ashish Mani, Shatakshi Sharma

Infographics
Shatakshi Sharma

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Maheshanand Pandey

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Wildlife Institute of India
Chandrabani, Dehradun - 248002,
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D. P. Mathuria, Executive Director (Technical)
Brijesh Sikka, Senior Consultant
Sandeep Behera, Biodiversity Consultant
Sunil Kumar, Assistant Engineer

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Y. V. Jhala, Dean

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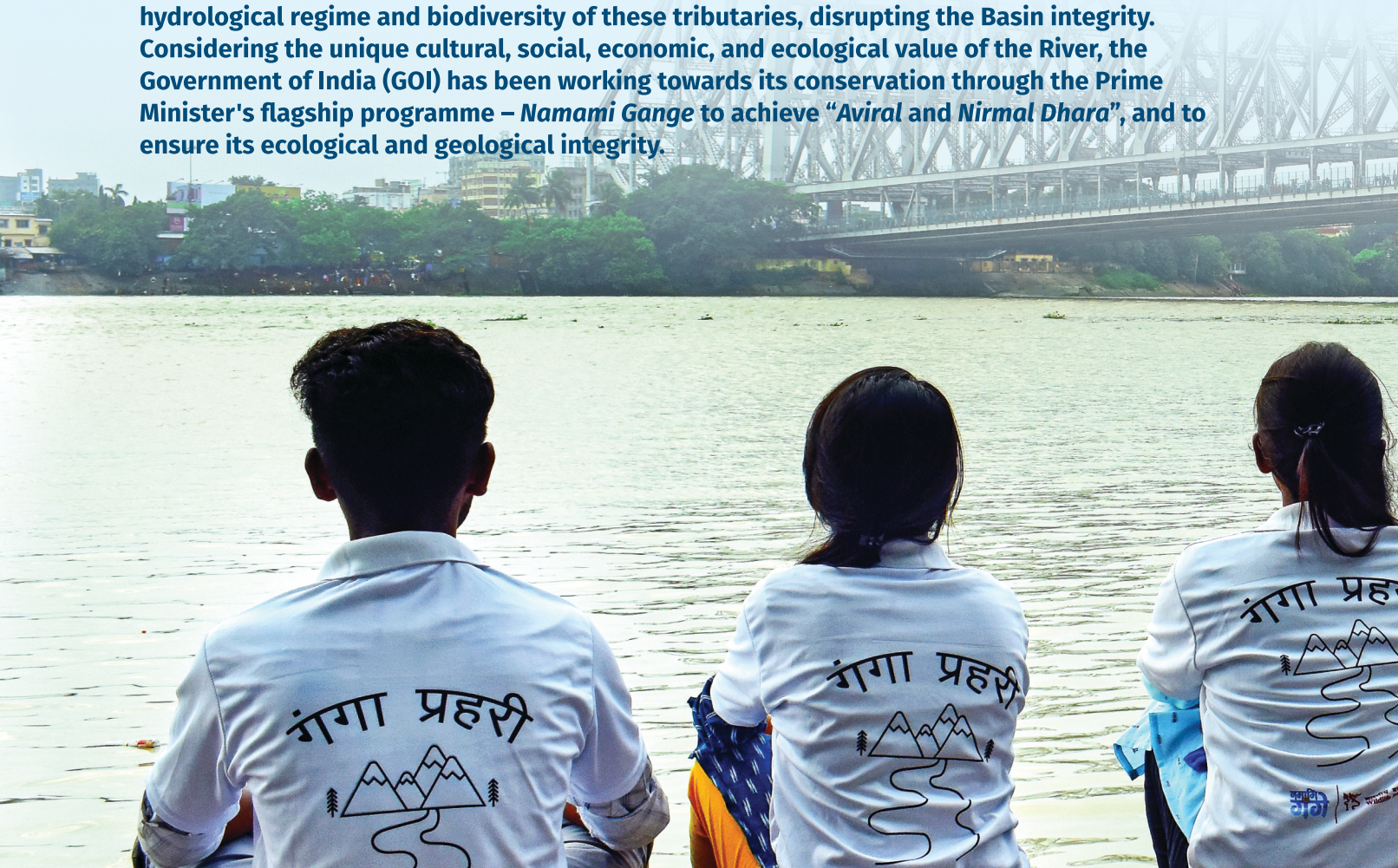
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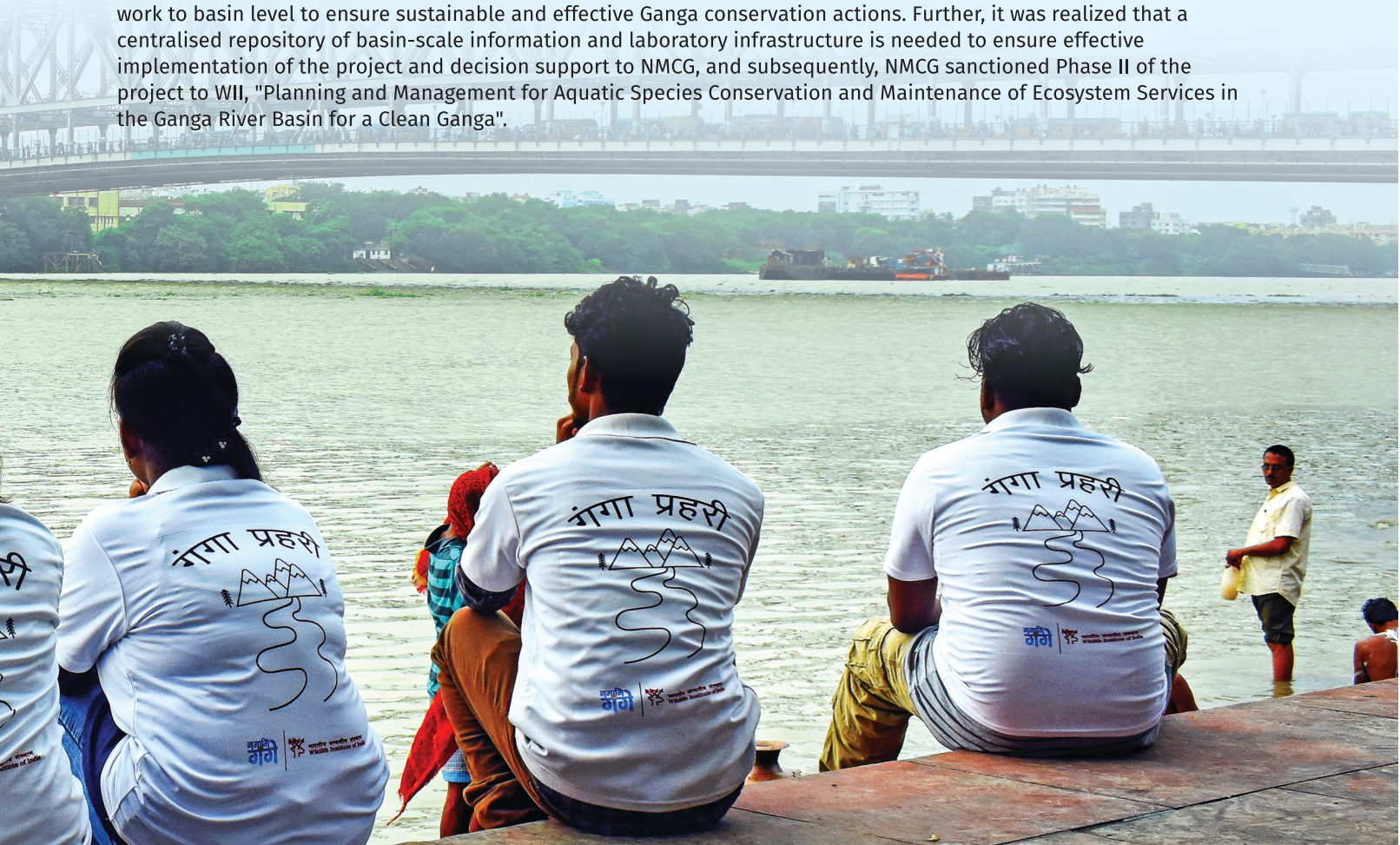
BACKGROUND

The Ganga River Basin covers India's 26.3% landmass, which is spread across 11 states, viz. Himachal Pradesh, Uttarakhand, Uttar Pradesh, Delhi, Haryana, Rajasthan, Bihar, Jharkhand, Chhattisgarh, Madhya Pradesh, and West Bengal. In terms of temperature, geomorphology, soil, biogeography, culture, and socioeconomic structure, the basin exhibits a significant degree of heterogeneity. The Ganga River's drainage basin is an intricate network of rivers and streams of Himalayan and Peninsular origin that contribute to 60% of its water flow. Alaknanda, Ramganga, Gomti, Ghaghra, Gandak, and Kosi are among the major tributaries that enter Ganga's north-bank and have their origins in the Himalayas. While the Yamuna River, which has its source in the Himalayas, and the Son River, which has its source in Peninsular India, are the main south-bank tributaries. The Ghaghra River contributes 20% to Ganga's water, while the Yamuna River contributes 16%. Ghaghra-Gomti, Kosi-Mahananda, Gandak, Yamuna, Son, Chambal, and Ramganga drains water into the Ganga in decreasing order. The Ganga River splits in Farakka, West Bengal, into the Padma River, which flows towards Bangladesh, and the Hooghly River, which runs through West Bengal and joins the Bay of Bengal, forming the world's biggest delta, the Sundarbans. The Peninsular rivers, namely Ajay, Rupnarayan, and Kangsabati (Kansai) revitalise the drainage of the Hooghly River. Along with improving the flow of the Ganga, these tributaries provide vital breeding grounds and refuge for aquatic keystone species. For example, the Nayar River provides a breeding grounds for the Golden mahseer (*Tor putitora*), while the Chambal and Ramganga rivers are breeding grounds for gharial (*Gavialis gangeticus*). Whereas, Yamuna, Kosi, and Gandak rivers have breeding populations of Gangetic dolphin (*Platanista gangetica*). However, tributaries such as the Yamuna also discharge significant pollutants into the Ganga River, which has a cumulative effect on interrupting the nitrogen cycle and the ecosystem's assimilative capacity. Reduced flow and riparian vegetation cover, increased siltation, wastewater inflow from rural and urban areas, and unsustainable resource extraction have resulted from land use and land cover changes surrounding these streams. These anthropogenic influences have modified the hydrological regime and biodiversity of these tributaries, disrupting the Basin integrity. Considering the unique cultural, social, economic, and ecological value of the River, the Government of India (GOI) has been working towards its conservation through the Prime Minister's flagship programme – *Namami Gange* to achieve "*Aviral* and *Nirmal Dhara*", and to ensure its ecological and geological integrity.



Conservation of both the Ganga River and its aquatic biodiversity thus has been one of the most important attributes of the *Namami Gange* programme. Given this, the National Mission for Clean Ganga (NMCG) designated the Wildlife Institute of India (WII), an autonomous institute of the Ministry of Environment, Forest and Climate Change, Government of India as the lead knowledge partner of NMCG and entrusted WII with the "Biodiversity Conservation and Ganga Rejuvenation" project to prepare a science-based aquatic species conservation plan for the Ganga River. WII as a lead knowledge partner and conservation planning body of NMCG created the Ganga Aqualife Conservation Monitoring Centre (GACMC) to spearhead the conservation of the Ganga River and its biodiversity.

GACMC has a repository of information on biodiversity and issues of the Ganga River. It continuously provides information on third-party queries to NMCG and Forest Departments of Ganga states. The spearhead teams comprising of the officials of the Forest Department of the Ganga basin states are carrying out training and ecological survey activities on their own such as Gangetic dolphin survey in Bihar, migratory bird survey at Sahibganj, Jharkhand, and training on ecological monitoring of rivers and wetlands in West Bengal. Stakeholders comprising personnel of the Forest and Veterinary departments, university professors, school teachers and students, religious groups, and local communities have been trained and sensitised. The rescue and rehabilitation centers established under the project enabled the Forest Department to scientifically tackle large consignments of confiscated aquatic animals, especially turtles of the Ganga River. The rescue team has successfully rehabilitated gharial, mugger, and more than 6,000 turtles back into the Ganga River, translocated muggers, and assisted in species restoration in the River. The trained cadre of forest staff, veterinarians, and a network of local communities and Ganga Praharis have improved the information network for poaching/entrapment/ trade of the threatened aquatic species of the Ganga River. Livelihood and skill enhancement activities for local communities are aligning Ganga conservation with the green economy through livelihood centers, including the innovative mobile livelihood center "Jalaj". Trained volunteers, "Ganga Prahari", from riverside- communities are adopting sustainable livelihood practices and promoting sustainable use of natural resources, conducting cleanliness drives, plantation drives, biodiversity monitoring, and rescue operations, and actively participating in all NMCG activities. The specific skill set and the workforce of these Ganga Praharis are being recognised at the state as well as the national level inspiring more youth to join the cadre. Nature interpretation centers, "*Ganga Darpan*" and "*Ganga Avlokan*", are playing a major role in public outreach. The social media pages such as Facebook and Instagram, are followed by more than 3,000 people across the globe from all walks of life. The impact of the project is visible through the enhanced synergies between departments, agencies, and communities at local, national, and global scales, all committed to a cleaner Ganga River. Initial efforts made through the implementation of Phase I of the NMCG-WII Ganga biodiversity conservation initiative, the "Biodiversity Conservation and Ganga Rejuvenation" project, emphasised the urgent need for accounting basin scale natural and anthropogenic processes, and upscaling the present work to basin level to ensure sustainable and effective Ganga conservation actions. Further, it was realized that a centralised repository of basin-scale information and laboratory infrastructure is needed to ensure effective implementation of the project and decision support to NMCG, and subsequently, NMCG sanctioned Phase II of the project to WII, "Planning and Management for Aquatic Species Conservation and Maintenance of Ecosystem Services in the Ganga River Basin for a Clean Ganga".



PHASE II

Planning and Management for Aquatic Species Conservation and Maintenance of Ecosystem Services in the Ganga River Basin for a Clean Ganga.

OBJECTIVES

01 Strengthen the aquatic biodiversity conservation measures at six identified biodiversity hotspots along the Ganga River and monitor status of other areas.

02 Explore the natural and assisted colonisation of species of conservation significance to other stretches of mainstem Ganga River.

03 Determine the current state of aquatic environment and biodiversity of the major tributaries and wetlands in Ganga basin.

04 Identify direct and indirect drivers affecting the integrity of the aquatic environment and biodiversity in the Ganga basin.

05 Pinpoint problematic areas and identify conservation priority zones.

06 Strengthen/establish rescue and rehabilitation centres at strategic locations for aquatic species in distress.

07 Involve communities and other stakeholders in the conservation process through capacity building, innovation and strengthening existing institutions.

08 Garner support for aquatic biodiversity and Ganga conservation through education and outreach programs.

09 Identify and analyse the hydro-socio-ecological relations in the river basin for efficient and targeted conservation action.

10 Prepare an action plan to minimise the negative impacts of the direct and indirect drivers on the aquatic environment and biodiversity of the select tributaries of the Ganga basin.

11 Develop a centralised facility of laboratories and resource centre for aiding in science based management of the Ganga River and its tributaries.

AIM

To intensify the conservation efforts in identified sites along the mainstem Ganga River and up-scale the conservation effort to basin level for aquatic biodiversity conservation and maintenance of ecosystem services for a clean Ganga.

This report provides component wise information on the work done during July – December 2022.

COMPONENT 01

SCIENCE-BASED AQUATIC SPECIES CONSERVATION AND MAINTENANCE OF ECOSYSTEM SERVICES IN THE GANGA RIVER BASIN



COMPONENT 02

CAPACITY BUILDING OF THE FOREST DEPARTMENT AND OTHER STAKEHOLDERS IN MANAGING AQUATIC AND WETLAND RESOURCES



COMPONENT 03

DEVELOP COMMUNITY BASED AQUATIC SPECIES CONSERVATION AND OUTREACH PROGRAMMES FOR THE GANGA RIVER BASIN



COMPONENT 1

SCIENCE-BASED AQUATIC SPECIES CONSERVATION AND MAINTENANCE OF ECOSYSTEM SERVICES IN THE GANGA RIVER BASIN

CHANGE DETECTION

To determine the distribution of the major aquatic species in the Ganga River basin, secondary data from literature review of earlier studies were obtained and compared with the primary data gathered during the ecological assessment of the Ganga River and its select tributaries. The findings indicate that the populations of umbrella species such as the Gangetic dolphin, otters, gharials, and muggers have become extensively fragmented as a result of loss of longitudinal and lateral connection and habitat degradation.

ECOLOGICAL ASSESSMENT

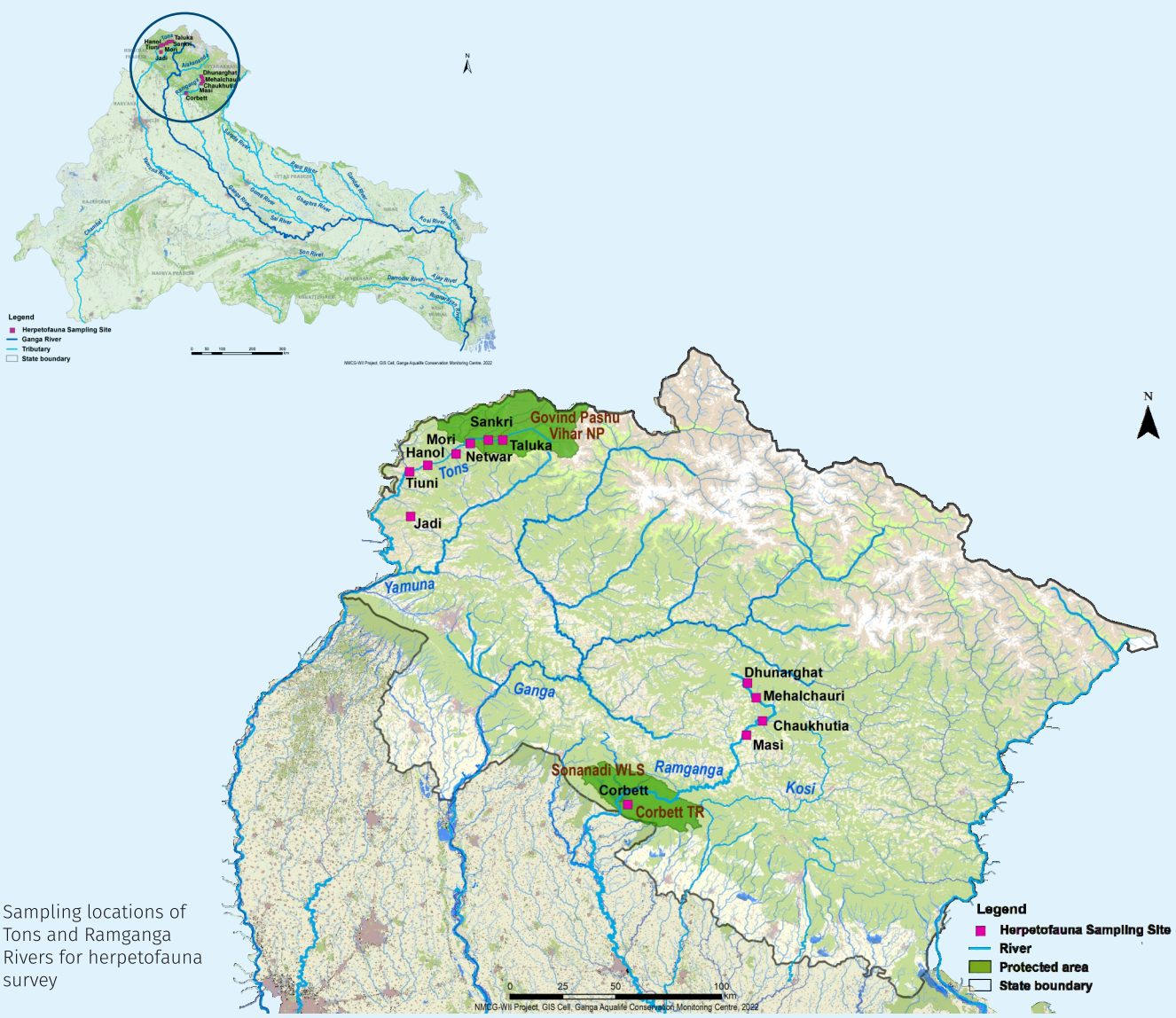
A systematic approach to river and biodiversity conservation planning

A 960 km post-monsoon higher vertebrate study was conducted in the Sharda, Babai, Rapti, Bagmati, and Mahananda rivers to determine the occupancy and encounter rate of Gangetic dolphins, smooth-coated otters, gharials, muggers, turtles, and waterbirds.

A preliminary ecological survey was conducted from June to October 2022 to document herpetofauna in the Upper Ganga basin, specifically the Tons and Ramganga rivers. Tons River is home to fourteen reptile species and eight amphibian species. Ramganga River is home to seventeen species of reptiles and eight species of amphibians. The most common amphibian species, with a relative abundance of 0.26, was the Asian common toad (*Duttaphrynus melanostictus*) (LC) (1.25 individual/hour). With a relative abundance of 0.13, Tuberculated Agama (*Laudakia tuberculate*) was the most often encountered reptile species (0.53 individual/hour).



Habitat modification, fragmentation, invasive species, overexploitation, pollution and climate change are some of the looming threats to freshwater diversity. In addition, persistent xenobiotics, nano-particles and micro-plastics pose a toxicological risk to the freshwater ecosystem. This component aims to document the aquatic diversity of the Ganga River basin and the threats to them, for science-based aquatic species conservation planning. Such documentation would aid in the decision-making process and can facilitate the prediction of future impacts under various scenarios. In addition, the loss of individuals as a result of accidental trapping in fishnets, injury by crafts, and poaching also contribute to the decline in the population of the priority species, viz. Gangetic dolphin, otters, gharial and mugger. To address such emergent situations and to abate the loss of individuals, rescue and rehabilitation centres are being strengthened/upgraded at strategic locations along the Ganga River, through this component. Such efforts would aid in effective rescue and subsequent rehabilitation of the rescued individuals.



Sampling locations of Tons and Ramganga Rivers for herpetofauna survey



Satellite Telemetry

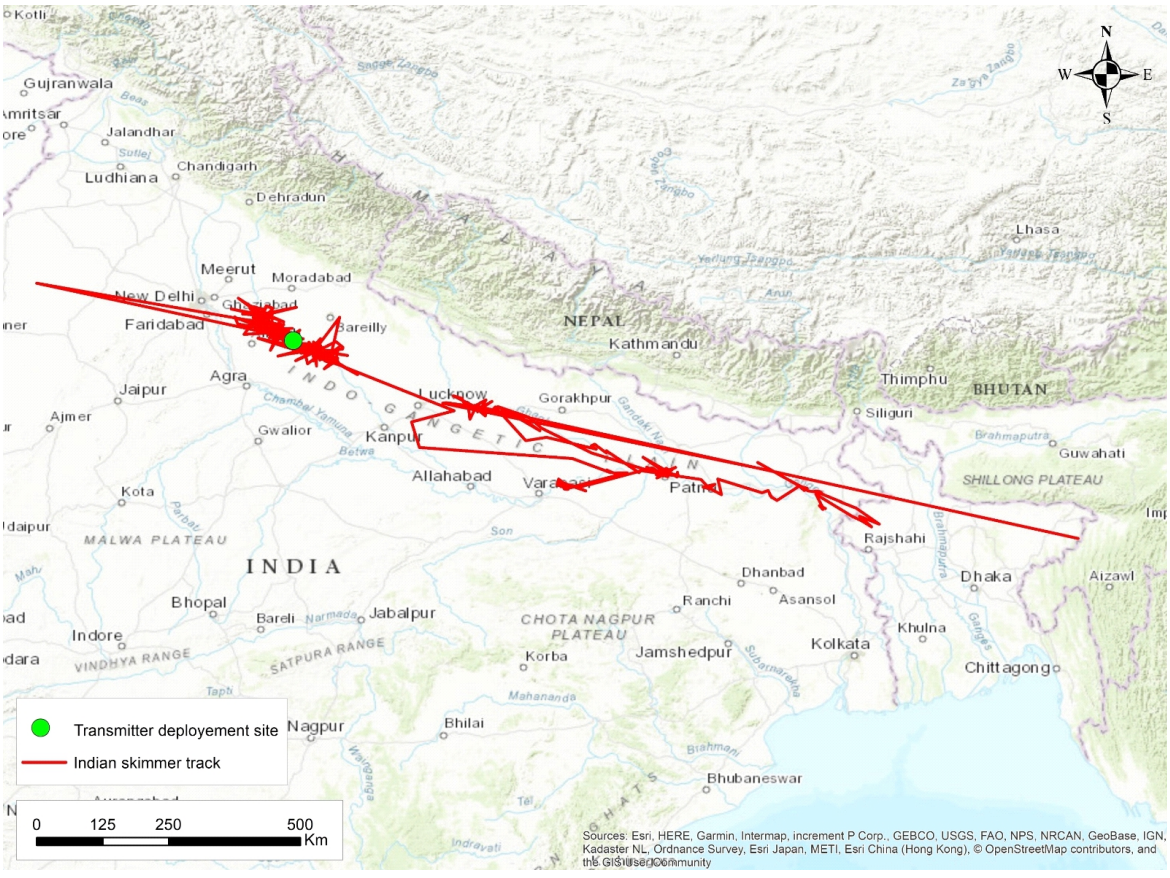
Satellite telemetry studies were carried out on Indian skimmer (*Rynchops albicollis*) and sarus crane (*Grus antigone*), to understand their movement patterns and home ranges. Two individuals each of the Indian skimmer and sarus crane were captured, satellite tagged and tracked for 159 days and 144 days, respectively.

Indian skimmer (*Rynchops albicollis*)

Indian skimmer inhabits big rivers in Western and Eastern India, as well as coastal estuaries. It is listed as 'Endangered' on the IUCN Red List of Threatened Species and under Schedule I of the Wild Life (Protection) Act of 1972. Sand mining is a growing threat to Indian skimmer breeding colonies, reducing their reproductive and foraging success. For satellite telemetry, the two individuals of Indian skimmers were captured and tagged in Bulandshahr, Uttar Pradesh. The satellite telemetry showed that these two individuals travelled a distance of 17,206 km with an average of 108.2 km/day. The longest distance covered in a single flight was 1,050 km, from Hanumangarh district in Rajasthan to Sylhet in Bangladesh. In the Ganga mainstem, the tagged Indian skimmer visited the Middle Ganga between Anupshahr and Farrukhabad and the Lower Ganga between Ghazipur and Rajmahal. It also visited the Ramganga River between Bareilly Barrage and Ganga confluence and the middle and lower stretches of the Ghaghra River.



Tagging of Indian skimmer



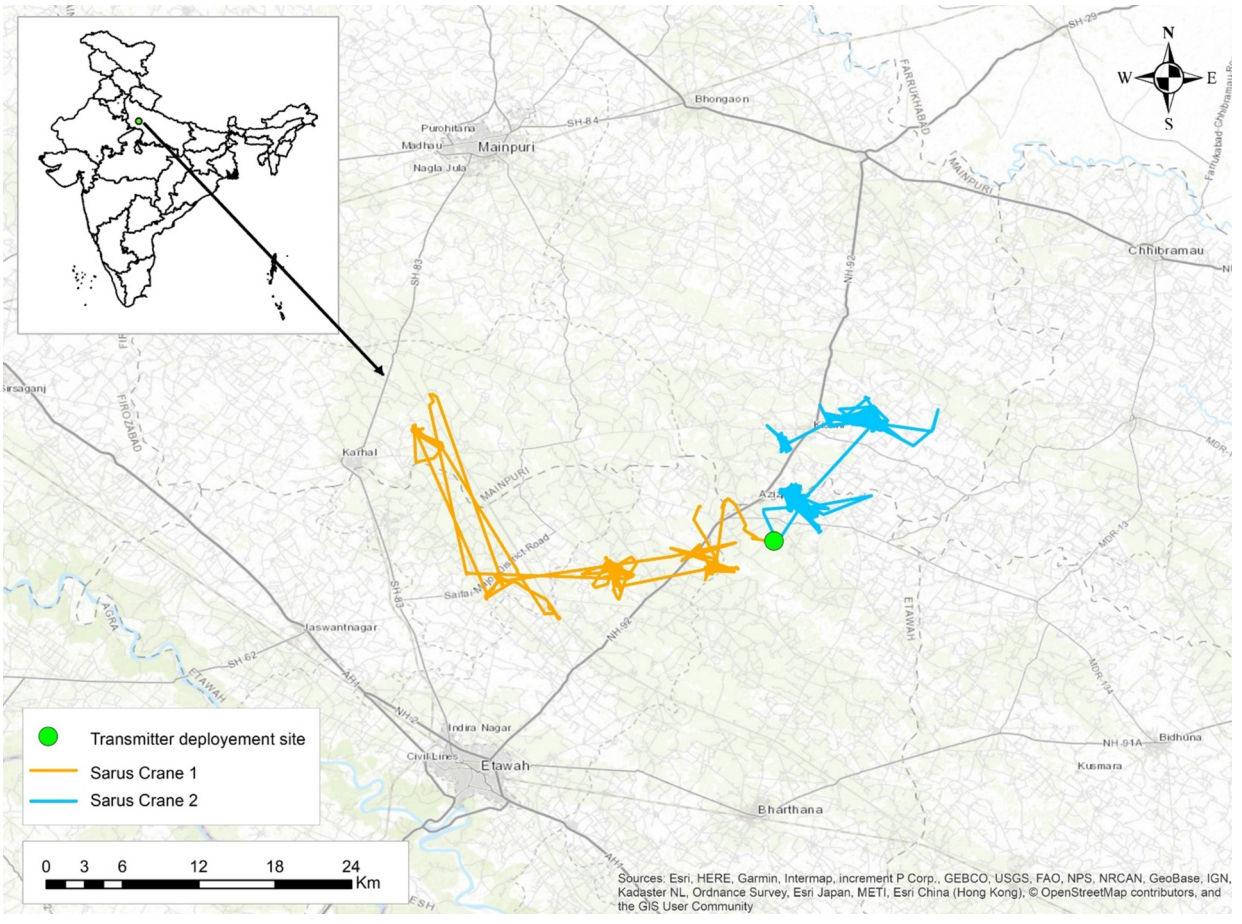
Satellite telemetry tracking of Indian skimmer

Sarus crane (*Grus antigone*)

Sarus crane is a non-migratory bird species found in Northern and Central India. Once prevalent in the rice fields of Uttar Pradesh, Bihar, Rajasthan, West Bengal, Gujarat, Madhya Pradesh, and Assam, sarus crane have declined in recent decades mainly due to habitat loss, wetland degradation, anthropogenic pressures, hunting and poaching. It is listed as 'Vulnerable' on the IUCN Red List of Threatened Species and under Schedule I of the Wild Life (Protection) Act of 1972. For satellite telemetry, the two individuals of sarus cranes were captured and tagged in the Sarasai Nawar wetland in Etawah, Uttar Pradesh. The satellite telemetry showed that the first sarus crane individual travelled a distance of 288 km with an average of 2 km/day and a home range of 242 km^2, while the second sarus crane individual travelled a distance of 525 km with an average of 3.65 km/day and a home range of 89 km^2. The first individual utilised the Sarasai Nawar marsh and the paddy fields of Karhal in Etawah, Uttar Pradesh, and the second individual utilised the Sarasai Nawar wetland and Kishni paddy fields in Mainpuri, Uttar Pradesh. No overlap was recorded in the movement pattern and range of the two individuals.



Tagging of sarus crane



Satellite telemetry tracking of sarus crane



Study of Small Rivers in the Upper Ganga

Smaller tributaries of the Ganga River, such as Asan, Solani, Garra, and Chandan, were studied for their contribution to the ecological richness of the Ganga River. The Asan River supports 88% of bird and 76% of fish species found in the upper Ganga and 31.03% of reptile and 25% of amphibian species found in the entire Ganga River. The Solani River supports



Asan River Basin



Solani River Basin

87.93% of reptile species, 57% of bird species, 35.17% of amphibian species, and 21% of fish species found in Ganga River. The Garra River supports 68% of bird species, 39.66% of reptile species, 10.71% of amphibian species, and 4.6% of fish species, including 9% of invasive fish found in the Ganga River. The secondary literature review of these small tributaries also highlights the lack of scientific documentation required to understand their ecological status.



Garra River Basin



Chandan River Basin



Important Insights from the Ecological Assessment

Himalayan wolf snake (*Lycodon mackinnoni*)

Himalayan wolf snake is endemic to the western Himalayas. In India, it has been recorded from Uttarakhand and Jammu and Kashmir. It is a non-venomous snake that inhabits subtropical to temperate vegetation associated with rocky outcrops. After being first described from Mussoorie 112 years ago, the Himalayan wolf snake has been reported for the first time from the Tons valley of the Ganga basin. The species is currently listed as 'Near Threatened' in the IUCN Red List of threatened species and listed under the Schedule II of the Wild Life (Protection) Act, 1972.



Himalayan wolf snake

Elongated tortoise (*Indotestudo elongata*)

Elongated tortoise is a widely distributed species found in South and Southeast Asia. This species primarily feeds on leaves, stems, and flowers and occasionally consume mushrooms, carrion and carnivore scats. In the Ganga River basin, elongated tortoise was reported from the Ramganga River during the ecological survey. The species is currently listed as 'Critically Endangered' in the IUCN Red List of threatened species and listed under Schedule I of the Wild Life (Protection) Act, 1972.



Elongated tortoise

ACTIVE ADAPTIVE MANAGEMENT PLANNING

Priority areas to strengthen the conservation measures

Conservation Priority Stretches Based on Flagship Species

Identifying the conservation priority areas as refugia, using the flagship-cum-indicator species approach, can aid in the long-term conservation of multiple species and ensure the uninterrupted functioning of ecological processes. For effective conservation planning, the study was conducted with the Gangetic dolphin as a flagship species in the Ganga River basin.

Gangetic dolphin (*Platanista gangetica*)

The Gangetic dolphin occurs in the South Asian subcontinent's, Indus, Ganges-Brahmaputra-Meghna, and Karnaphuli-Sangu river systems, from the deltas upstream until they are obstructed by stony obstacles, shallow water, fast currents, dams, or barrages (low, gated diversion dams). The species is listed as 'Endangered' on the IUCN Red List of Threatened Species and under Schedule I of the Wild Life (Protection) Act of 1972. Unintentional mortality due to entanglement in fishing gear, poaching for dolphin oil, habitat damage owing to development projects, pollution, overexploitation of prey, and fragmented populations caused by dams and barrages are the major threats to the species.

For the identification of conservation priority stretches based on the flagship species, the data was collected along the 4,635 km stretch in Ganga, Yamuna, Chambal, Ghaghra, Gandak, Kosi, Rupnarayan and Son rivers. The study revealed that since the 19th Century, there was a 24.37% decline in the distribution range of Gangetic

dolphin (Table 1.1). The abundance estimates obtained using the N-mixture model in the Ganga River basin were 3,330 ± 620 (Table 1.2). Based on the flagship-cum-indicator species approach, 12.2% (610 km) of the surveyed stretches were designated as high conservation priority stretches (Table 1.3). Protection of these stretches is likely to ensure sustained reproduction of Gangetic dolphin and provide refugia for other threatened species of the Ganga River and its tributaries, which are under increasing anthropogenic pressure.

Table 1.1: Gangetic dolphin Range decline

Rivers	Historical distribution (Length)	Present Distribution	Range decline
Ganga	Bhimgoda-Ganga sagar (2,150 km)	Bijnor-Kanpur; Fatehpur-Ganga sagar (2,010 km)	-140 km (2.74 %)
Yamuna	Delhi-Prayagraj (1,050 km)	Bareh-Prayagraj (435 km)	-615 km (12.04%)
Chambal	Batesura-Panchnada (285 km)	Basai Dang-Bareh (235 km)	-50 km (0.98%)
Son	Bichhi - Doriganj (430 km)	No sighting (0)	-430 km (8.42 %)
Ghaghra	Girijapuri barrage-Chhapra (615 km)	Girijapuri barrage - Chhapra (615 km)	0
Gandak	Gandak Barrage-Confluence at Patna (295 km)	Gandak Barrage- Confluence at Patna (295 km)	0
Kosi	Kosi Barrage-Kursela (235 km)	Piprahi-Kursela (225 km)	-10 km (0.20%)
Rupnarayan	Ghatal-Gadiara (48 km)	Ghatal-Gadiara (80 km)	+32 km
TOTAL	5,108 km	3,895 km	-1,245 km (24.37 %)



Current distribution range of Gangetic dolphin in the Ganga River basin



Table 1.2: Gangetic dolphin population estimates using the N-mixture models

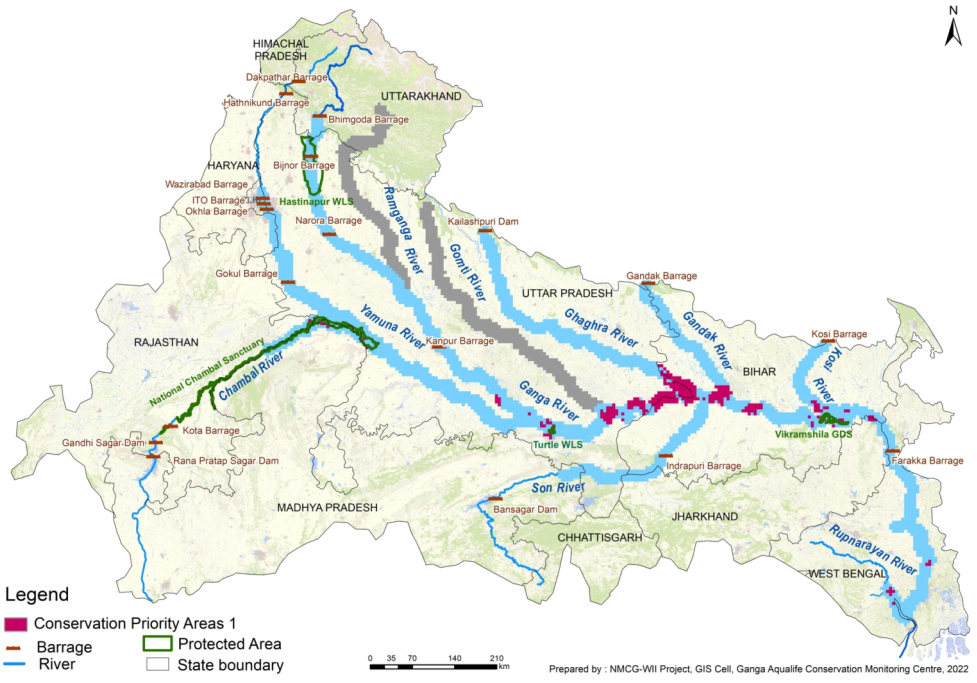
River	Surveyed length (km)	Population mean ± SE	95% CI-lower	95% CI-upper	CV
Ganga	2,070	2,009.76 ± 332.04	1,454.95	2,718.18	16.52
Yamuna	435	97.14 ± 28.49	60.98	164.05	29.33
Chambal	405	110.86 ± 27.2	70	172	24.54
Ghaghra	615	532.83 ± 108.38	349.95	766.03	20.34
Gandak	295	169.02 ± 44.84	94.98	268	26.53
Kosi	235	311.38 ± 58.56	209	434.05	18.81
Rupnarayan	80	99.48 ± 20.74	64	146	20.85
Ganga Basin	4,135*	3,330 ± 620	2,304	4,668	18.61

*4635 including 500 km of Son; CV-Coefficient of Variance

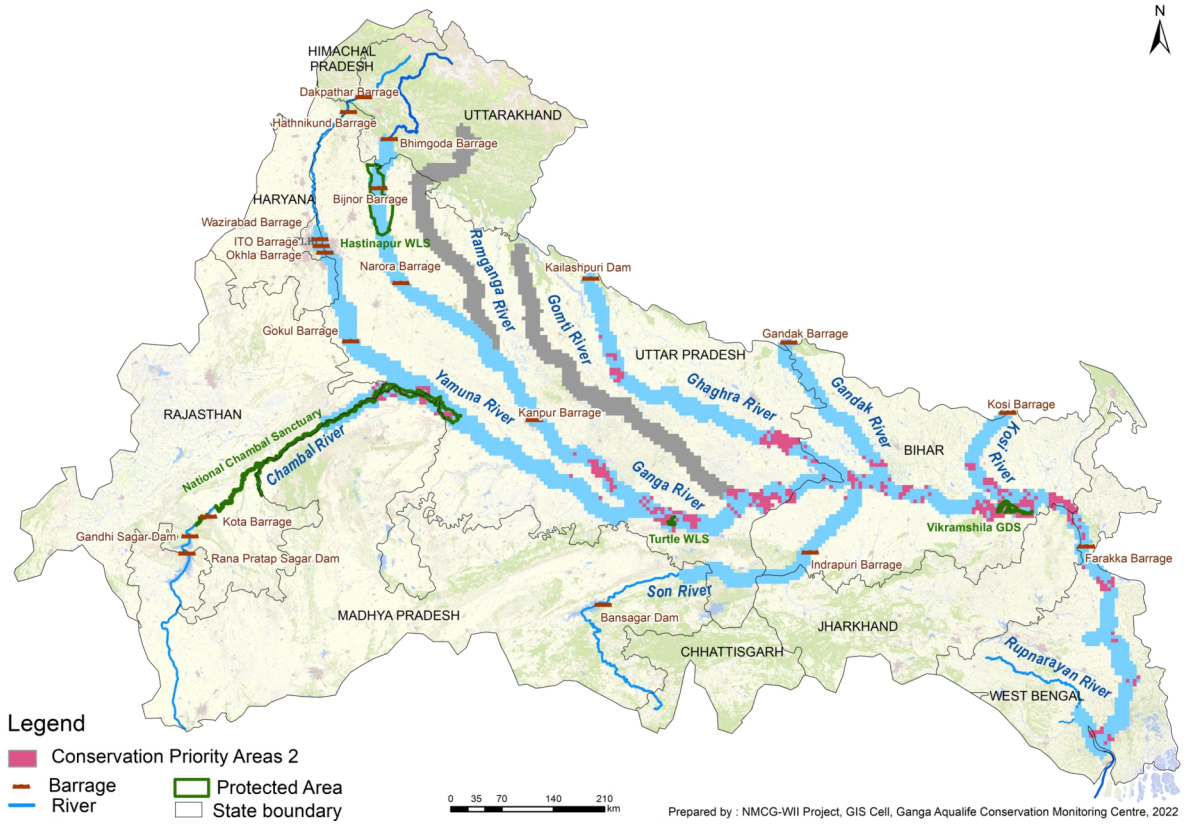
Table 1.3: Conservation priority stretches

River	Total length (km)	High Priority Stretches (CPS 1) (km)	Moderate Priority Stretches (CPS 2) (km)	Low Priority Stretches (CPS 3) (km)
Ganga	2,070	325 (6.5 %)	435 (8.7 %)	310 (8.7 %)
Yamuna	435	20(0.4 %)	50 (1.0 %)	45(0.9 %)
Chambal	405	85 (1.7 %)	60 (1.2 %)	50 (1.0 %)
Ghaghra	615	85 (1.7 %)	55 (1.1 %)	150 (3.0 %)
Son	500	5 (0.1 %)	5 (0.1 %)	20 (0.4 %)
Gandak	295	5 (0.1%)	35 (0.7 %)	75 (1.5%)
Kosi	235	70 (1.4 %)	45 (0.9 %)	45 (0.9 %)
Rupnarayan	80	15 (0.3 %)	30 (0.6 %)	20 (0.4 %)
Total	4,635	610 (12.2 %)	715 (14.3 %)	715 (14.3 %)

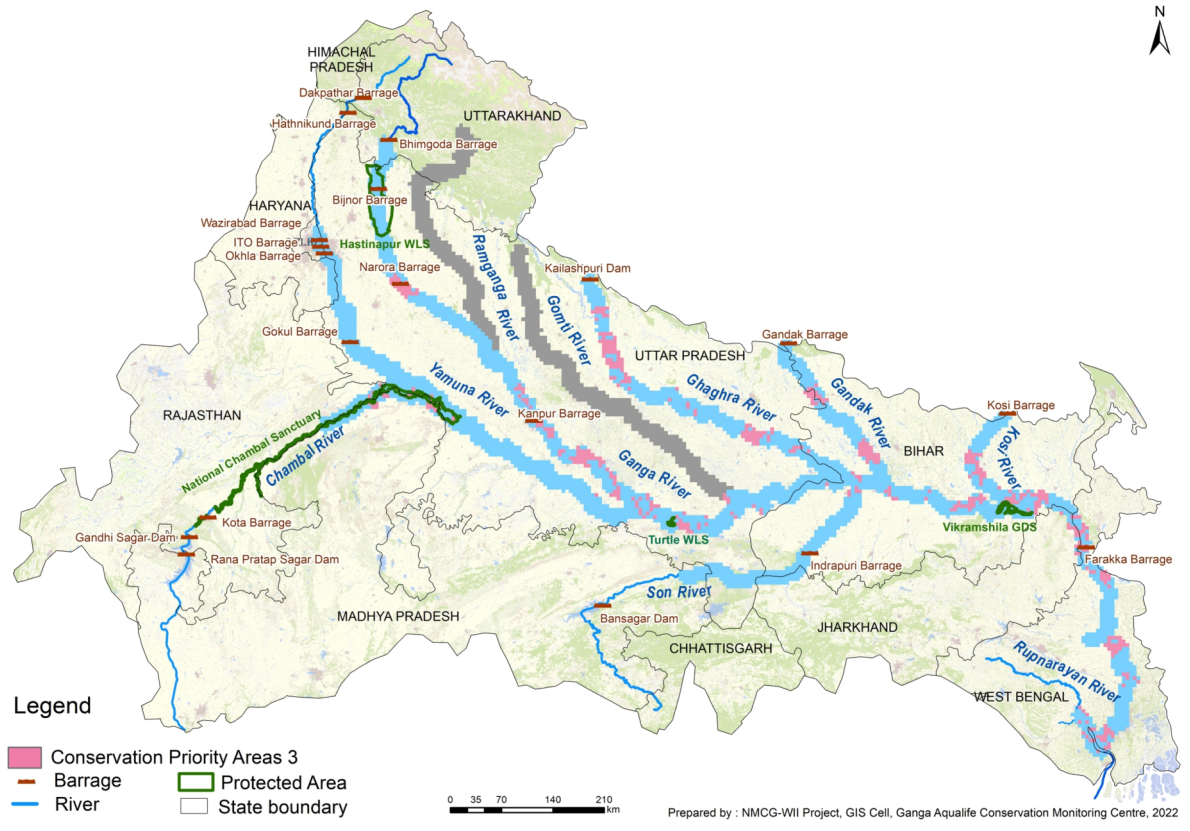
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Conservation priority areas 1, 2, and 3 in the Ganga River basin

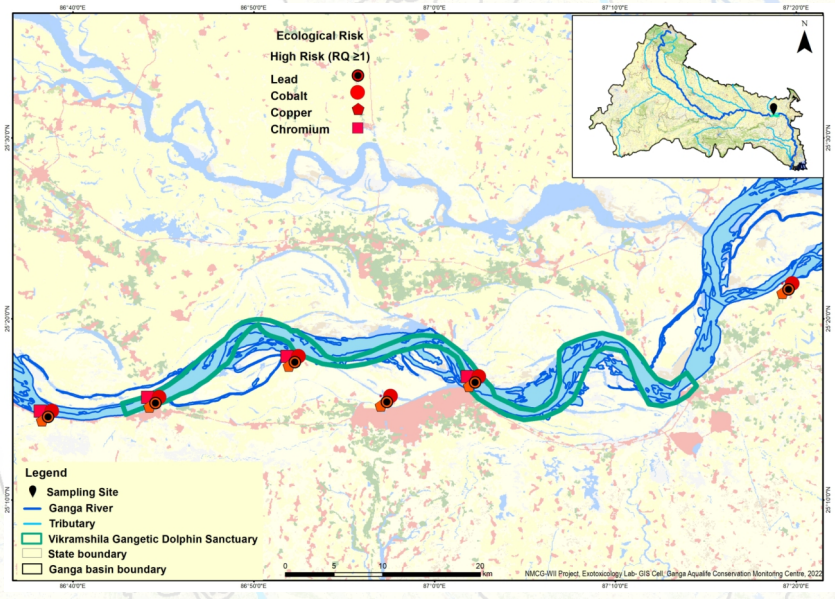


TECHNOLOGY IN ECOLOGY

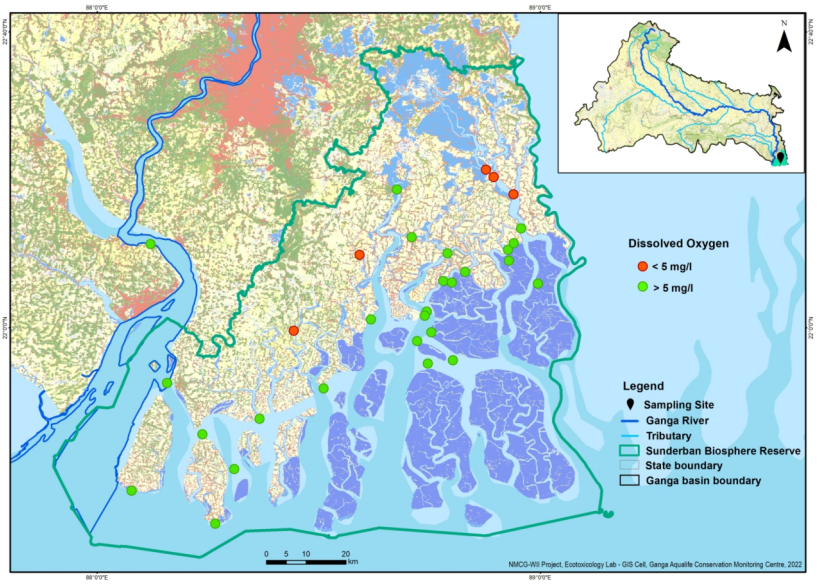
Integrating modern approaches in conservation

Eco-toxicological Assessment

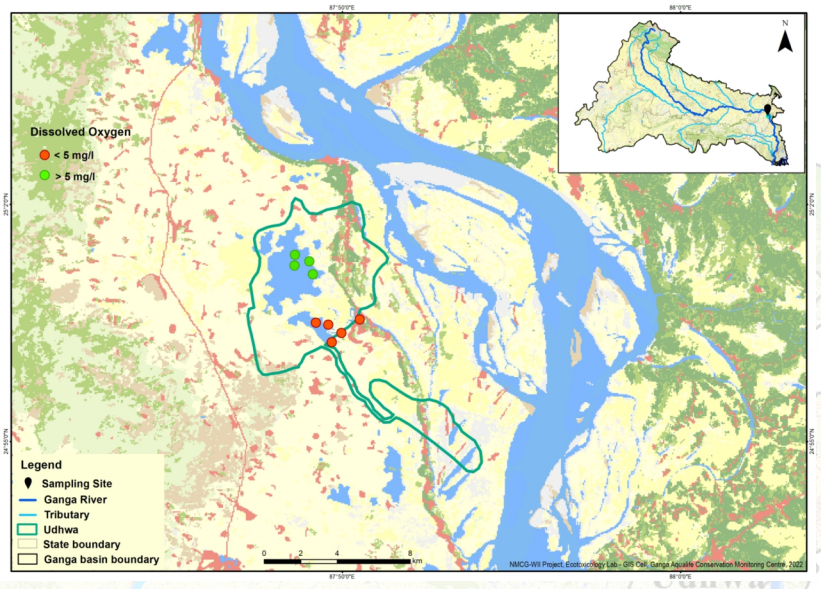
Heavy metal concentrations and water quality parameters were investigated in the surface water of five wetlands, namely Vikramshila, Gogabeel, and Kabartal in Bihar, Udhwa in Jharkhand, and Sunderban in West Bengal. For the study, a total of 200 samples were collected from 63 locations during the monsoon period from August to September 2022. The assessment of heavy metals, viz. Chromium, Copper, Cobalt, Cadmium, Arsenic, Mercury, Lead and Arsenic revealed that Vikramshila and Sunderban wetlands were at high ecological risk, while Gogabeel, Kabartal, and Udhwa wetlands were at low ecological risk. Assessment of water quality parameters, viz. pH, Dissolved Oxygen (DO), conductivity, Total Dissolved Solids (TDS), Nitrate and salinity, revealed that Udhwa, Kabartal, and Sunderban wetlands were at high ecological risk, while Gogabeel and Vikramshila wetlands were at low ecological risk.



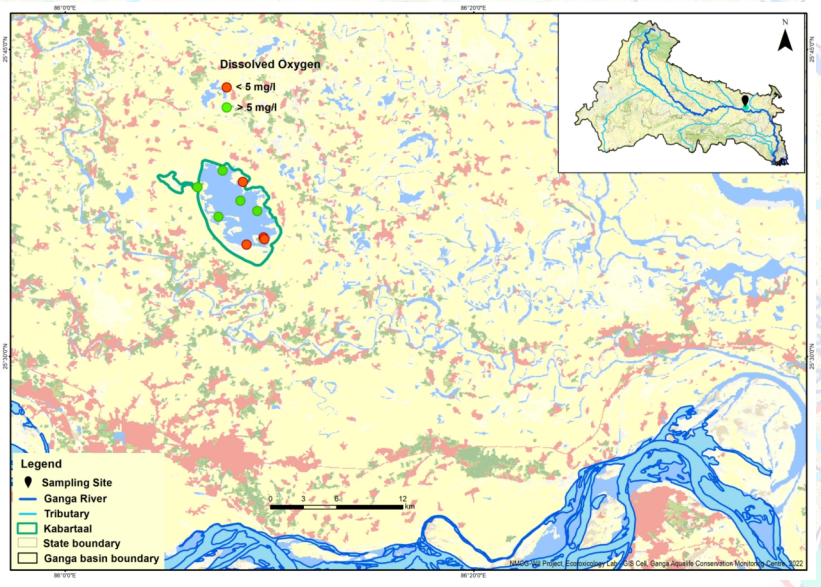
Heavy metals in Vikramshila (Bihar) and Sunderban (West Bengal) wetlands



West Bengal



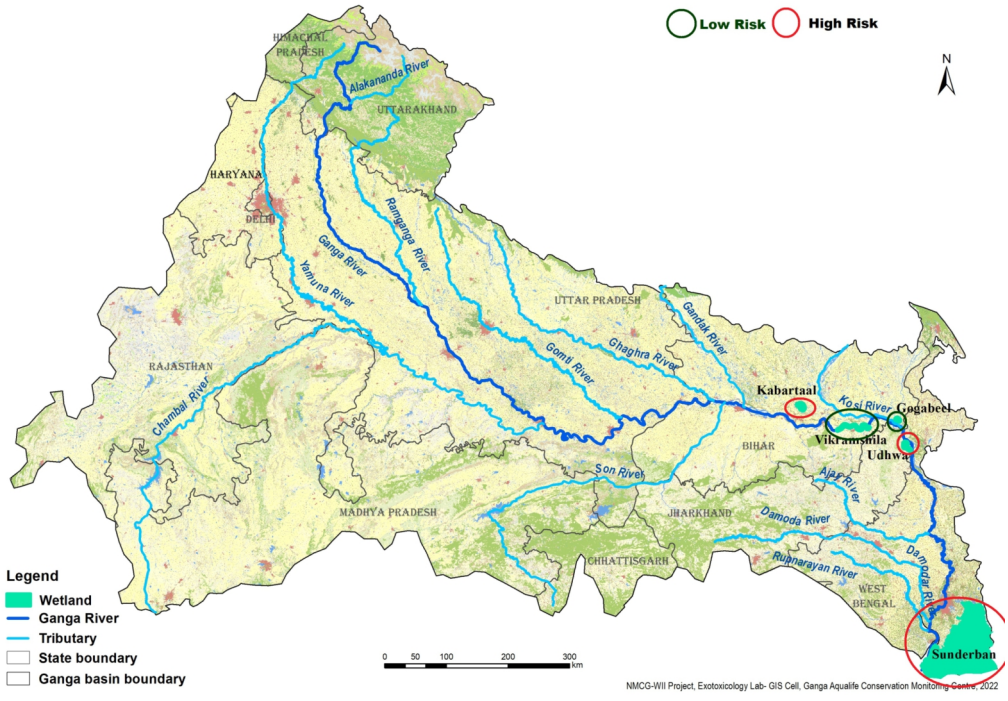
Jharkhand



Bihar

Water quality parameters of Sunderban (West Bengal), Udhwa (Jharkhand), and Kabartal (Bihar) wetlands

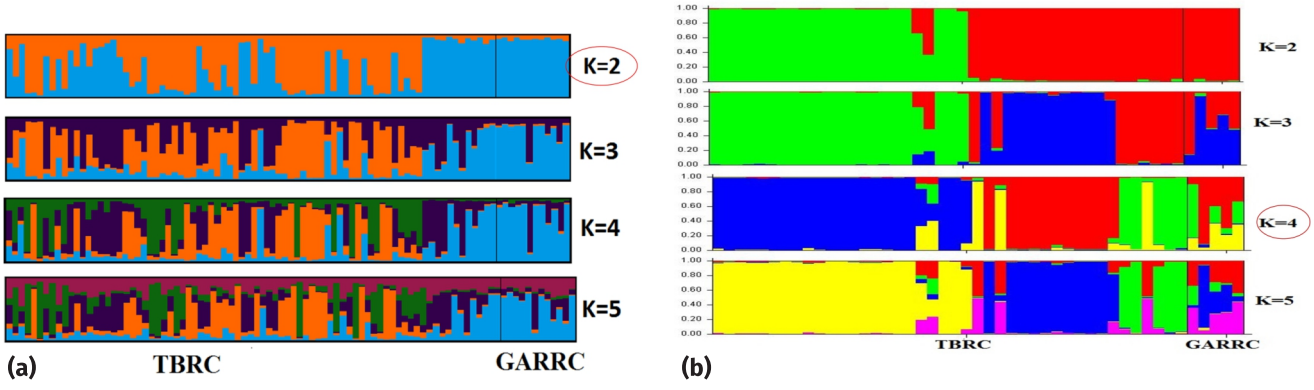




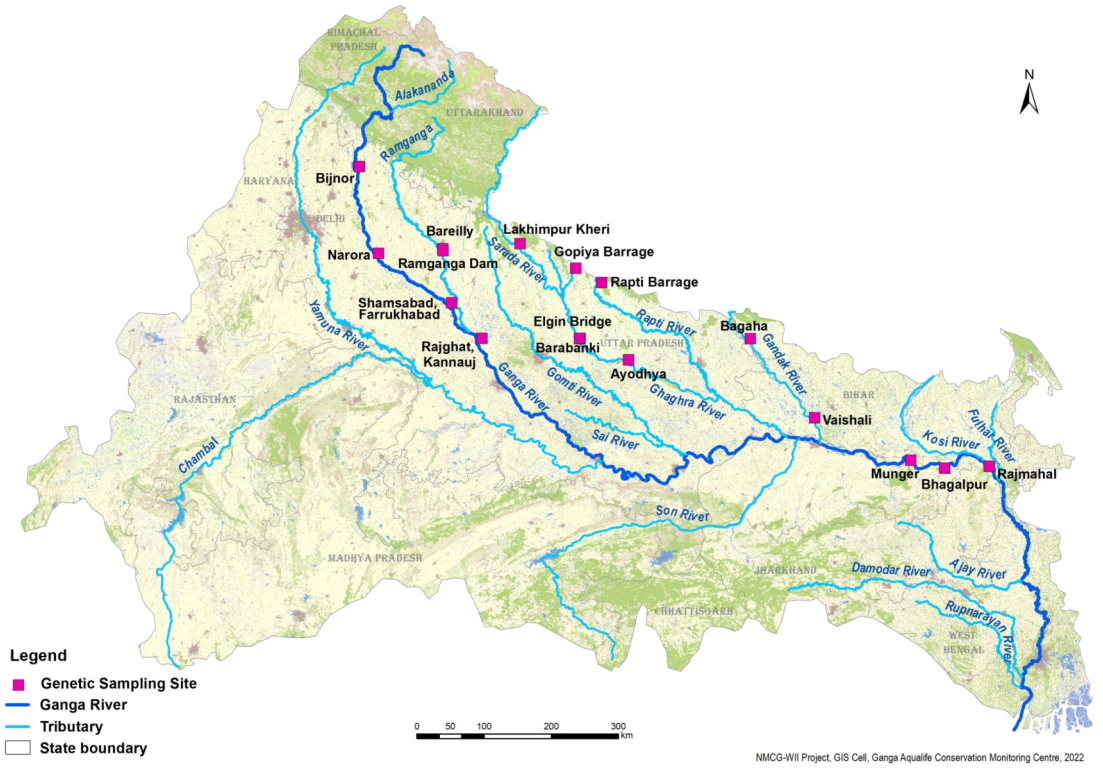
Ecological risk assessment of five wetlands in Bihar, Jharkhand and West Bengal

Genetic Analysis

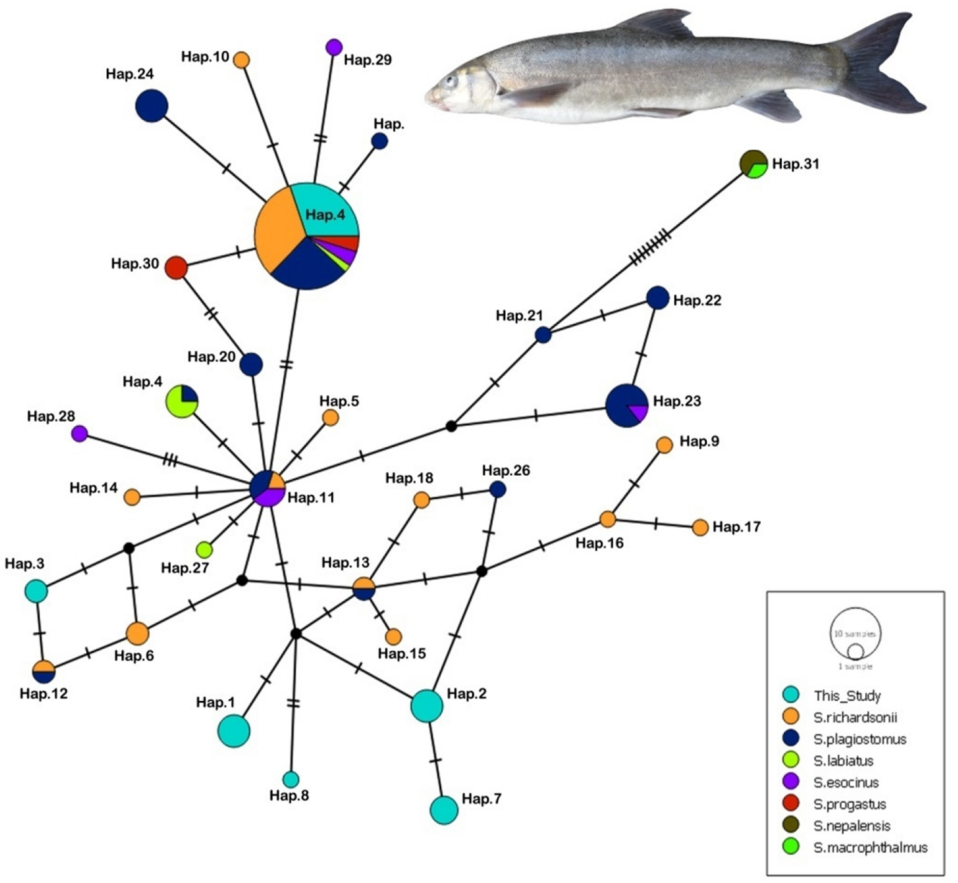
To assess genetic variability and gene flow pattern, biological samples were collected from select turtle and fish species. Genetic analysis of biological samples of Critically Endangered three-stripped roofed turtle (*Batagur dhongoka*) using microsatellite markers revealed a moderate level of genetic diversity (HE: 0.495; Ho: 0.494), whereas high mtDNA diversity (h>0.8) indicating maternal gene flow. The structure analysis of *Batagur dhongoka* also revealed the presence of two genetic clusters with the presence of few admixed assignations. Critically Endangered red-crowned roofed turtle (*Batagur kachuga*) also showed a low level of genetic diversity (HE: 0.54; Ho: 0.49) indicating low effective population size, whereas high mtDNA diversity indicating high maternal gene flow. The structure analysis of *Batagur kachuga* also indicates the presence of four genetic clusters with high genetic admixture in both Sarnath and Narora populations. Analysis of biological samples of helicopter catfish (*Wallago attu*) collected from the Ganga, Ghaghra, Rapti, Sharda, Ramganga, and Gandak rivers suggest that the samples collected from the different rivers are genetically well connected and retain high genetic diversity. In addition, well-supported unique genetic or cladding pattern was observed, but not associated with geographical distribution. Biological samples of Snow trout (*Schizothorax richardsonii*) were collected from different sites of the upper Yamuna River and compared with the populations of the Alaknanda, Bhagirathi, and Ganga rivers. The result revealed relatively low genetic differentiation among the *Schizothorax* sps. with high genetic diversity and gene flow within the species.



Population Genetic structure of a) *Batagur dhongoka* and b) *Batagur kachuga*



Biological samples collected for *Wallago attu* in Ganga River basin

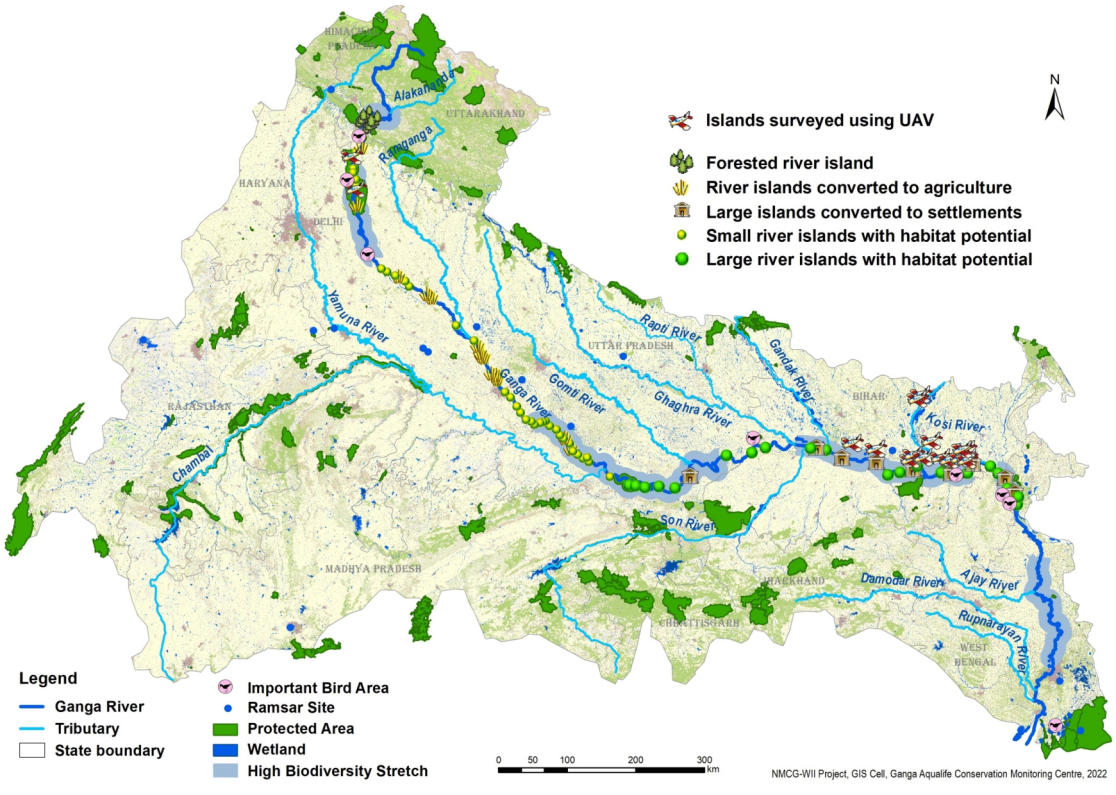


Genetic relationships of different species of *Schizothorax richardsonii*



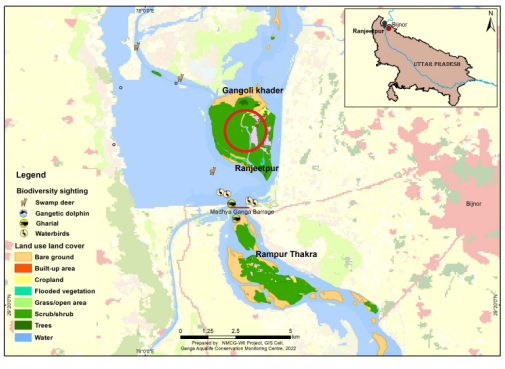
A Nested UAV-RS Approach for Monitoring the River Islands Diara

In surveillance activities such as rivers, bridges, and shorelines inspection and monitoring, an autonomous unmanned aerial vehicle (UAV) can reduce operational expenses, speed the monitoring process, and be employed in situations when a manned inspection is not possible. UAV based surveys were undertaken to study the river islands near the Hastinapur Wildlife Sanctuary. The survey revealed that the islands in the middle Ganga are smaller in size than those in the lower Ganga. The conversion of islands into agricultural fields has begun; the river islands in Rampur shows 80% disturbance, and the island of Khijarpur is being transformed, as evidenced by satellite imagery taken five years ago. The deer habitat in the nearby towns of Shirjepur, Lalpur, and Khirjurpur needs to be managed along with agricultural activity. During the survey, a rare sighting of the Indian grassbird (*Graminicola bengalensis*), which is listed as 'Near Threatened' in the in the IUCN Red List of threatened species, along with the Indian softshell turtle (*Nilsonia gangetica*) (VU) and Indian roofed turtle (*Pangshura tecta*) (LC) were recorded.



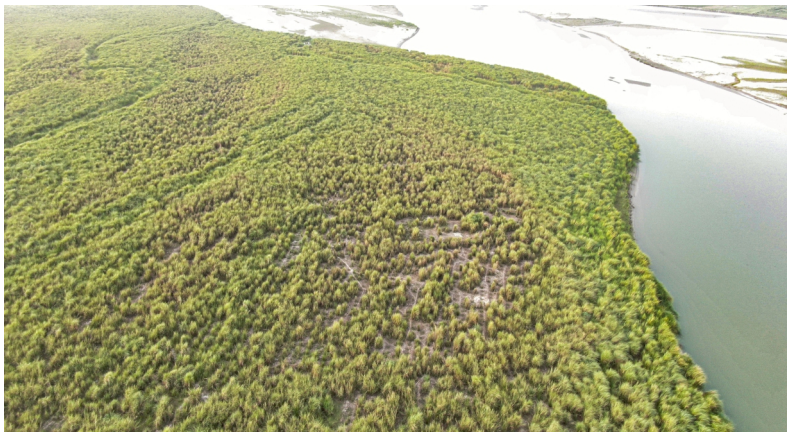
Map depicting high biodiversity stretches and UAV survey location

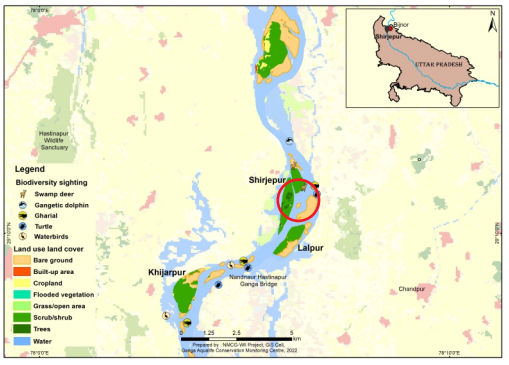
Mapping via the UAV drone



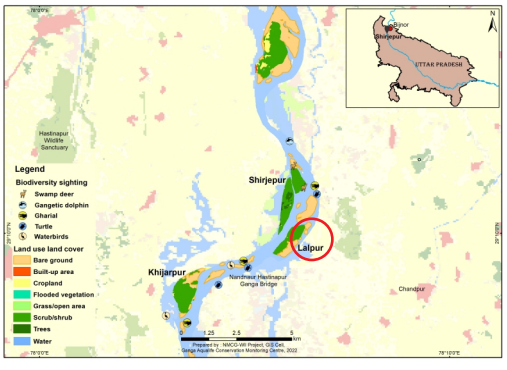


Gangoli khader/Ranjeetpur
Good habitat, scrub veg, low disturbance





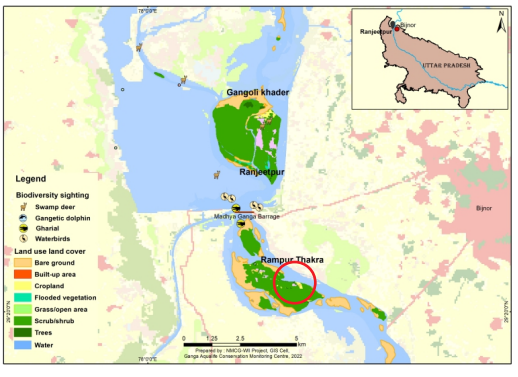
Shirjepur near Behbalpur region
Natural vegetation, low disturbance



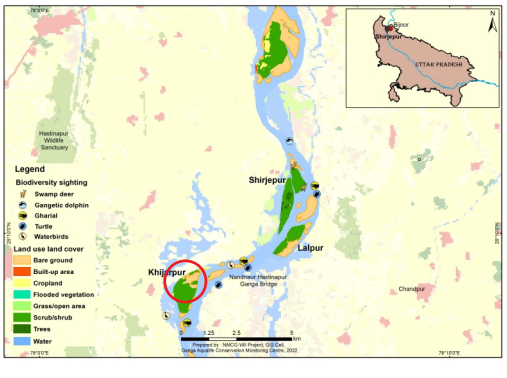
Lalpur near Raipur Khader region
Natural Vegetation, low disturbance







Rampur Thakra
Converted to agriculture, high disturbance



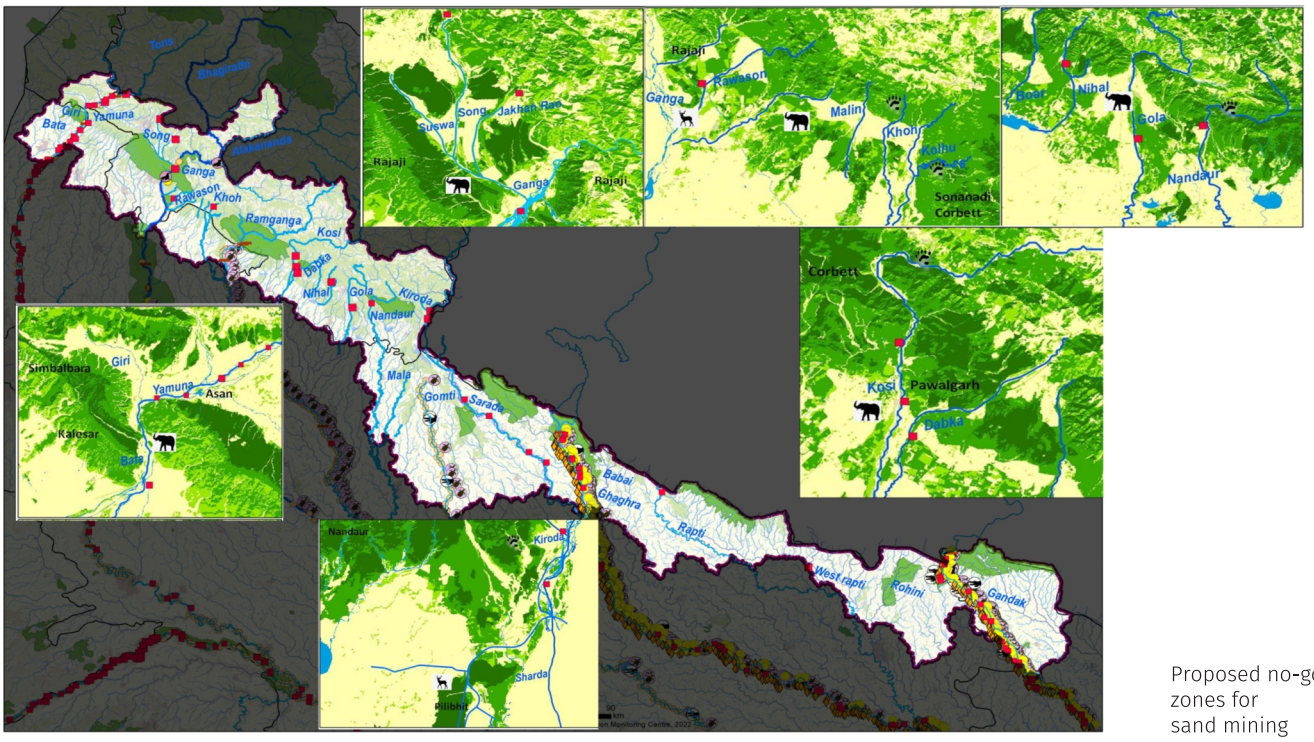
Khijarpur near Nandnaur Hastinapur Ganga bridge
Converted to agriculture, high disturbance





UAV-based Survey on Sand Mining in the Terai Arc Landscape

To assess the impacts of sand mining in the rivers of the Terai Arc Landscape, several drone flights were made on select sites and then the data obtained was processed at the WII Headquarters in Dehradun for proposing no-go zones for sand mining in river eco-sensitive zones. Sand mining regulations should be imposed in these areas and the restrictions for distance from forests, Protected Area, and important riparian habitats such as river islands and crossing corridors should be formulated. The proposed no-go zone for sand mining using the UAV drone includes Rawason, Khoh, Nihal and Kosi rivers, Dabka upstream, Gola elephant corridor, Nandhaur River upstream and near State Industrial Development Corporation of Uttarakhand Limited (SIDCUL), Kiroda nala and Sharda River near Boom Forest range, Song River and Jakhan Rao, and Giri, Bata and Yamuna confluence.



Proposed no-go zones for sand mining

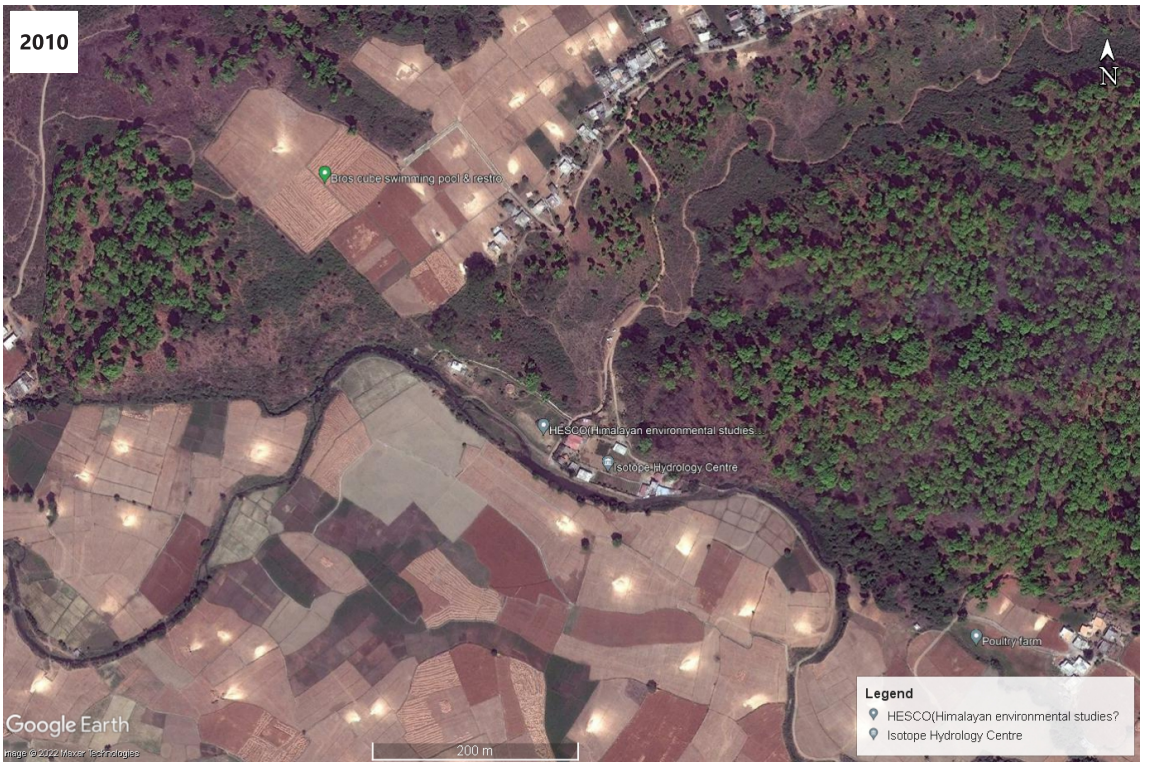
Rejuvenating Small Streams and Rivers

An assessment of the river rejuvenation initiative undertaken by the Himalayan Environmental Studies And Conservation Organisation (HESCO) is underway to examine the factors that contributed to the rejuvenation of the Asan River, a second-order tributary of the Ganga River in Uttarakhand. The key findings of the assessment are:

- HESCO and the adjacent forest were divided into 200 x 200 m sampling grids and further divided into 20 x 20 m sub -plot for vegetation sampling.
- A total of 120 bird species were recorded of which maximum species were recorded in forest habitats (n=92) followed by agriculture (n=42) and riverine (n=40) habitats.
- Overall 516.38 individuals/ha plant density was recorded.
- Sal (*Shorea robusta*) was the most dominant tree species with 329.31 individuals/ha.
- Carbon sequestration potential was calculated using a universal standard protocol by Brown et al. (1989) for >5cm DBH wood species.
- The carbon sequestration capacity of HESCO and the adjacent forest was 90 Mega gram (Mg)/ha.
- Among trees, Sal with 51.32 Mg/ha contributed maximum to the Carbon Sequestration, followed by 9.20 Mg/ha of

Mahal mol (*Pyrus pashia*), 7.18 Mg/ha of Gular (*Ficus racemosa*), and 4.45 Mg/ha of Kaamala (*Mallotus philippensis*).

- HESCO revived rivulet between 2009-2019: The figure shows an increase in average water discharge from 100 litre/sec to 700 litre/sec.

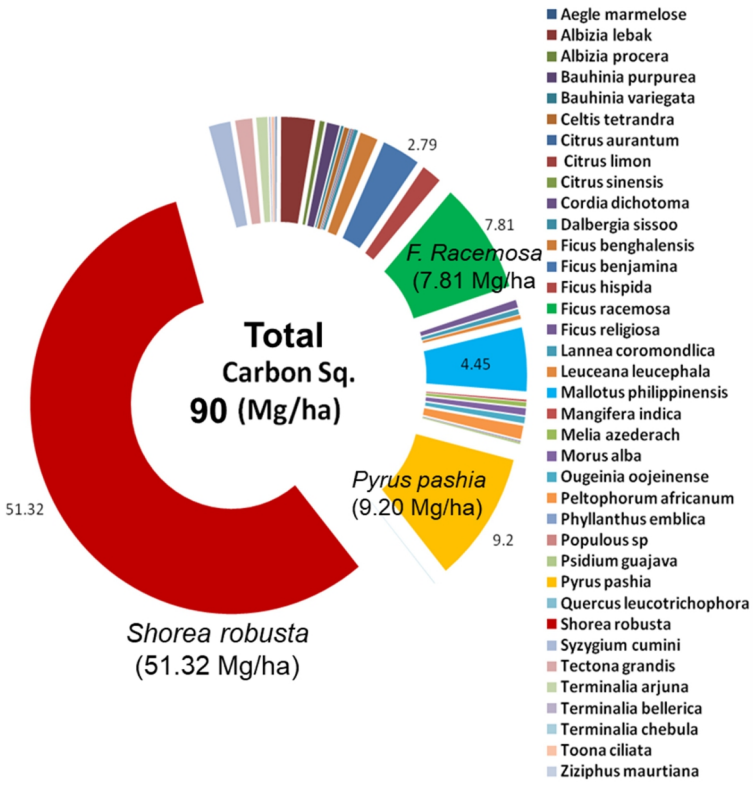


Imagery from 2010 showing the landscape around HESCO



Imagery from 2022 showing the landscape around HESCO





Carbon Sequestration
by tree species

RESCUE, REHABILITATION, RELEASE, AND RESEARCH

Four R's to strengthen conservation measures

The rescue and rehabilitation centers at Narora and Sarnath were maintained, as well as managed during the summer and winter seasons. Nutritional control for chelonians and managing the chelonians' housing and environmental enrichment, the release of turtles were the objectives achieved. The rehabilitated turtles from Kachua Punarwas Kendra, Sarnath were released in the Ganga River in the newly designated Turtle Sanctuary in Bhadohi District. 692 captive-bred Three-striped roofed turtle (*Batagur dhongoka*) and 67 confiscated Indian flapshell turtles (*Lissemys spp.*) were released after successful rehabilitation. Three capacity-building programmes were conducted in Kolkata from 21st-23rd June 2022 for frontline staff of the West Bengal Forest Department. A total of 40 personnel were sensitised regarding protocols to be adopted for the rescue and rehabilitation of freshwater aquatic macro-fauna. Two workshops for strengthening the capacities of field officials in Rajasthan, one each for field veterinarians and para-veterinarians of the Animal Husbandry Department, Government of Rajasthan working along Chambal River were organised at Jaipur on 19th-20th July and 23rd-24th July 2022, respectively. Capacity of 50 officials representing various districts of Rajasthan was developed for the rescue and rehabilitation of freshwater aquatic macrofauna.





Ganga Aqualife Rescue and Rehabilitation Centre, Narora



Kachua Punarvas Kendra, Sarnath











Capacity Building

PROJECT APPRAISAL

Monitoring project implementation

The Seventh meeting of the Monitoring Committee was held under the Chairmanship of Director General, NMCG, Shri G. Asok Kumar, on 29th November 2022, in the newly constructed Ganga Aqulife labs at the Wildlife Institute of India. The Committee members Padma Bhushan Dr. Anil Prakash Joshi, Prof. Jamal Ahmad Khan, Aligarh Muslim University, Prof. Rajiv Sinha, IIT Kanpur appreciated the efforts put in by the NMCG-WII team to carry the project activities. The committee member released brochures on the small tributaries.









COMPONENT 2

CAPACITY BUILDING OF THE FOREST DEPARTMENT AND OTHER STAKEHOLDERS IN MANAGING AQUATIC AND WETLAND RESOURCES

CATCH THEM YOUNG — THE BAL GANGA PRAHARI PROGRAMME

Linking Bal Ganga Prahari with conservation

To instill the conservation values in the young minds, the Bal Ganga Prahari programme was launched in 2020, with the initiation of Phase II of the project. School children from the different states in the Ganga River basin are included in this programme, and select schools are being adopted. About 31,000 school students from 66 different schools in the Ganga River basin have been sensitised through various activities and programmes (Table 2.1).

Table 2.1: Activities organised for the Bal Ganga Prahari programme in the Ganga River basin from July 2022-December 2022

Type of the workshops conducted for Bal Ganga Praharis	No. of Bal Ganga Praharis present	No. of Schools	No. of Districts Covered
“Card Making Session"Har Ghar Tiranga	220	1	1
Awareness Programme	2,845	9	9
Ganga Utsav Celebration	3,214	14	14
Har Ghar Tiranga	9,430	13	13
Hindi Diwas Celebration	450	1	1
International Literacy Day	550	1	1
National Wildlife Week Celebration	6,477	10	10
Painting Competition	1,650	1	1
State Level Bal Ganga Prahari Training Programme	86	8	1
World Nature Conservation Day	5,790	8	8
Total	30,712	66	59

Successful implementation of the conservation action plan will depend on the capacity of the stakeholders trained in monitoring of aquatic biodiversity, management planning of wetland, rescue and rehabilitation protocols. Further, to detect any changes in habitat features and species assemblage in future, the capacity of different stakeholders including forest departments, animal husbandry departments, veterinarians and volunteers from concerned areas will be extremely critical. With this background, this component aims to developing capacities of stakeholders for effective conservation of the Ganga.

SPEARHEAD TEAM

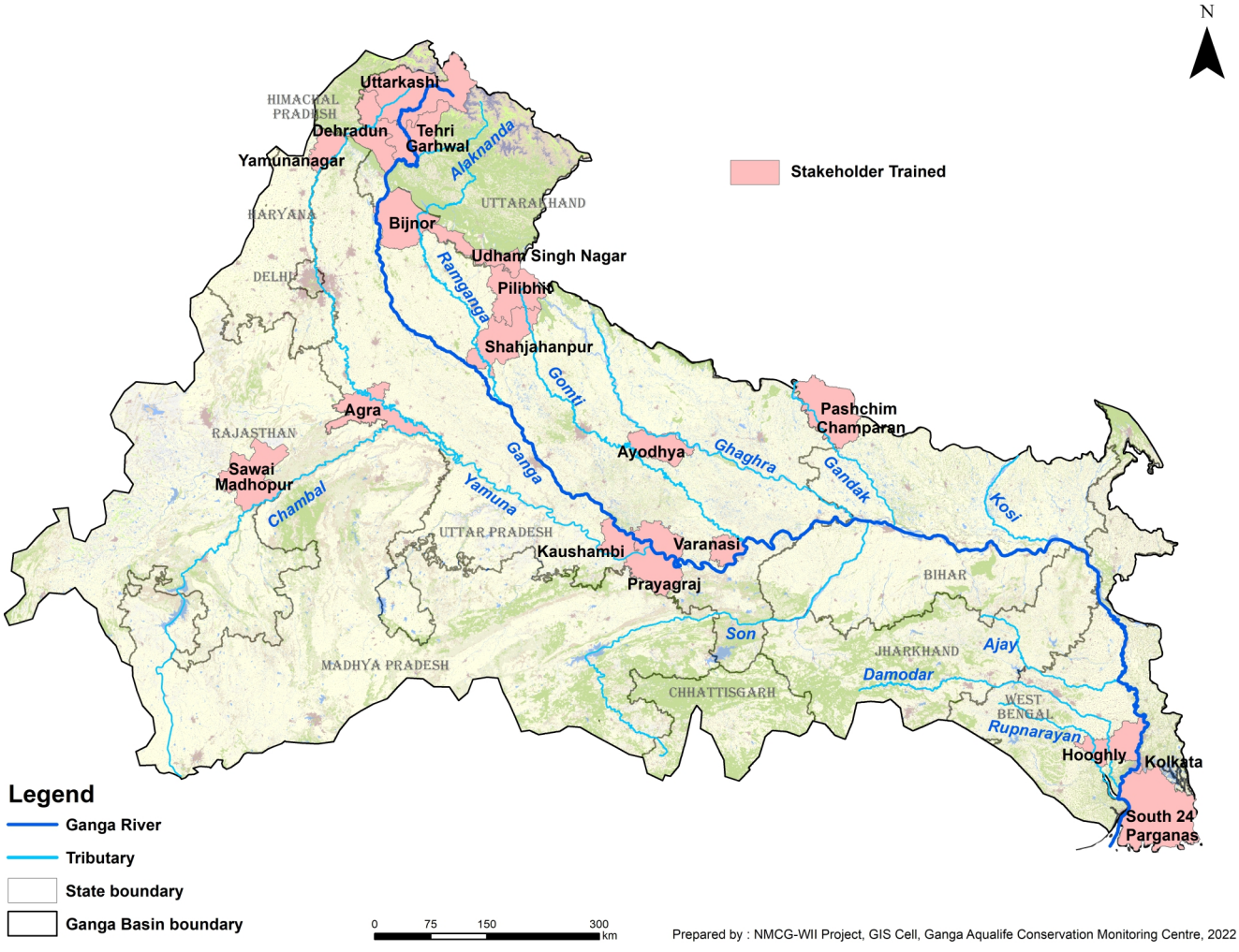
To promote and expedite the conservation efforts

A group of selected individuals from the Ganga Praharis cadre, Forest Departments, and other stakeholders were invited to the headquarters of the Wildlife Institute of India, Dehradun, for the training programme. The participants are taught various tools and techniques for managing wildlife and enhancing their conservation efforts. After the completion of their training, they are designated as spearheads. These trained individuals develop a skillset to motivate, influence, and mobilise their respective communities. From June to December 2022, four spearhead training were conducted in which 185 participants from the three Ganga River basin states, namely Uttarakhand (N= 95), Uttar Pradesh (N= 55) and Rajasthan (N= 35) were trained (Table 2.2). The purpose of these trainings was to develop the capacity of the stakeholders about the ecological profile of aquatic fauna and the significance of biodiversity conservation of Ganga River and its tributaries.

Table 2.2: Spearhead involved in trainings conducted in Ganga River Basin from July 2022-December 2022

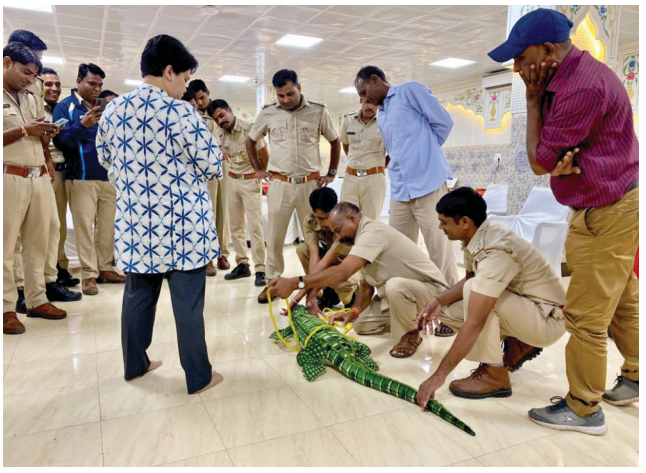
Spearhead involved	Uttarakhand	Uttar Pradesh	Rajasthan	Total
Bal Ganga Prahari	85	0	0	85
Forest Officials	0	0	35	35
GTF & ETF	10	10	0	20
Forest officials, Zoo keepers and Veterinarians	0	45	0	45
Total	95	55	35	185





Spatial map of the presence of trained stakeholders in the Ganga River basin



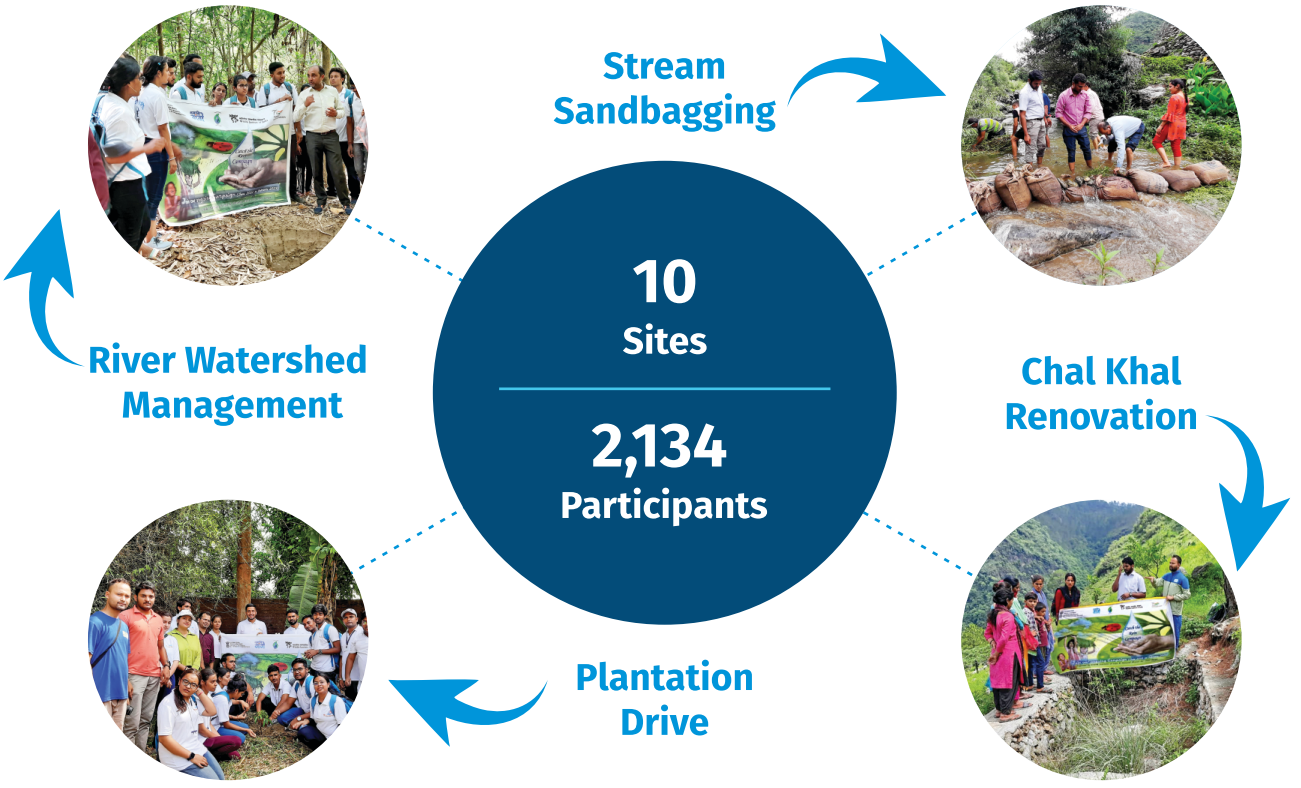




Stakeholder training workshops

CATCH THE RAIN CAMPAIGN

As part of the "Catch the Rain" programme efforts are being made to build check dams, water harvesting pits, rooftop rain water harvesting structures, and other similar structures; to clear encroachments from tanks and de-silt them to increase their storage capacity; and to clear obstacles from the channels that transport water to these structures from catchment areas, among other things. People actively participated in the repairs of step-wells, the use of abandoned wells to replenish aquifers with water, and other activities. Implementing the campaign's objectives, the WII-NMCG Team conducted awareness activities, viz. plantation drives, cleanliness drives. Also, people are taught about the conservation of water resources through traditional methods, viz. *chal khal* in the hilly areas, stream sandbagging, river watershed management, and plantation drives. Stakeholder including teachers, students, and local communities were sensitised by the various programmes conducted in the Ganga basin states mainly in Uttarakhand, Rajasthan, Uttar Pradesh, and Bihar. A total of 35 sites in the Ganga basin states have been covered through the campaign.



COMPONENT 3

DEVELOP COMMUNITY BASED AQUATIC SPECIES CONSERVATION AND OUTREACH PROGRAMMES FOR THE GANGA RIVER BASIN

VOCAL FOR LOCAL — GANGA PRAHARI

Local community involved in Ganga River conservation initiatives

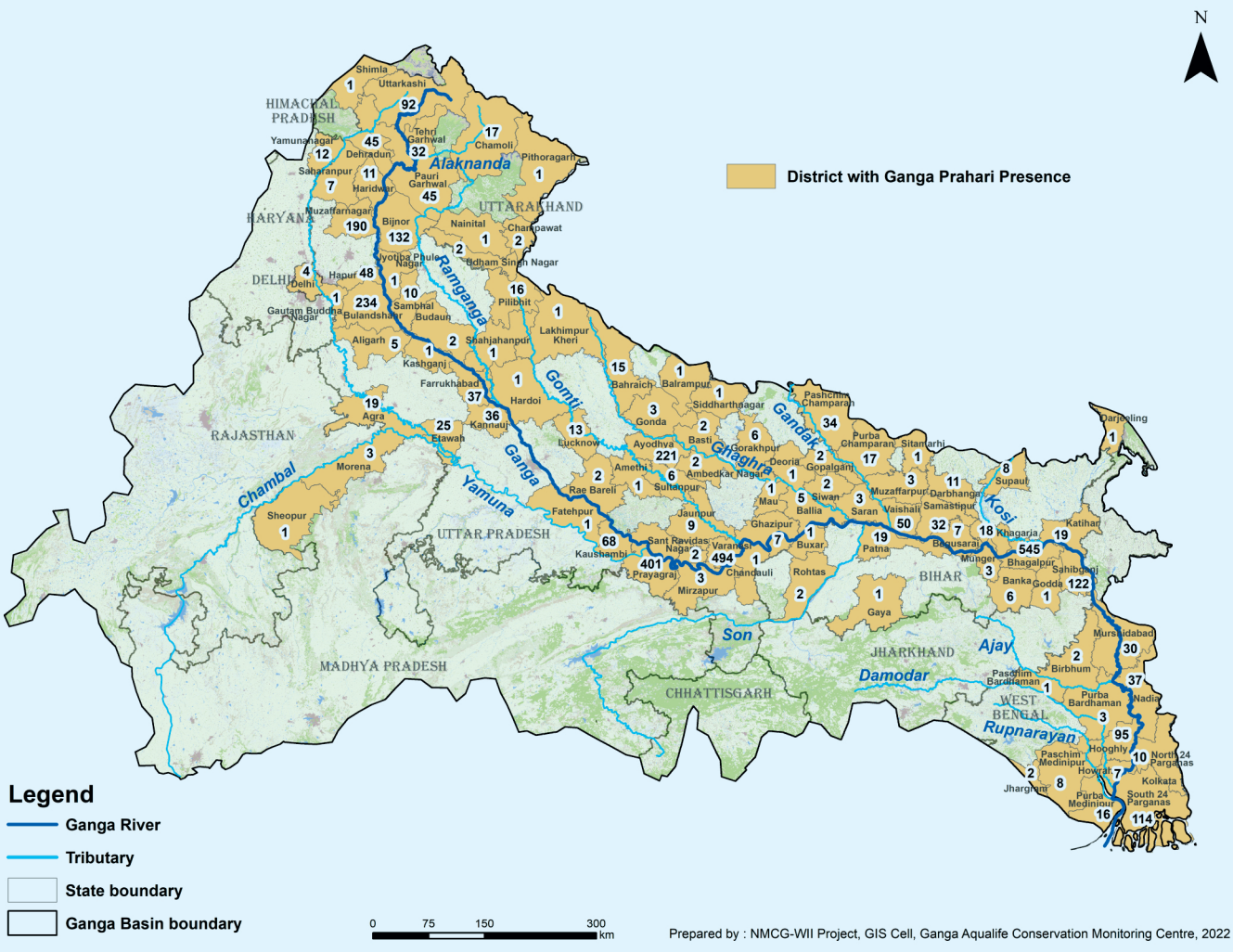
Ganga Praharis are mostly local community volunteers who work to conserve aquatic life by maintaining the river's *Aviral* and *Nirmal Dhara*. The formation of this cadre was envisioned within the context of participatory conservation initiatives, in which people interested in the process typically reside in areas with high social cohesiveness and regularly collaborate on common community projects. A total of 3,559 volunteers from the Ganga River basin are part of the Ganga Prahari cadre. Between July to December 2022, a total of 453 volunteers joined the Ganga Prahari cadre (Table 3.1).

Table 3.1: Ganga Praharis in the Ganga River basin inducted in the cadre from July to December 2022

Rivers	Female	Male	Total
Asan	1	5	6
Bhagirathi	0	1	1
Bidyadhari	62	1	63
Daha	0	1	1
Falgu	0	1	1
Gandak	10	6	16
Ganga	86	29	115
Ghaghra	37	1	38
Gomti	11	5	16
Hooghly	60	72	132
Kailash	1	0	1
Kansabati	0	1	1
Sharda	0	1	1
Son	0	1	1
Yamuna	53	7	60
Total	321	132	453



River conservation decision is a societal one, owning to trade-offs between competitive use of river's resources between maintaining ecological integrity as well as for sustaining the communities. Aligning local livelihoods with conservation goals is known to create a larger constituency of support for conservation, for which site-specific strategies needs to be developed. These communities should also be made aware about the role of an ecologically intact Ganga basin in enhancing the quality of life. The local communities residing along the banks of the Ganga River have high interests in conservation of the Ganga and its aquatic diversity. These local communities have shown their support to conservation initiatives for the Ganga River and some of the members of communities are now part of the Ganga Prahari cadre of trained volunteers. This component aimed to extend this trained cadre at the basin scale. The component also develops high-quality, science-based awareness and outreach material on Ganga River conservation.



Spatial presence of the Ganga Praharis in the Ganga River basin



COMMUNITY ENGAGEMENT IN GANGA RIVER AND BIODIVERSITY CONSERVATION

Between July and December 2022, a total of 757 activities were conducted, during which more than 33,000 participants were reached (Table 3.2). Ganga Praharis conducted a total of 134 activities and reached out to more than 11,000 people (Table 3.3), and with inputs from the NMCG-WII team, 164 activities were conducted, through which more than 25,000 people were sensitised (Table 3.4).

Table 3.2: Participation in onsite project activities conducted between July and December 2022

	Bihar	Haryana	Jharkhand	Uttar Pradesh	Uttarakhand	West Bengal	Grand Total
Awareness Programme	2,137	222	36	5,160	28	0	7,583
Cleanliness Drives	0	0	0	181	0	0	181
Consultative Meetings	561	161	34	1,301	127	17	2,201
Cultural Activities	35	0	0	12,593	0	0	12,628
Days Celebration	157	0	0	315	0	0	472
Field Visit	27	0	4	104	0	0	135
Livelihood Activities	893	168	200	1,804	105	261	3,431
Livelihood Training	35	105	0	425	63	0	628
Orientation Programme	26	0	0	17	29	0	72
Others	95	370	0	2,371	209	4	3,049
Plantation	0	0	0	1,162	0	14	1,176
Sensitization Workshops	82	0	0	1,109	0	0	1,191
Socio-economic Survey	81	38	0	242	10	0	371
Training Workshops	0	0	0	99	0	0	99
Grand Total	**4,129**	**1,064**	**274**	**26,883**	**571**	**296**	**33,217**

Table 3.3: Participation in onsite activities conducted by Ganga Praharis between July and December 2022

	Uttarakhand	Uttar Pradesh	Bihar	Jharkhand	West Bengal	Total
Awards & Achievements	0	218	0	0	0	218
Awareness Activity	174	2,211	1,138	319	72	3,914
Cultural Activity	0	17	0	0	0	17
Cleanliness Drive	6	400	28	32	5	471
Ecological Monitoring	0	240	19	0	0	259
Livelihood Activity	259	0	0	0	0	259
Consultative Meeting	0	175	0	0	0	175
Livelihood Training	0	16	0	0	0	16
Plantation	12	85	13	203	0	313
Rescue & Rehabilitation	0	110	24	0	0	134
Others	376	3,000	378	1,527	111	5,392
Total	**827**	**6,472**	**1,600**	**2,081**	**188**	**11,168**

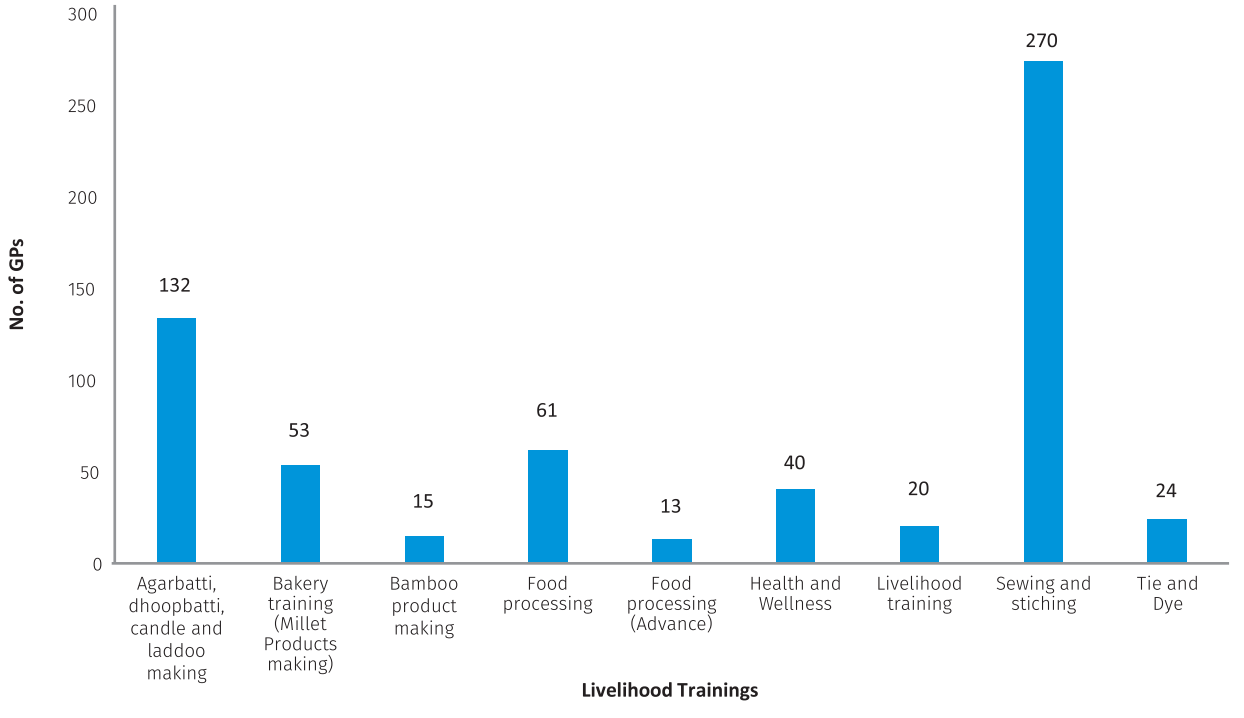
Table 3.4: Participation in onsite activities conducted by Ganga Praharis with the help of the NMCG-WII team between July and December 2022

	Bihar	Jharkhand	Uttar Pradesh	Uttarakhand	West Bengal	Total
Awareness Activity	22	17,037	4,003	176	44	21,282
Cleanliness Drive	15	51	211	0	0	277
Consultative Meetings	0	134	0	0	0	134
Livelihood Activities	0	73	141	0	82	296
Ecological monitoring	0	0	37	0	0	37
Plantation Programme	0	13	196	19	0	228
Rescue & Rehabilitation	0	0	72	0	0	72
Others	133	227	2,121	278	421	3,180
Total	170	17,535	6,781	473	547	25,506

LINKING CONSERVATION AND GREEN ECONOMY

A community-based approach

The term "Alternative Livelihood Project" refers to interventions that aim to minimise the predominance of environmentally destructive activities by replacing lower-impact livelihood activities that give at least similar benefits. The alternate livelihood training provided at the training centres established by the NMCG-WII provides the dependent communities with an alternative option for generating revenue and reducing their reliance on the Ganga River and its tributaries. Between June and December 2022, a total of 23 livelihood training activities were conducted across the Ganga River states, in which 628 Ganga Praharis were trained. The livelihood training ranged from bamboo product making to sewing and stitching. The maximum number of participants was recorded for sewing and stitching.



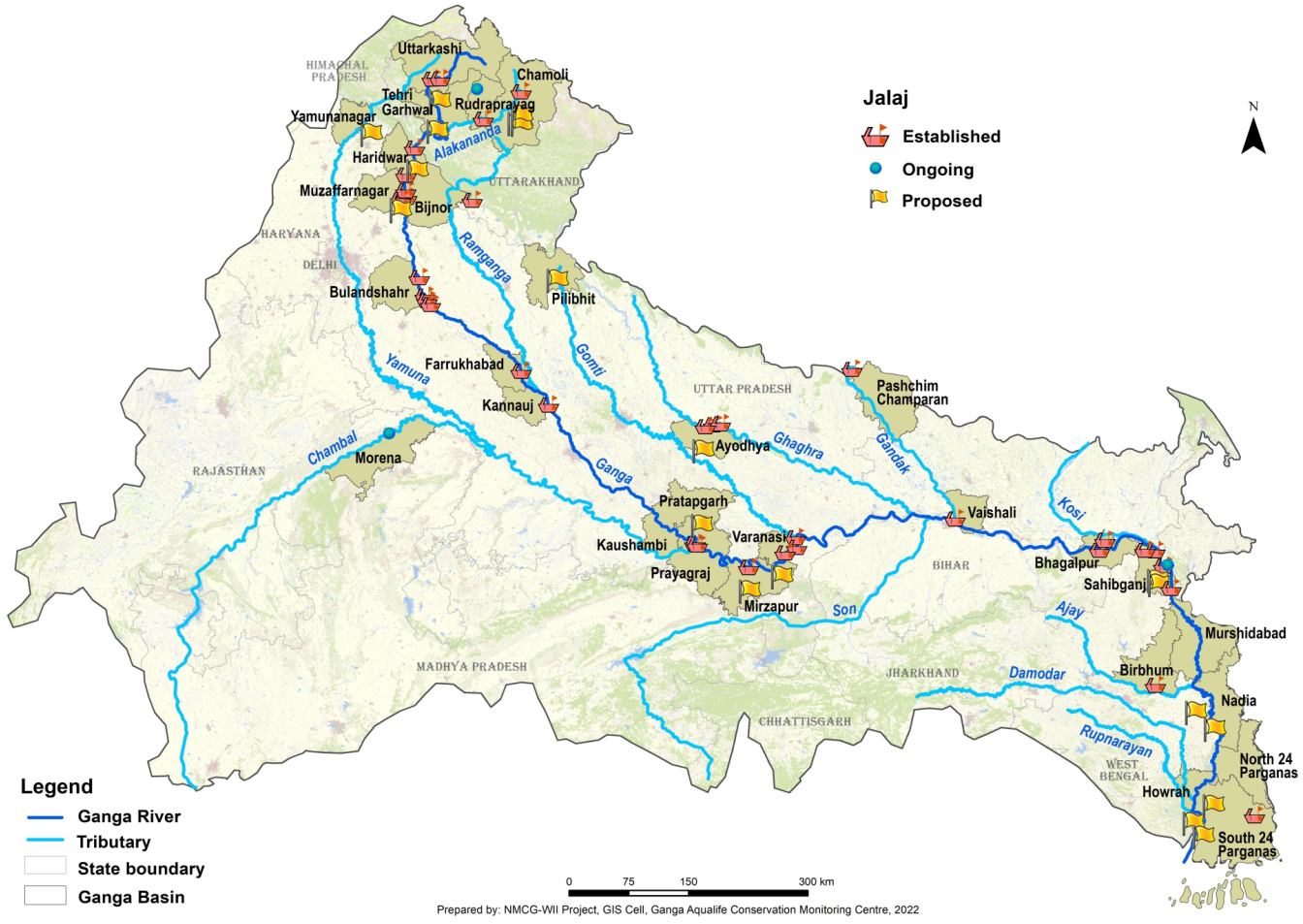
Number of participants in livelihood training programmes



JALAJ

Connecting river and people to realise Arth Ganga

The Jalaj aims to realise *Arth Ganga* in the Ganga River basin by linking local livelihoods and wellness with aquatic conservation through establishing a model representing and highlighting symbiotic linkages between river and people. A total of 75 Jalaj are being established in the Ganga River basin in consonance with the Government of India's *Azadi Ka Amrit Mahotsav*- celebrating 75 years of India's independence. The Jalaj initiative was launched at 26 locations in the Ganga River basin states by the Honourable Union Minister for Jal Shakti, Shri Gajendra Singh Shekhawat on 16th August 2022 during the event 'Yamuna Par Azadi Ka Amrit Mahotsav'. The key Jalaj model for generating livelihood includes an awareness boat, sale point and production unit, awareness centre, destination wedding, dolphin safari, ecotourism, a handicraft centre, health and wellness centre, heritage water mill site, homestay and safari, rejuvenation retreat, souvenir and tailoring shop, and training centre (Tables 3.5 and 3.6).



Map showing locations of established, ongoing, and proposed Jalaj

Table 3.5: Identified Jalaj sites

Name of the Jalaj	Jalaj Model	District/State	River
Jalaj Anand Ganga	Homestay	Uttarkashi, Uttarakhand	Bhagirathi
Jalaj Aali	Souvenir shop and production unit	Uttarkashi, Uttarakhand	Bhagirathi
Jalaj Prayaas	Health and wellness center and food preservation unit	Muzaffarnagar, Uttar Pradesh	Ganga
Jalaj Ganga Viharini	Jalaj Safari	Bijnor, Uttar Pradesh	Ganga
Jalaj Parikshit	Jalaj Safari	Muzaffarnagar, Uttar Pradesh	Ganga
Jalaj Urja	Awareness Corner	Bulandshahr, Uttar Pradesh	Ganga
Jalaj Kasturi	Jalaj Safari	Kannauj, Uttar Pradesh	Ganga
Jalaj Arkja	Jalaj Safari	Prayagraj, Uttar Pradesh	Yamuna
Jalaj Abhyaran	Souvenir Shop	Pilibhit, Uttar Pradesh	Gomti
Jalaj Shashwat	Jalaj Safari	Ayodhya, Uttar Pradesh	Ghaghra
Jalaj Sarayu	Production unit	Ayodhya, Uttar Pradesh	Ghaghra
Jalaj Samagra	Jalaj Production and sale point	Varanasi, Uttar Pradesh	Ganga
Jalaj Narayani	Health and wellness center	Varanasi, Uttar Pradesh	Ganga
Jalaj Amala	Souvenir Shop	Bhagalpur, Bihar	Ganga
Jalaj Shardul	Souvenir and tailoring shop	West Champaran, Bihar	Gandak
Jalaj Saras	Awareness and Safari (21 boats)	Begusarai, Bihar	Kosi
Jalaj Ram Chiraiya	Awareness Centre and homestay	Katihar, Bihar	Ganga
Jalaj Shallika	Awareness Centre and Safari	Begusarai, Bihar	Ganga
Jalaj Utsavi	Jalaj Safari	Sahibganj, Jharkhand	Ganga
Jalaj Panchajannya	Awareness Corner and Sale Point	Nadia, West Bengal	Hooghly
Jalaj Aarya	Training Center and Production Unit	24 Parganas (South), West Bengal	Hooghly
Jalaj Chitrangada	Awareness Boat, sale point, and production unit	Murshidabad, West Bengal	Hooghly
Jalaj Aikatana	Awareness Boat	Hooghly, West Bengal	Hooghly
Jalaj Sundari	Awareness corner and sale point	24 Pargana (South), West Bengal	Hooghly
Jalaj Nisarga	Awareness Corner and Sale Point	Kolkata, West Bengal	Hooghly
Jalaj Charmanyavati	Awareness Corner	Morena, Madhya Pradesh	Chambal

Table 3.6: Income generated by Jalaj initiative

Jalaj	District	State	River	Income since the inauguration (INR)
Aali	Uttarkashi	Uttarakhand	Bhagirathi	20,000
Anand Ganga	Uttarkashi	Uttarakhand	Bhagirathi	1,50,000
Ganga Viharini	Bijnor	UP	Ganga	77,690
Prayaas	Muzaffarnagar	UP	Ganga	58,000
Parikshit	Muzaffarnagar	UP	Ganga	1,27,000
Urja	Bulandshahr	UP	Ganga	72,000
Kasturi	Kannauj	UP	Ganga	16,500
Arkaja	Prayagraj	UP	Yamuna	2,46,000



Jalaj	District	State	River	Income since the inauguration (INR)
Shashwat	Ayodhya	UP	Ghaghra	2,88,000
Samagra	Varanasi	UP	Ganga	18,000
Narayani	Varanasi	UP	Ganga	14,160
Amala	Bhagalpur	Bihar	Ganga	58,275
Shardul	West Champaran	Bihar	Gandak	17,850
Saras	Begusarai	Bihar	Kosi	1,33,500
Utsavi	Sahibganj	Jharkhand	Ganga	11,700
Sundari	South 24 Parganas	WB	Hooghly	39,470
Aikanta	Hooghly	WB	Hooghly	27,000
Chitrangada	Murshidabad	WB	Hooghly	1,18,800







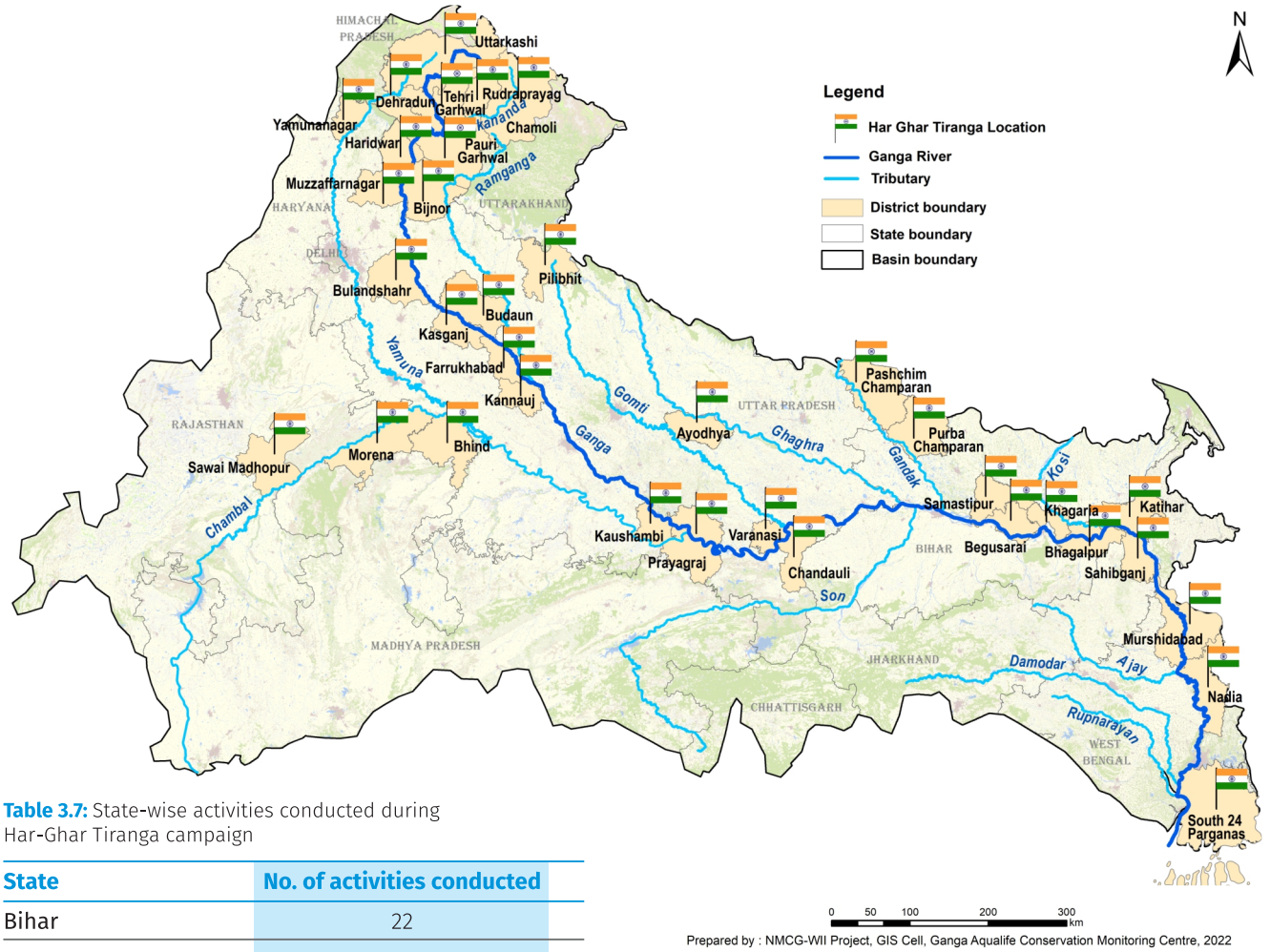




AZADI KA AMRIT MAHOTSAV

Har-Ghar and Har-Ghat Tiranga initiative

Har Ghar Tiranga is a campaign under the aegis of Azadi Ka Amrit Mahotsav to encourage people to bring the Tiranga home and hoist it to commemorate India's 75th anniversary of independence. The celebration was carried out from the 13th to 15th of August 2022 in the Ganga basin states by the NMCG-WII team, the Ganga Prahari cadre, Forest Departments, and other line agencies and stakeholders. The activities included flag hoisting, awareness rallies, painting competition, and cultural activities in villages, schools, colleges, forest department offices, district administration offices, etc., residing along the Ganga River and its select tributaries. During the Har-Ghar Trianga, 133 activities were conducted in eight states, in which 55,814 participants were involved directly and about 3 lakh indirectly (Table 3.7). The Har-Ghat Tiranga was carried out in 16 districts and four states, in which 46 activities were conducted, and more than five thousand participants participated (Table 3.8).



Map showing the locations of state-wise activities conducted during Har-Ghar Tiranga campaign

Table 3.7: State-wise activities conducted during Har-Ghar Tiranga campaign

State	No. of activities conducted
Bihar	22
Haryana	5
Jharkhand	8
Madhya Pradesh	6
Rajasthan	3
Uttar Pradesh	62
Uttarakhand	23
West Bengal	4
Total	133





Map showing the locations of state-wise activities conducted during Har-Ghat Tiranga campaign

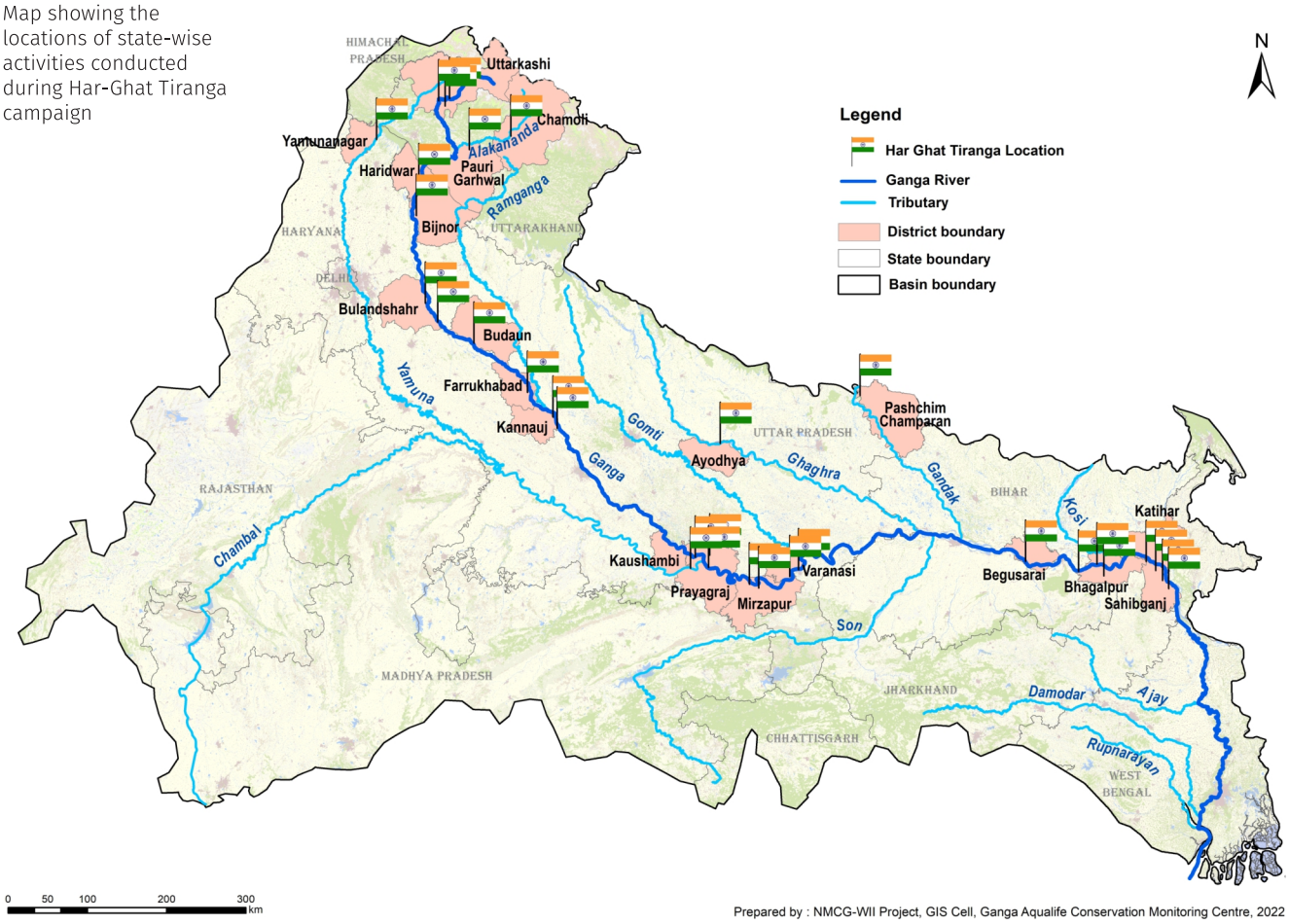


Table 3.8: State-wise activities conducted during Har-Ghat Tiranga campaign

State	No. of activities	Type of activities
Uttarakhand	7	Flag Hoisting, Slogan reciting, Cleanliness drive, Cultural programs, Awareness Rallies, Tiranga river walk, Bike rally
Uttar Pradesh	30	
Bihar	5	
Jharkhand	4	
Total	46	

INTERPRETATION CENTRES

Promoting river and biodiversity conservation

The development of interpretation centers at strategic locations throughout the Ganga River basin was a critical step toward educating and involving local communities in the natural systems of the Ganga River basin by developing a network of community-based environmental education programmes, explaining the value of aquatic biodiversity in the Ganga River, and increasing public awareness of the river ecosystem, its state, and resources. To create awareness about rivers and their biodiversity, the low cost interpretive corners namely "*Jalmala Samwad*" and "Eco Clubs" were established. These corners have informative panels and wall paintings depicting the species and their habitat found in the River ecosystem. These informative panels have been designed in a way to support the school's educational goals as well, and till now 14 *Jalmala Samwad* and 37 eco club corners have been established. Each school was also provided with a toolbox "*Ganga Gyan Kosh*" containing relevant teaching tools. The toolbox comprised of:

- Material to carry out activities mentioned in 'Discovering Ganga' – Teaching Manual.
- A guide on How to use '*Ganga Gyan Kosh*'.
- Books on River Ganga and its tributaries.
- A Map of the Ganga River basin with tributaries.
- Origami brochure – To help students learn about aquatic species with the help of origami.
- Snake & Ladder Game – To make students learn about Do's & Don't to have a healthy River ecosystem.
- Bookmarks with species printed on them and information about the species in the form of a poem written on the back.
- Food Web of Ganga Cards – Different cards of species found in the Ganga River Basin were provided to inform students about the interdependence of each species found in the River ecosystem.
- Pen drive – A pen drive containing educational movies on Rivers, video of puppet shows performed by our team during several occasions Dekho-2 Sab Badal Raha Hai and Sparsh Ganga, street play video performed by our eco-club members, Soft copy of all the materials provided in '*Ganga Gyan Kosh*' for future reference.



Existing and Proposed Nature Interpretation centres



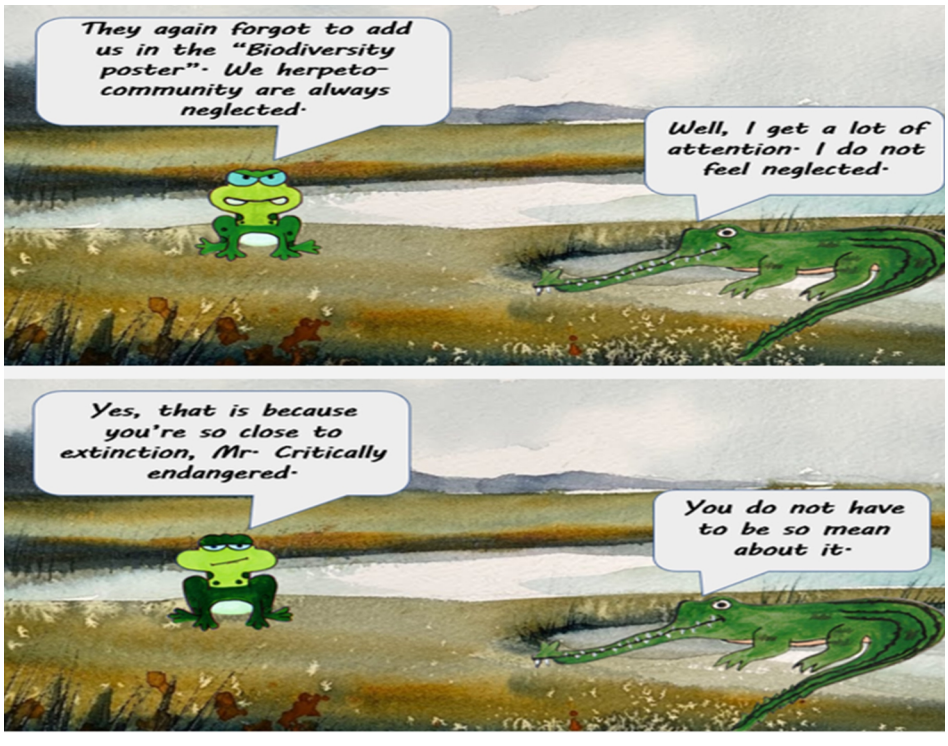
OUTREACH ACTIVITIES AND DIGITAL MEDIA

It is critical to raise public awareness in order to teach and educate people and impact their attitudes, behavior, and beliefs about aquatic biodiversity conservation and river rejuvenation. To propagate the message and gain the necessary support to change public opinion, multiple awareness-raising strategies, methods, and resources were used. Digital and traditional designing are not just decorative tools, but they can also be used to raise awareness and educate the masses about conservation. To raise awareness and target the masses, wall paintings and the distribution of various books, brochures, comic strips, and other materials were carried out on various occasions. Comic strips, Important days and 75 posts on alternatives to plastic were uploaded on social media platforms and the views & likes for these social media contents were about 618. Workshops on community and school awareness along the Yamuna River, as well as visits to the Sarnath Interpretation Center, sensitised 4,571 school children and members of the community. Sign boards for *Ganga Avlokan* were also installed at sites near the *Ganga Avlokan* center at Chandi Ghat, Haridwar.









Comic strips on biodiversity awareness



Sign boards for Ganga Avlokan









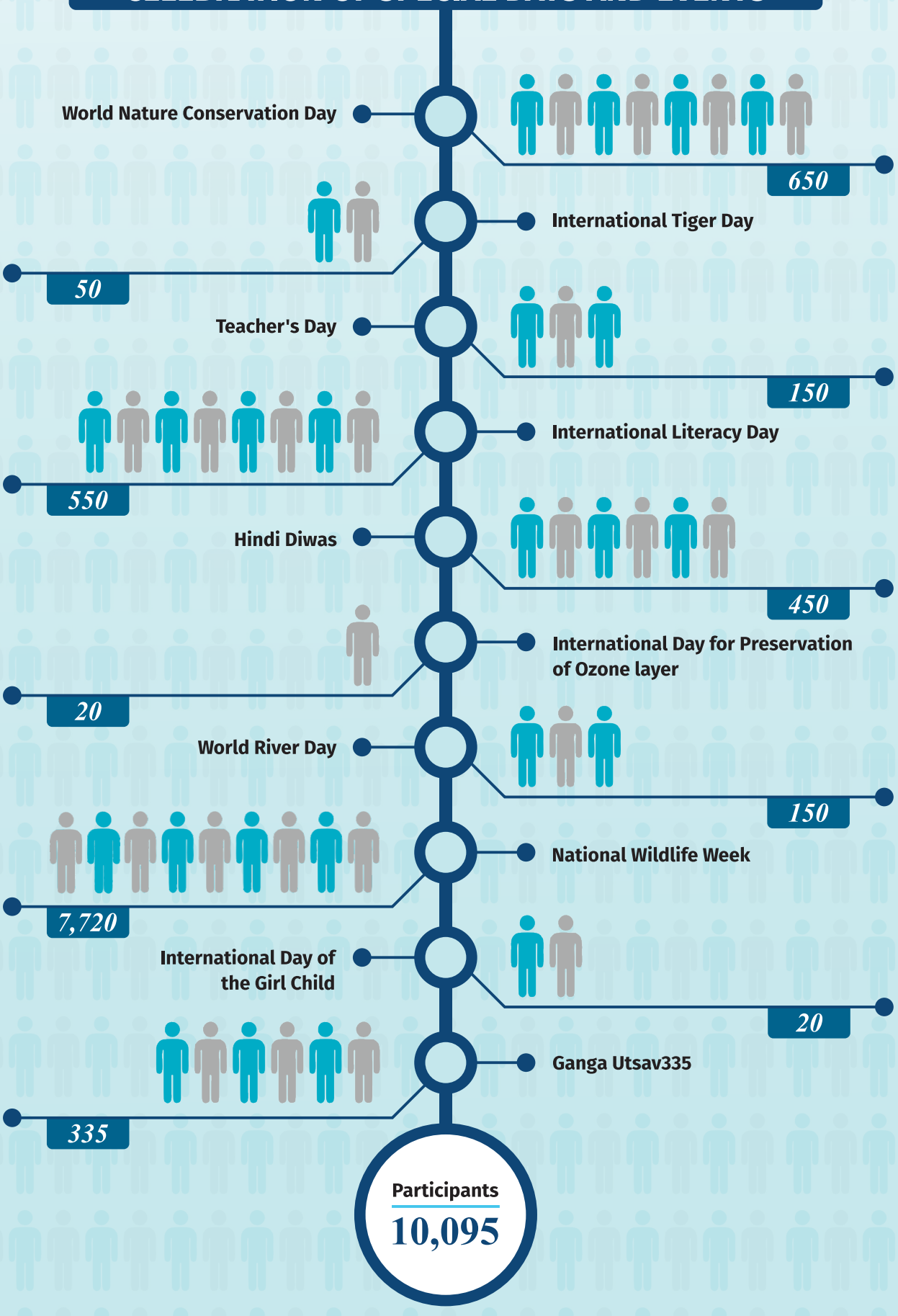
Digital Media -
Ban on single-use plastic and posts as alternatives to reduce the use of plastic





Digital Media – Post on Important Days

CELEBRATION OF SPECIAL DAYS AND EVENTS



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NOTES

NOTES



NMCG

National Mission for Clean Ganga,
Department of Water Resources, River Development & Ganga Rejuvenation, Ministry of Jal Shakti, Major Dhyan Chand Stadium, India Gate, New Delhi - 110001

भारतीय वन्यजीव संस्थान
Wildlife Institute of India

Wildlife Institute of India
Chandrabani, Dehradun-248001, Uttarakhand
wii.gov.in/nmcg/national-mission-for-clean-ganga

GACMC

Ganga Aqualife Conservation Monitoring Centre
Wildlife Institute of India, Dehradun
nmcg@wii.gov.in