511

IN THE HON'BLE NATIONAL GREEN TRIBUNAL, PRINCIPAL BENCH AT NEW DELHI

ORIGINAL APPLICATION No. 203 OF 2023

IN THE MATTER OF:

TUSHAR GOSWAMI   .... APPLICANT

VERSUS

UNION OF INDIA & Ors.   ....RESPONDENT(s)

INDEX   **N.D.O.H:- 06.02.2024**

Dated:22.12.2023
Place- New Delhi

Filed by:-

RAHUL PRATAP
Advocate for MoEF&CC
(Respondent no.1)
A-46, First Floor Defence Colony
New Delhi-110024
Tel-9910727778
Email: rahulpratap.adv@gmail.com
D\13061\2005

IN THE HON'BLE NATIONAL GREEN TRIBUNAL
PRINCIPAL BENCH AT NEW DELHI
IN
ORIGINAL APPLICATION NO. 203 OF 2023

IN THE MATTER OF:

TUSHAR GOSWAMI   **.... APPLICANT**

                         VERSUS

UNION OF INDIA & ORS   **...RESPONDENTS**

COMPLIANCE AFFIDAVIT ON BEHALF OF THE RESPONDENT NO.1 UNION OF INDIA, MINISTRY OF ENVIRONMENT, FOREST AND CLIMATE CHANGE (MoEF&CC), NEW DELHI.

MOST RESPECTFULLY SHOWETH:

I, Ved Prakash Mishra, S/o Shri Ram Sidh Mishra Aged about 49 years, working as Director in the Ministry of Environment, Forest and Climate Change at New Delhi- 110003, do hereby solemnly affirm and State as under:

1. That I am duly authorized to swear this affidavit as such conversant with the facts of the present case and competent to swear the present affidavit.

2. That I have read and understood the contents of the accompanying reply and state that the same has been drafted under my instructions based on the official records.

STATEMENT OF FACTS:

3. It is submitted that, the Hon'ble Tribunal on 15.12.2023 had inquired about the de notification of the Turtle Wildlife Sanctuary.

REPLY ON FACTS

4. It is submitted that, Turtle Wildlife Sanctuary (hereinafter referred as TWS) was declared on 21 December 1989 in accordance with the provisions contained in the Wild Life (Protection) Act, 1972 by the State Government of Uttar Pradesh.

5. It is submitted that, as per section 26A (3) of the Wild Life (Protection) Act, 1972, no alteration of the boundaries of a sanctuary shall be made by the State Government except on a recommendation of the National Board for Wild Life (NBWL).

6. It is submitted that the NBWL is constituted under section 5A of the Wild Life (Protection) Act 1972. As per Section 5B of the said Act, the NBWL, in its discretion, constitutes its Standing Committee for the purpose of
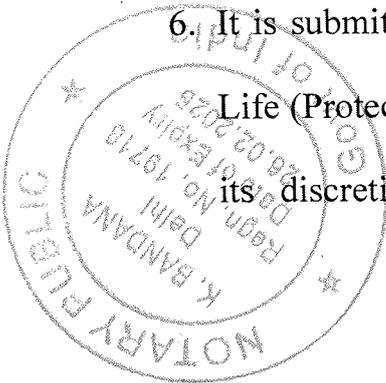
exercising such powers and performing such duties as may be delegated to the Standing Committee by the NBWL.

7. It is further submitted that Hon'ble Supreme Court of India in its order dated 5.10.2015 in W.P. (C) No. 202/1995 directed that all matters for grant of permissions for implementation of projects in areas falling in National parks/sanctuaries, including rationalization of boundaries etc. will be considered by the Standing Committee of the National Board for Wild Life ("NBWL") and also requested the NBWL to furnish a copy of the orders passed by it within 30 days' time to the C.E.C who if, for any reason, they are aggrieved by the decision of the Standing Committee of NBWL to approach this Court by filing an appropriate petition/application.

8. It is submitted that the proposals for rationalization/alteration of boundaries/denotification of a sanctuary are forwarded by State/Union Territory Governments to the Ministry of Environment, Forest and Climate Change for placing before the Standing Committee of the National Board for Wild Life (SCNBWL) after thorough scrutiny by the State/Union Territory Governments/Administrators and the State Boards for Wild Life (SBWL) headed by the respective Chief Ministers/Administrators.

9. It is submitted that, the SCNBWL, which also includes eminent ecologists, conservationists and environmentalists, takes informed decisions on the proposals placed for its consideration.

10. It is submitted that the proposal for denotification of the TWS was based on the study "Assessment of the wildlife values of the Ganga River from Bijnor to Ballia including turtle wild life sanctuary, Uttar Pradesh" conducted by the Wildlife Institute of India, Dehradun (WII), a technical arm of the Ministry. The study was conducted on the request of the State Government of Uttar Pradesh. The report was submitted to the State Government vide WII no. WII/SAH-TWS-UP/2018 dated 6th July 2018 **(ANNEXURE –I).**
(Pg No. 8 to 67)

11. It is submitted that, the study highlighted that *"Only five freshwater turtle species were encountered in TWS out of the 13 species reported from the Ganga River. Capture rates for turtle species were low in the TWS, indicating low abundance of turtles during the sampling period and high anthropogenic disturbance within TWS."* Accordingly, the WII made following conclusions about efficacy of Turtle Wildlife Sanctuary:

"3.1.5 very low encounter rate of turtles in TWS indicate high human disturbance leading to habitat alteration within a very small Protected Area. Sites along the TWS in left bank are seen to have least suitable habitat for turtles with high anthropogenic presence such as cemented Ghats, intense
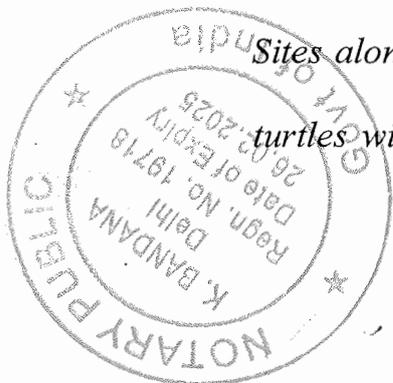
ferry and boat activity, pollution and human presence along the river. The sand bar in the right bank of the sanctuary though is an excellent habitat for turtles and breeding birds, is also under severe anthropogenic pressure. Higher diversity and catch of fish species from the TWS is indicative of restriction on fishing in the sanctuary"

12. It is further submitted that, the proposal for de-notification of Turtle Wildlife Sanctuary accordingly as per the process was received in the Ministry from the State Government along with the recommendations of the SBWL and Chief Wild Life Warden, Uttar Pradesh.

13. It is submitted that the proposal was considered in 50th meeting of the SCNBWL held on 7th September 2018. After discussions, the SCNBWL recommended the proposal of the State Government of Uttar Pradesh along with the conditions SBWL and informed that the State Government may proceed with the process of de-notification of existing Turtle Wildlife Sanctuary and notification of proposed Wildlife Sanctuary as per the prevailing instructions and relevant provisions of the Wild Life (Protection) Act, 1972.

14. It is submitted that the Ministry is fully committed to the conservation of forests and wildlife in the country and has been taking necessary measures in this regard. The proposal for de-notification of the erstwhile Turtle Wildlife
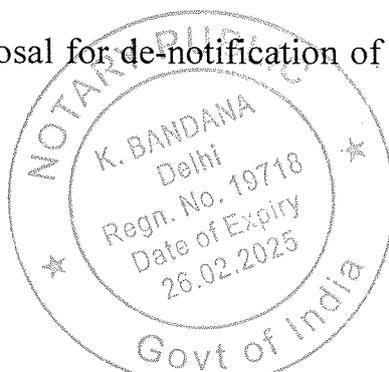
Sanctuary, Uttar Pradesh was recommended by the SCNBWL in accordance with the Wild Life (Protection) Act, 1972 and order of Hon'ble Supreme Court of India dated 5.10.2015 in W.P. (C) No. 202/1995.

15. It is humbly prayed that in view of the foregoing submissions, the Hon'ble Tribunal may kindly pass such order(s) as may be deemed fit and proper.

DEPONENT

VERIFICATION:

Verified at New Delhi on this the 21 day of Dec 2023 that the contents of this reply affidavit based on official record(s) maintained and information available in the office are correct to my knowledge and belief. No part of it is false and nothing has been concealed there from.
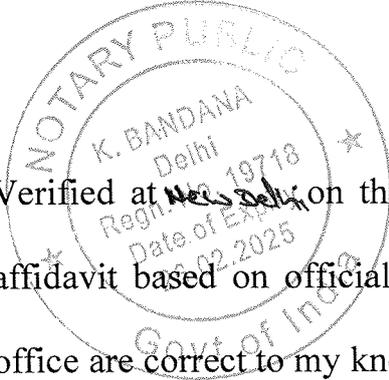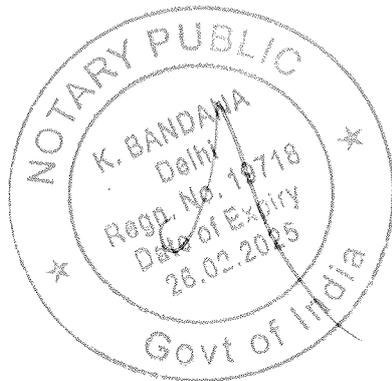
2 1 DEC 2023

DEPONENT

Annexure - I

ASSESSMENT OF THE WILDLIFE VALUES OF THE GANGA RIVER FROM BIJNOR TO BALLIA INCLUDING TURTLE WILDLIFE SANCTUARY, UTTAR PRADESH
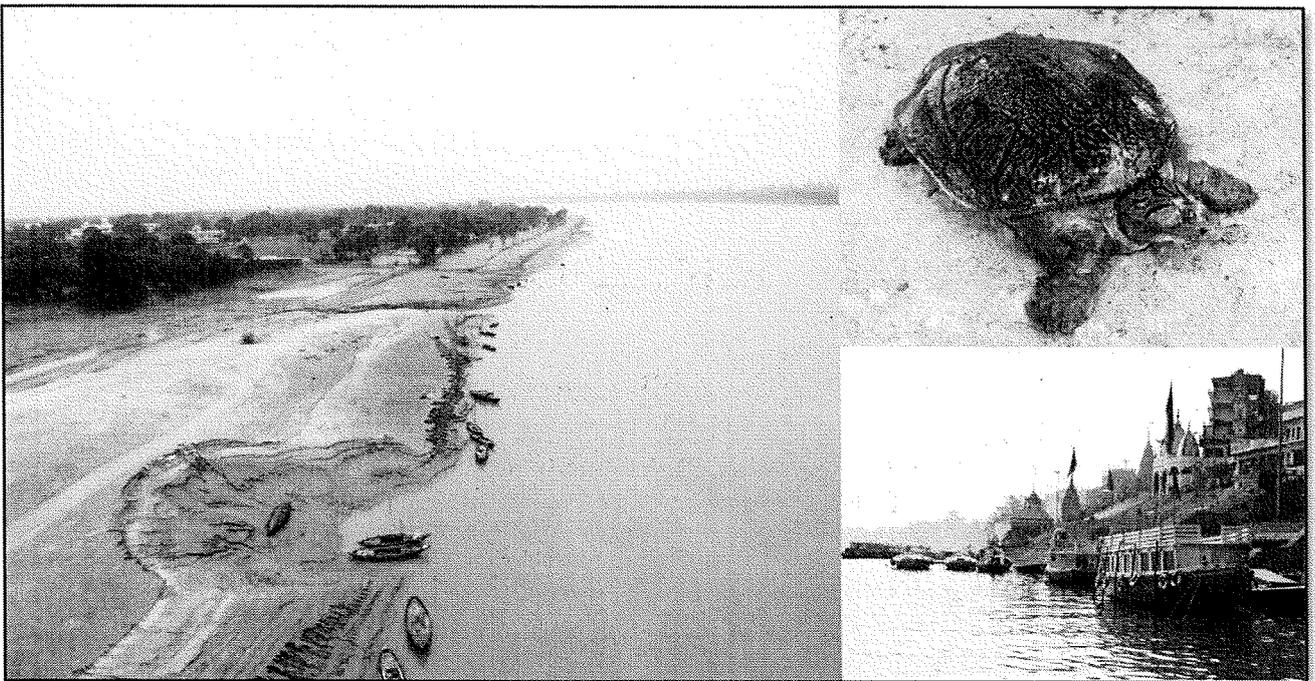
भारतीय वन्यजीव संस्थान
Wildlife Institute of India

July 2018

ASSESSMENT OF THE WILDLIFE VALUES
OF THE GANGA RIVER FROM BIJNOR TO BALLIA INCLUDING
TURTLE WILDLIFE SANCTUARY, UTTAR PRADESH

भारतीय वन्यजीव संस्थान
Wildlife Institute of India

July 2018

The Team

Advisors	:	Dr. V. B. Mathur, Director Dr. G. S. Rawat, Dean
Supervisors	:	Dr. S. A. Hussain, Scientist G Dr. R. Suresh Kumar, Scientist E Dr. J. A. Johnson, Scientist E
Researchers	:	Aftab A. Usmani, Aishwarya Ramachandran, Anuja Josephine Mital, Goura Chandra Das, Niladri Dasgupta, P. Gangaiamaran, Prabhakar Yadav, Zeeshan Ali, Saurav Gawan, Rahim Shaikh
Citation	:	WII (2018): Assessment of Wildlife Values of the Ganga River from Bijnor to Ballia Including Turtle Wildlife Sanctuary, Uttar Pradesh. Technical Report. Wildlife Institute of India, Dehra Dun. Pp. 66.

521

Contents

Acknowledgements

523

Executive summary   ⌒13

Freshwater ecosystems, especially riverine systems, give rise to unique habitat mosaics, which support distinctive biodiversity and provide substantial ecosystem services, creating a strong imperative for their protection and restoration. They are being impacted globally by divergent but frequently concurrent processes including water pollution, over-fishing, alteration of natural flow regime, invasive species, climate change and human-induced habitat loss. These dynamic systems are often poorly protected, and require conservation measures through systematic planning. Systematic Conservation Planning (SCP) is widely considered as the most influential paradigm to identify and bring areas under protection through effective planning and spatial prioritization. The SCP requires an evaluation of sites for their biodiversity values, habitat heterogeneity, habitat dynamics, and existing human-induced habitat alteration factors. The Ganga River is the lifeline to more than 500 million people as it flows through five riparian states. It also harbours a unique assemblage of biodiversity due to its passage through three distinct biogeographic zones and unique habitat mosaics. Apart from nurturing umbrella species like the Gangetic river dolphin, otters, gharial and mugger, the Ganga River basin is recognized as a Global Turtle Priority Area and a Turtle Biodiversity Hotspot. With the aim of protecting and conserving the diverse array of biota and their habitats, a 7 km stretch of the Ganga River between Rajghat (Malviya Bridge) to Ramnagar Fort in Varanasi District, Uttar Pradesh was declared as the Kachhua Vanyajiv Abhyaranya (Turtle Wildlife Sanctuary – TWS). Although declared a protected area, increase in riverbank agriculture, river traffic, water pollution through sewage and solid wastes are posing a threat to the biodiversity of TWS and the river-riparian habitats. High human disturbance in the form of cultural-religious activities are influencing the biological values of TWS.

Considering the above, a rapid assessment study (March- July, 2018) was conducted in the TWS to evaluate its efficacy as a protected area; and to identify areas for effective biodiversity conservation. Stretch of the Ganga River between Bijnor to Ballia in Uttar Pradesh was evaluated following Systematic Conservation Planning approach. The objectives of this study were (1) Assessment of habitat structure of TWS and to detect changes over time, (2) Evaluation of efficacy of TWS and adjoining riverscape as a refugia for species of conservation concern; and (3) Prioritization of the Ganga River stretches with mosaics of riverine habitats for conservation planning.

A spatial assessment using remote sensing data for the period 1974 to 2016 revealed no significant changes in river channel and sand deposition in the TWS. However, ~28% increase in the vegetation cover was observed which could be attributed to the protection accorded to the riparian areas by the Forest Department compared with an expansion of agricultural areas on the landward side.

Out of 13 species of turtle reported from Ganga River, only 5 species were encountered during the field sampling with the combined efforts of visual encounter surveys and in-stream sampling using gill nets and box traps within the TWS and upstream and downstream of the Sanctuary limit. Very low encounter rate of turtles in TWS indicates high human disturbance leading to habitat alterations within a very small Protected Area. Sites along the TWS in the left bank are seen to have the least suitable habitat for turtles with high anthropogenic disturbances such as cemented ghats, intense ferry and boat activity, pollution, and human presence along the river. The sand bar in the right bank of the TWS, though is an excellent habitat for turtles and breeding birds, is also under severe anthropogenic pressure.

Out of 64 species of fish reported from the Middle Ganga stretch, a total of 45 species belonging to 38 genera, 16 family and five orders were recorded during the sampling period. The fish catch was higher inside TWS as compared to upstream and downstream of the sanctuary and this could be attributed to prohibition of fishing within the Sanctuary limits.

A total of 28 species of birds were observed, of which four species were of threatened categories as per the IUCN Red List. Nests of breeding birds were not observed from the TWS due to high biotic disturbance. A nesting site of the Indian Skimmer was identified at approximately 6 km upstream of the Sanctuary. Five pairs of Indian Skimmer and 14 pairs of Little tern, 4 pairs of River Lapwing a Near Threatened Species were observed from the vicinity.

A rapid assessment of wildlife values was conducted in the entire stretch of the Ganga River falling within Uttar Pradesh and priority areas were identified through a scoring matrix. Kruskal's Multidimensional Scale analysis described the habitat parameters that influence species distribution. These parameters were sand mining, channel depth, fishing activities, presence of village/town and riverbed agriculture. Channel depth is the only factor which is positively influencing species distribution. Based on the scoring matrix, the highest biological value was attributed to a river stretch within the Hastinapur Wildlife Sanctuary, followed by the stretch from Brijghat to Narora, which is a notified Ramsar Site. In addition to these, moderate biological value was assigned to the stretch downstream of Newada till Ballia. Habitat characteristic score (channel depth, meanders and river islands) was high in the downstream of Allahabad, till Ballia as this stretch persistently maintains high depth classes, meanders and river islands representing a complex mosaic of habitats.

The anthropogenic influence scores was almost similar in the entire stretch from Bijnor barrage to Ballia as the river bed agriculture was prominent in the upper stretch, whereas fishing, sand mining, and human settlements were prevalent in the lower stretch of the river. The stretch between Hastinapur Wildlife Sanctuary and Narora already enjoys the protected area status. In spite of the protected status, TWS scored low due to its small size and high human disturbance. Based on the combined scores, a 140 km stretch downstream Newada in Allahabad district to Adalpur in Mirzapur district has been considered as the priority stretch for conservation. It is suggested that this area may be brought under the purview of Wild Life (Protection) Act, 1972 by declaring it as a wildlife sanctuary for the conservation of aquatic biodiversity of the Ganga River in Uttar Pradesh. Since the ecological characteristics and wildlife values vary along this 140 km stretch on account of anthropogenic pressures, harmonization for excluding some areas having high anthropogenic pressures on account of intense cultural-religious uses may be required, and to be done by the Uttar Pradesh Forest Department.

CHAPTER I

1.1 Background

Recognizing the ecological, social, natural and cultural significance of a 7 km stretch of Ganga River between Rajghat (Malviya Bridge) to Ramnagar Fort, for the conservation, propagation and development of wildlife and their environment was declared as the *Kachhua Vanyajiv Abhyaranya* (Turtle Wildlife Sanctuary) vide Government of Uttar Pradesh notification No. 4170/04-3-62/89 dated 21-12-1989 (Annexure X) under the provisions of the Section 18 of the Indian Wild Life (Protection) Act, 1972. The main objectives for the creation of this sanctuary were to:

- Conserve and promote of representative ecosystem and biodiversity of Gangetic plains.
- Develop and nurture the biodiversity as (in the form of) live museums or Gene banks.
- Conservation of wildlife and their natural habitats.
- Create favorable conditions especially to conserve natural ecosystem.
- Provide an opportunity for the common masses to study the aquatic flora and fauna of the region.
- Create conservation awareness among villagers, administration and political leaders.
- Conservation of protected areas with the participation of the people residing in and around the area.
- Promote environmentally conscious tourism and develop the protected areas as a natural ecological tourism destination.
- Promote ecological and environmental research studies in and around the protected areas.

One of the objectives of declaring this area as a Turtle Wildlife Sanctuary (TWS) was to conserve the Gangetic softshell turtle *Nilssonia gangetica*, a carnivorous turtle abundant in this region which helps in scavenging half burnt corpses dumped in this section of the river eventually aid in cleaning the Ganga River and improve water quality. As part of the management measures the Kashi Forest Division started rearing *N. gangetica* at the Sarnath Turtle Centre and releasing them in the Sanctuary from 1987. The Centre also acted as a rescue and rehabilitation facility for confiscated turtles from illegal trade and released them in the Sanctuary enhancing the source population genetic diversity. Over 41,000 turtles have been released till date in the Sanctuary by the Kashi Forest Department (estimated from Kashi Wildlife Division log books). However, the effectiveness of these released population in establishing the base population of turtles in the Sanctuary and outside the Sanctuary boundary has not been assessed. There are few surveys conducted primarily based on 'visual encounters'. This method is not considered as an accurate representation of all the turtle species present or their abundance and is biased towards basking species and certain size classes. The Sanctuary area is also highly disturbed due to religious rituals, boat traffic, holy ablutions, cremation and puja offerings as this section of the Ganga River is known to be one of the highest cultural-religious significance.

The PCCF (Wildlife), Uttar Pradesh requested the Director, Wildlife Institute of India vide Letter No. 3032/dated 08-03-2018, seeking suggestions and recommendations on an ongoing Public Interest Litigation No. 34434 of 2017 between Bharat Jhunjhunwala *vs* Union of India and 3 others regarding stopping the plying of vessels in the Sanctuary. The PCCF (Wildlife), Uttar Pradesh vide Letter No. 44/23-2-12/Lucknow/dated 16-3-2018 also requested Wildlife Institute of India to review the management effectiveness of TWS. In response to the above, the Wildlife Institute of India conducted a rapid ecological assessment of freshwater turtles and associated species in the designated stretch of River Ganga in Uttar Pradesh including the TWS from March to July, 2018.

1.2 Introduction

Freshwater ecosystems, especially riverine systems, are impacted globally by quite a few divergent but frequently concurrent processes including water pollution, over-fishing, alteration of natural flow regime, invasive species, climate change and human-induced habitat loss (Richter et al., 1997; Abell, Allan & Lehner, 2007). These dynamic systems give rise to unique habitat mosaics which support distinctive biodiversity and provide substantial ecosystem services (Schroter et al., 2005), creating a strong imperative for their protection and restoration. However, these ecosystems are globally poorly protected, and continuing declines in their condition demonstrate an urgent need for conservation measures through systematic planning (Abell, 2002; Rodrigues et al., 2004; Kingsford & Neville, 2005; Revenga et al., 2005; Dudgeon et al., 2006). Scientific literature about freshwater protected areas and their designating criteria is scant.

Systematic Conservation Planning (SCP) is widely considered as the most influential paradigm to identify and bring areas under protection priority for conservation (Margules & Pressey, 2000; Knight et al., 2010; Sarkar & Illoldi-Rangel, 2010). SCP, on representation in freshwater protected areas is focused largely on representing biodiversity, such as species and ecosystem types (Kirkpatrick, 1983). However, consideration of connectivity of freshwater ecosystems with upstream, downstream or upland areas is crucial in planning. It concerns the evaluation of sites for their biodiversity value, habitat heterogeneity, habitat dynamics, and existing human-induced habitat alteration factors. The holistic paradigm would ensure participatory planning and collaborative implementation of strategies, decisions and actions that secure the long-term survival and favourable conservation status of biodiversity in general.

The Ganga River is the largest river in India and flows through five states. The River is the lifeline of over 500 million people from 11 basin states and provide habitat for numerous flora and fauna. The Ganga River harbours a unique assemblage of biodiversity due to its passage through three distinct biogeographic zones, namely Himalaya (West Himalaya - 2B), Gangetic Plain (Upper Gangetic Plain – 7A and Lower Gangetic Plain – 7B) and Coasts (East Coast – 8B). A smaller stretch of the Ganga River, in Jharkhand state, also borders the Deccan Peninsula (Chhota Nagpur – 6B) (Rodgers & Panwar, 1988). The habitat mosaic of the River nurture more than 140 aquatic species including a wide variety of primitive phytoplanktons to highly developed vertebrates like the Gangetic river dolphin (*Platanista gangetica*), Smooth-coated otter (*Lutrogale perspicillata*), Gharial (*Gavialis gangeticus*), Gangetic softshell turtle

(*Nilssonia gangetica*) and several species of endemic freshwater crabs (Bashir *et al.* 2010). Other obligate aquatic species like waterbirds and island nesting birds are also important components of this riverscape. The Ganga River is also known to support more than 143 species of fish that belong to 11 orders, 72 genera and 32 families (Sarkar *et al.* 2012), which accounts for 20% of the total freshwater fishes reported in India. The Ganga River basin is recognized as a Global Turtle Priority Area (Buhlmann *et al.* 2009) and a Turtle Biodiversity Hotspot (Mittermeier *et al.* 2015). The Ganges River is known to support up to 13 species of freshwater turtles, classified into nine genera. Of these, nine species are under threatened categories such as Red-crowned roofed turtle *Batagur kachuga* (CR), Three-striped roofed turtle *Batagur dhongoka* (EN), Indian narrow-headed softshell turtle *Chitra indica* (EN) and Gangetic softshell turtle *Nilssonia gangetica* (VU).

The Turtle Wildlife Sanctuary (TWS) is a 7 km section of the middle stretch of the Ganga River near Varanasi, Uttar Pradesh between Ramnagar Fort to Rajghat (Malviya Bridge). The Middle Ganga stretch is characterized by large fertile floodplains that are extensively used for agriculture. Bank feature alteration due to agriculture, construction and sand mining has disrupted the lateral connectivity of the River. The aquatic and riparian habitat of the TWS has also been disrupted by similar threats. Being a holy place of tremendous religious and cultural importance, the region is also experiencing considerable tourist pressure. Although declared a protected area, increase in river bank and river-bed agriculture, increase in river traffic, and water pollution through sewage and solid waste are posing threats to the biodiversity of this section of the River.

Adopting the Systematic Conservation Planning, a select stretch from Bijnor to Ballia in Uttar Pradesh including the TWS was evaluated with the following objectives,

1. Spatial assessment of habitat structure of TWS, Varanasi.
2. Assess the efficacy of the TWS and adjoining riverscape as a refugia for species of conservation concern.
3. Prioritize the Ganga River stretches with mosaic of riverine habitats for conservation planning in Uttar Pradesh.

1.3 Study Area

A phase-wise study was carried out from Bijnor to Ballia in Uttar Pradesh (Figure 1.1) including intensive assessment of the TWS and adjoining area at Varanasi.

The Varanasi city is situated in eastern part of Uttar Pradesh along the northern bank of the Ganga River and is known as one of the oldest surviving cities in the world. It is an important pilgrimage site for both Buddhist and Hindus with the main tourist attraction being the Holy Ganga and over 100 *Ghats* along the River (Das, 2009). The stretch of Ganga River passing through Varanasi is a part of the middle Ganga that extend from the Haridwar to Farakka with typical geomorphic and biotic characteristics.

In 1989, a stretch of 7 km from Ramnagar fort to Malviya Bridge was declared as the Turtle Wildlife Sanctuary under the Wild Life (Protection) Act, 1972 as part of the Ganga Action Plan-Phase I. As a part of the Sanctuary, a turtle rearing facility was developed in Sarnath with the objectives of rearing carnivorous turtles so as to release them in the Turtle Sanctuary. It was believed that these turtles could devour the dead bodies in the Ganga River thus would assist in cleaning the river system. However, the main aim of creating this Sanctuary was to conserve and propagate the aquatic wildlife and their environment in Gangetic plains.
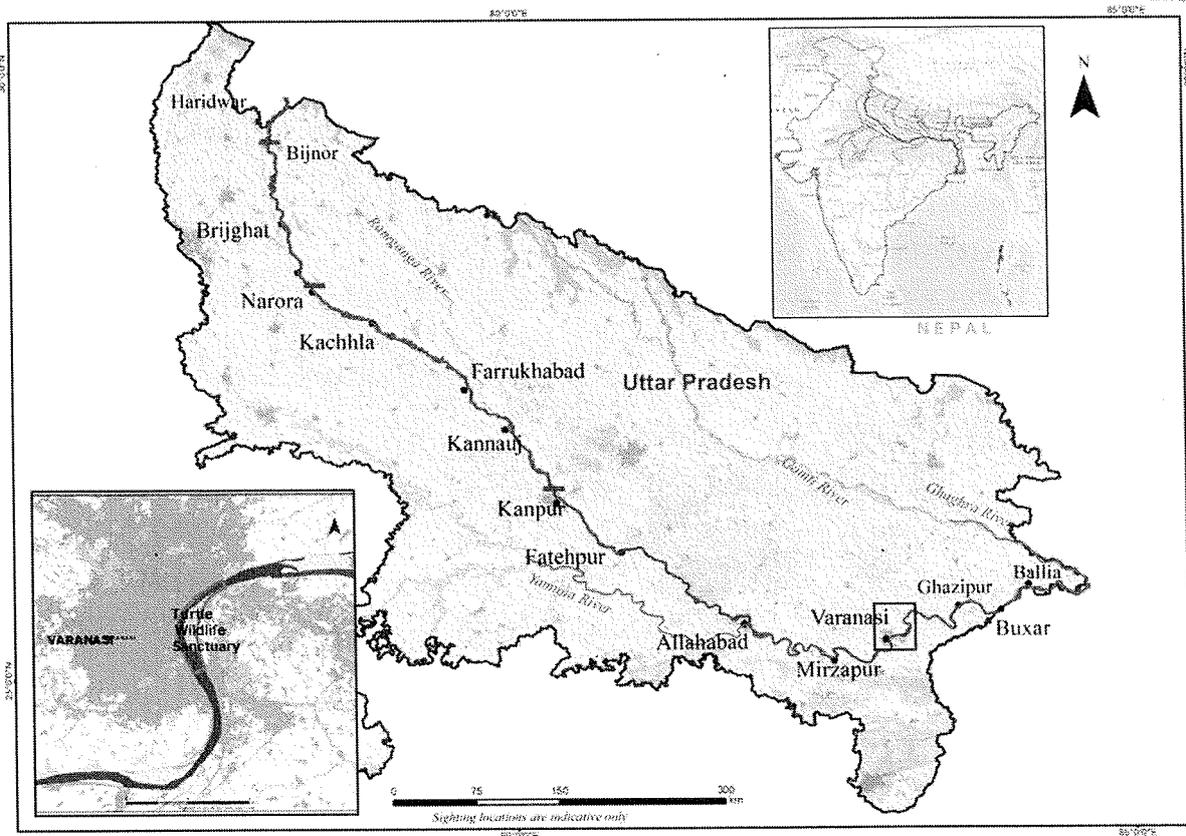
Figure 1.1 Study area and intensive study location in TWS

CHAPTER II

2.1 Spatial assessment of habitat dynamics of TWS

2.1.1 Introduction

The turtle wildlife sanctuary is a 7 km river stretch starting from upstream Ramnagar fort to Malviya Bridge. The Varanasi city lies on the western bank of the sanctuary. The bank is almost concretized with more than 80 Ghats witnessing thousands of pilgrims every day. This stretch is forming a large meander with huge sand bar on the eastern side (Figure 2.1).

The Sanctuary is providing a refuge to the biodiversity of this riverscape especially to the scavenging turtle species. These turtles help to reduce the organic load of the river in the form of unburnt/partially burnt bodies.

Sand bars situated on eastern banks are crucial for the survival of the birds and reptiles in terms of their nesting and basking requirements. The sediment dynamics of the Sanctuary is one of the most important factor that governs the distribution of aquatic biodiversity. Any change in the river channel and sand bar may drastically affect the existence of ancient ghats along the western banks as well as the biodiversity of this region, and therefore the Land use/Land cover (LULC) was assessed in the Sanctuary boundary.

Figure 2.1 Outline of Turtle Sanctuary. (Source: ArcGIS 10.2 Base map Imagery)

2.1.2 Methodology

Remote sensing images of the Sanctuary area were obtained for the period of 1974 to 2016. The images were classified using ERDAS IMAGINE 2015 (Debnath et al 2017). The data used in the classification included *Landsat* satellite images of the year 1974, 1988, 1994, 1998, 2000, 2003, 2008, 2011, 2013 and 2016. The water and the land area were calculated using change detection.

The area is very dynamic as landscape pattern keeps on changing throughout the year. Hence the images were classified into three categories i.e. Water, Sand and Vegetation (Mishra et al., 2017). Land transformation from one LULC class to another is one of the most important aspects of LULC dynamics. The proportional changes in the sand bar and river width are calculated to know the dynamics of the river channel and sand deposition in the Sanctuary.

2.1.3 Findings

Analyses of change in LULC from 1974 to 2016 revealed that there is no regular trend and significant change in the Sanctuary in terms of sand bar dynamics and water area. All the minor changes in the area of sand bar (-3.29 to +3.93) were due the dynamic nature of river depending upon the seasonal fluctuations and variations in annual rain fall. The vegetation cover showed increasing trend from 1988 to 2003 with more than 10 times increase in the vegetation area. Increase in the vegetation cover (28.38%) may be due to the agricultural expansions and the plantation in the area. After a sudden decrease during 2008, the area under vegetation cover was observed to be stable till 2016. Table 2.1, 2.2 and Figure 2.2 highlight the area under different LULC classes.

2.1.4 Conclusions

The spatial assessment using remote sensing data for the period 1974 to 2016 revealed no significant changes in river channel and sand deposition in the TWS. However, ~28% increase in the vegetation cover was observed which could be attributed to the protection accorded to the riparian areas by the Forest Department and expansion of agricultural areas on the landward side as the boundary of the Sanctuary is not clear. The irregular trend in water and sand area are product of in-stream seasonal patterns of channel flow. However, the hydro-dynamics and the bar formation in the Sanctuary area is stable over the years and could provide suitable nesting and basking habitat for turtles, crocodiles and nesting riverine birds, if adequate protection is provided.

Table 2.1 Area under different Land use/Land cover classes between 1974 and 2016 in the Turtle Wildlife Sanctuary, Uttar Pradesh

Year	Area under different categories (ha)						Total Area (ha)
	Water	%	Sand	%	Vegetation	%	
1974	309.24	43.21	379.08	52.97	27.36	3.82	715.68
1988	319.41	45.91	373.59	53.70	2.70	0.39	695.70
1994	354.87	51.01	302.13	43.43	38.70	5.56	695.70
2000	274.21	40.03	366.91	53.56	43.92	6.41	685.03
2003	323.98	47.29	300.08	43.80	61.02	8.91	685.08
2008	240.39	34.55	445.95	64.10	9.36	1.35	695.70
2011	265.14	38.11	393.48	56.56	37.08	5.33	695.70
2013	274.34	40.05	358.49	52.33	52.25	7.63	685.08
2016	272.43	39.16	379.53	54.55	43.74	6.29	695.70

Table 2.2. Change (%) in different Land use/Land cover classes between 1974 and 2016 in the Varanasi Turtle Sanctuary, Uttar Pradesh

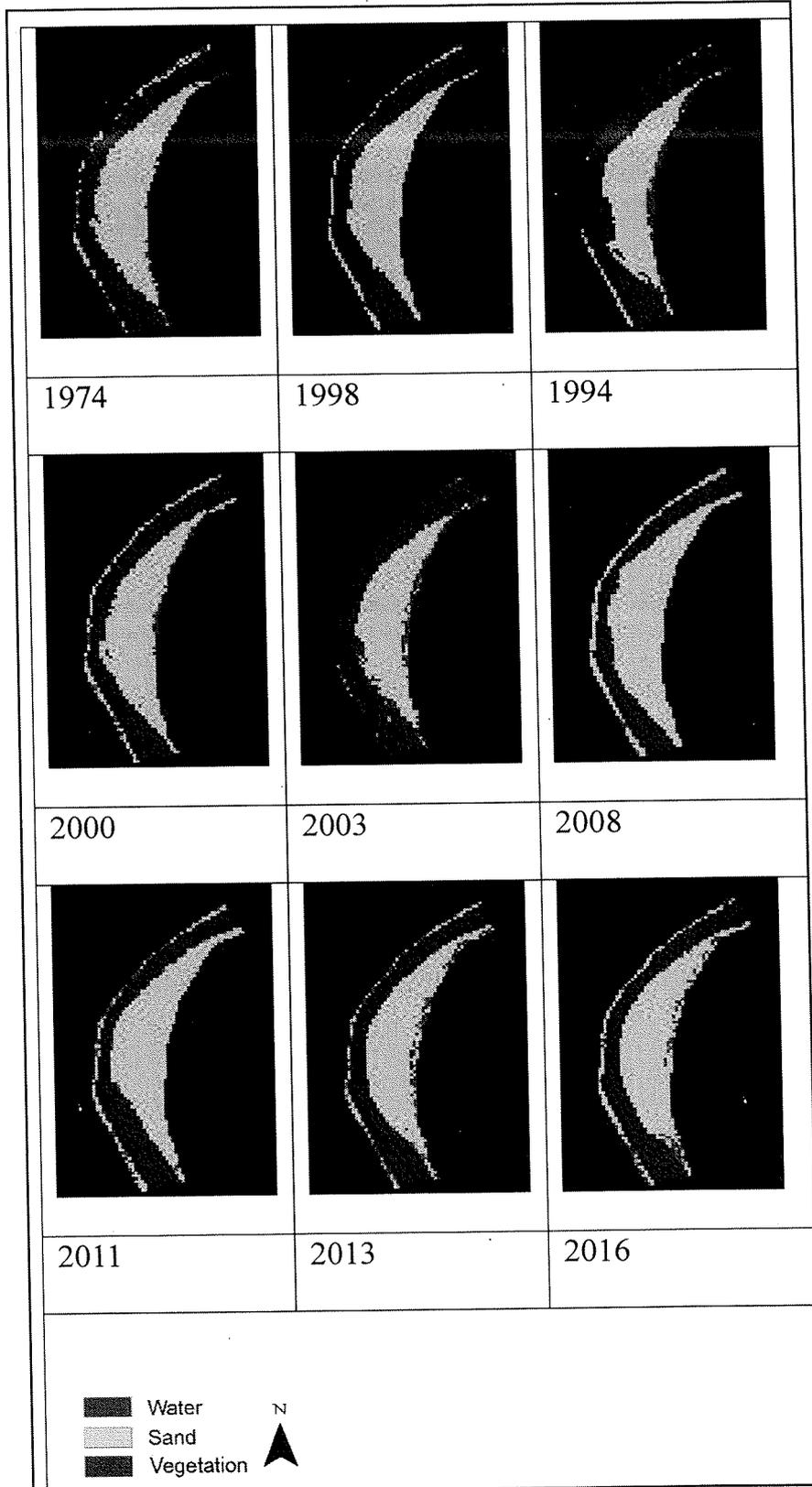| Year	Change (%) in different landuse classes		
	Water	Sand	Vegetation
1974	0.00	0.00	0.00
1988	3.29	-1.45	-90.13
1994	14.76	-20.30	41.45
2000	-11.33	-3.21	60.53
2003	4.77	-20.84	123.03
2008	-22.26	17.64	-65.79
2011	-14.26	3.80	35.53
2013	-11.29	-5.43	90.95
2016	-11.90	0.12	59.87
Mean	5.36 (±3.88)	-3.29 (±3.93)	28.38 (±23.22)

Figure 2.2 Map showing Land use / Land cover change between 1974 to 2016 at the Turtle
Wildlife Sanctuary, Uttar Pradesh

CHAPTER III

3.1 Assessment of the efficacy of the TWS and adjoining riverscape as a refugia for species of conservation concern

3.1.1 Introduction

Freshwater turtles are considered as keystone species from which other animals and plants benefit (Noureen et al., 2007) and as indicator species which get seriously affected by any modification in habitat. They are the first to disappear from a destroyed habitat (Bour, 2008). Despite the unique turtle diversity, no qualitative or quantitative base line information exists on the species wise occurrence or abundance in different habitats, in the State of Uttar Pradesh (Singh *et al.* 2009). There have been few scientific surveys in the upper Ganga, Gomti and Yamuna rivers (Basu 1993; Basu, 1996; Rao, 1998). Six of the 11 species (Table 3.1) found in the lower stretches of river Ganga comprising the Turtle Wildlife Sanctuary, Varanasi are Schedule I species and designated the highest level of protection as per the Wildlife (Protection) Act, 1972.

Given that freshwater turtles depend critically on natural river flow dynamics, sand and silt deposition, submerged aquatic vegetation and emergent island habitats for feeding, basking and breeding (Lenhart et al., 2013), the increasing anthropogenic pressures on the river channel and banks can lead to regional extirpation of turtles.

Table 3.1 Checklist of turtle species known to occur in and around the Turtle Wildlife Sanctuary (TWS), their status as per IUCN Red List and Wild Life (Protection) Act, 1972.

#	Scientific name	Common name	IUCN status	WPA Schedule
1	*Batagur kachuga*	Red-crowned roofed turtle	Critically Endangered	Schedule I
2	*Batagur dhongoka*	Three striped roofed turtle	Endangered	Not listed
3	*Geoclemys hamiltonii*	Spotted pond turtle	Vulnerable	Schedule I
4	*Pangshura tecta*	Indian roofed turtle	Least concern	Schedule I
5	*Pangshura smithii*	Brown roofed turtle	Near threatened	Not listed
6	*Pangshura tentoria*	Indian tent turtle	Least concern	Not listed
7	*Hardella thurjii*	Crowned river turtle	Vulnerable	Not listed
8	*Melanochelys trijuga*	Indian black turtle	Near threatened	Not listed
9	*Nilssonia gangetica*	Indian/Ganges softshell turtle	Vulnerable	Schedule I
10	*Nilssonia hurum*	Indian Peacock softshell turtle	Vulnerable	Schedule I
11	*Lissemys punctata*	Indian flapshell turtle	Least concern	Schedule I

The declining population of freshwater turtles in the middle and lower Ganga stretches, including the Turtle Wildlife Sanctuary necessitates baseline data collection for the abundance and distribution of the freshwater turtles.

3.1.2 Methodology

A reconnaissance survey had been carried out earlier inside the Turtle Wildlife Sanctuary, Varanasi in the first week of October 2017 for freshwater turtles using Visual Encounter Surveys and semi-structured questionnaire surveys. The respondents were fishermen who demonstrated ecological knowledge of turtles, their seasonal activity and nesting patterns. Information was also collected on perception of locals towards turtles, areas with turtle presence, fishing intensity, nest predation and poaching for trade.

The depth profile of the 25 km Ganga river stretch was assessed through bathymetry surveys conducted by motor boat using a hand held depth sounder (Hondex PS-7), along the stretch in and around the Turtle Wildlife Sanctuary. A data point was created at every 50 m interval on transects along the entire cross section of the river as well as on transects diagonally between two cross sections of the river. The distance between two cross sections was maintained at approximately 1 km. A bathymetric map was then generated in a GIS system from the geo-coordinates and data on the depth profile of the sanctuary.

A rapid ecological assessment for freshwater turtles and associated aquatic species in the same stretch was conducted from April to May 2018. Since the TWS is longitudinally connected in which turtles might be moving in and out of the sanctuary this study was conducted in the TWS as well as 5 km buffer areas upstream and downstream of the sanctuary. The river stretch from Sehwar till Mirzapur was divided into twenty segments of 1 km length, which were intensively monitored for the presence of turtle species and other aquatic wildlife such as fish and riverine birds. Sampling locations within each stretch were chosen on the basis of accessibility, suitability to deploy nets and probability of encountering turtles based on habitat quality and least anthropogenic disturbances.

3.1.2.1 In-stream sampling procedure

Survey methodology for turtles is highly variable and visual surveys is one of the easiest, efficient and cost effective methods of documenting presence of turtles in an area. They can be conducted via boat or walking along the river bank; scanning for presence of turtles through binoculars. Turtles can alternatively be caught using a wide variety of trapping methods each suitable for a specific habitat or species. Gill mesh nets, Hoop traps, Basking traps are commonly used for many turtle ecological studies across the world. To increase the likelihood of species detection, multiple trapping methods are deployed in a variety of depths (Glorioso et al., 2010) and to reduce bias towards certain species or size classes. When working with assemblages of species that differ in behaviour, a suite of capture techniques may be required (Liner, 2006). Extensive literature survey and questionnaire based surveys were conducted to know the kind of species occurring in the area. Boat surveys were carried out to record dolphin, birds and turtles. However due to summer season the sightings of turtles were very low. Hence

the observations were supplemented with turtle trapping (Figure 3.1). In general three sampling methods were used targeting different species:

i. **Visual Encounters Surveys (VES)** - Visual surveys were conducted by a single observer using Nikon binoculars (8x40) in a wooden row boat travelling at an approximate speed of 2-3 km/hr. The boat would travel at a distance of 6-10 m from the river bank and was conducted between 9 - 11 a.m. for a duration of half an hour to record any sightings of freshwater turtles in a 1 km river stretch.

ii. **Gill nets (Mesh sizes (3", 4", 6" and 8")** - Four nylon monofilament gill nets of different mesh sizes with dimensions 50 m length and 3 m height were deployed in all the segments for 4 hours in the day and 6 hours in the night.

iii. **Box traps** - Two box traps with wooden frames and dimensions 1 x 1 x 0.5 m were deployed in strategic locations in the site with sufficient water depth and low disturbance in all the segments for 4 and 6 hour periods in the day and night respectively. They were baited with chicken intestines hanging from the top tied with rope to the frame.

Morphometric data such as Straight Carapace Lengths, Width; Plastron Length, Width; and weight were measured for each turtle captured. Age class and sex was also recorded following Das (1995).

Trapping methods were repeated twice across the river segments during the survey period. All traps were deployed by a research team on site and checked at every two hour intervals to record captures and prevent any accidental mortality. Box traps were deployed by experienced assistants under supervision of researchers and checked regularly. Trapping methods such as hook lines were not utilized as they are an invasive method and result in turtle mortalities. Hoop nets and basking traps methods are not suitable due to extremely low capture rates and low efficiency in fast flowing rivers with strong current like the Ganga, with high disturbance factors.

To estimate fish diversity and abundance, two additional gill nets of mesh size 1"and 2" were deployed in all segments for 4 hours in the day and night from April to May 2018. This was conducted in co-ordination with the sampling for freshwater turtles. Upon capture, each unique species was measured and photographed as a voucher specimen. Catch per unit effort (CPUE) was combined for all gill nets and was calculated as the number of fish catch per total sampling effort.

The river banks which could serve as basking and nesting habitat for turtles were assessed for characteristics such as riverbank slope, sand bank extent, % cover of riparian vegetation. This was recorded through visual surveys by walking along the river bank edge. Land-cover types of the floodplains (agriculture, scrub, bare sand, etc.) was also recorded and a habitat matrix was prepared. Anthropogenic pressures were mainly quantified during the study period for number of motor boats operational and threats at sites in categories such as Construction

activity, pollution, fishing activity, agriculture and sand mining were quantified into a score from 1 to 5 (1- no habitat, 5- very good habitat) for overall aquatic habitat quality.

a. Deploying Gill net in the TWS
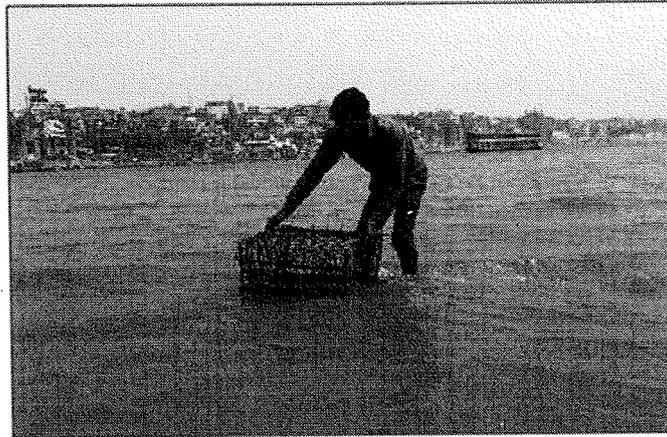
b. Deploying Box traps in the TWS
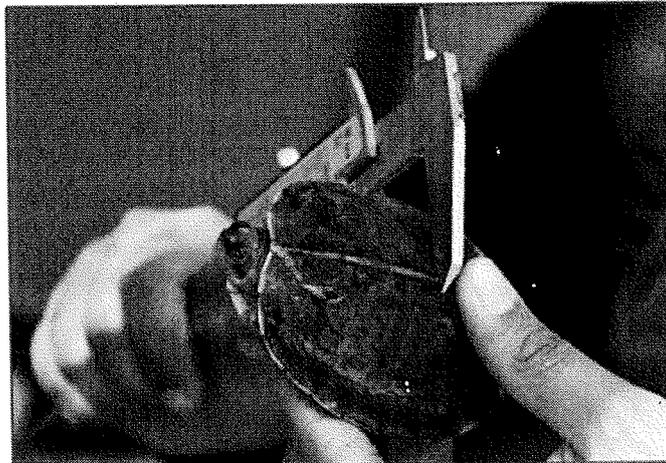
c. Morphometric measurement of Turtles

Figure 3.1 Sampling methods during the study in and around TWS from April to May 2018 (a to c).

3.1.3 Findings

During the study period from April to May 2018, sampling was conducted for 32 days with a combined effort of 1648 hours including all sampling methods.

3.1.3.1 Depth profile

A bathymetric map was visualised in a GIS system from the bathymetric sampling conducted for a 25 km stretch from Chunar to downstream of the TWS, in the month of March 2018 (Figure 3.2). The middle part of the Sanctuary show very few shallow areas of 0-5 feet depth. The depth increase towards both the Sanctuary boundaries and overall depth remain more than 10 feet in the surveyed section of the river.
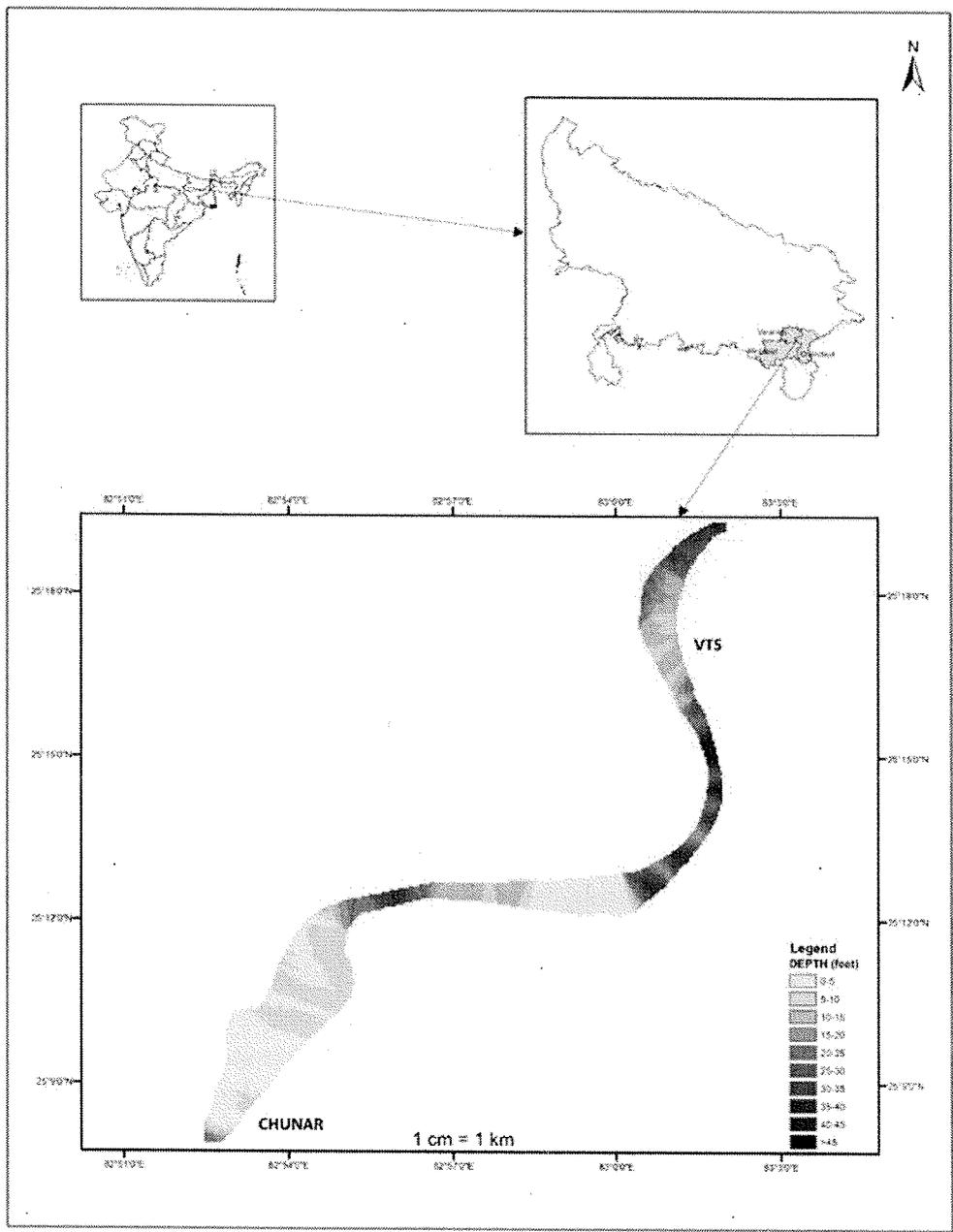
Figure 3.2 Bathymetric map of river Ganga from Chunar till the TWS in March 2018

3.1.3.2 Encounter of Turtles

Questionnaire survey (n=12) conducted with fishermen across the study area revealed that a majority of them identified up to four species of freshwater turtles from pictures provided and all fishermen confirmed the presence of the Ganges softshell turtle *Nilssonia gangetica* in the TWS. Most fishermen reported seeing large sized individuals of the Ganges softshell turtles which they refer to as *"katawa"* in their local Hindi language, at sites close to Assi and Manikarnika Ghat in the TWS as well as at sites near the mouth of rivers Varuna and Assi Nala. Fishermen also reported occasional nesting of turtle species in sand banks upstream of the sanctuary. Many fishermen reported the inability to capture large sized Ganges Softshell turtles as they often break their fishing nets and escape, if captured in the nets. The threats to turtles were identified as occasional accidental captures in nets followed by intentional hook line captures for consumption.

A total of five species of freshwater turtles (n=9) were encountered during the study period as shown in Figure 3.3, with the combined efforts of Visual Encounter Surveys and In water sampling of using Gill nets and Box traps.

Visual Encounter Surveys: VES were conducted in all 20 intensive sampling sites during the day and three turtle species (n=7) were encountered in four sites from the initial reconnaissance survey and intensive survey. The total Encounter Rate was 0.27 turtles per km during the entire study area (Table 3.2).

Table 3.2 VES data for freshwater turtles from reconnaissance and intensive surveys during the study period

Date	Site	Species encountered	No. of Individuals	Total Effort (hrs)	Encounter Rate
30/09/2017	V1	*Nilssonia gangetica*	3		
02/10/2017	V1	*Nilssonia gangetica*	1		
17/05/2018	V2	*Pangshura smithii*	1	12.5	0.27 per km
21/05/2018	V12	*Nilssonia gangetica*	1		
30/5/2018	V1	*Pangshura tecta*	1		

Gillnet and Box trap sampling: During the study period, in a total of 32 days of sampling- Two individuals of two species Indian Tent Turtle *Pangshura tentoria* and Indian Flapshell Turtle *Lissemys punctata* (Schedule I) were captured (Table 3.3). Morphometric data such as Curved and Straight Carapace Lengths and Width; Plastron Length and Width were measured for each turtle. Age class, sex was also recorded (Appendix I). Despite sufficient intensive efforts low CPUE can be attributed due to the low abundance of turtles in the study area.
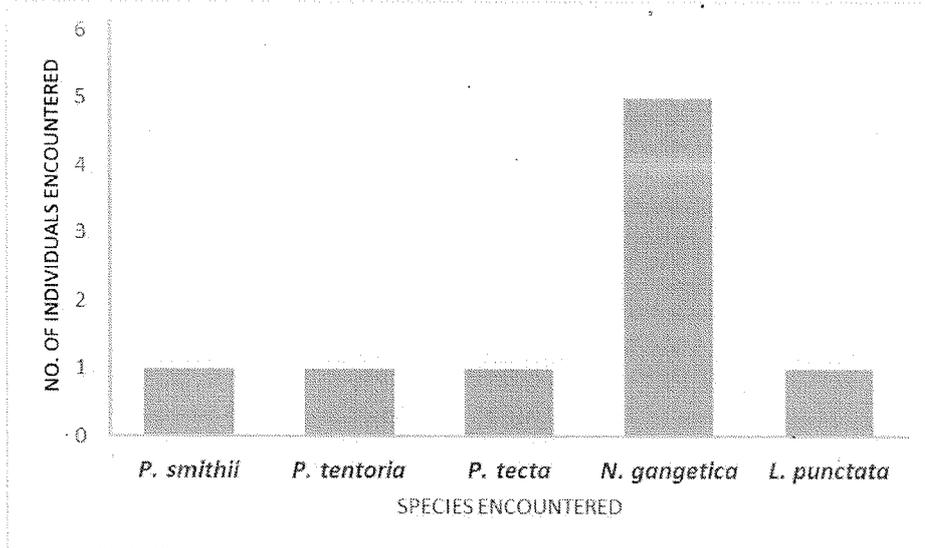
Figure 3.3 Species encountered using combined efforts of VES, Gill nets and box traps during the sampling for ecological status assessment in and around the Varanasi Turtle Wildlife Sanctuary

Table 3.3 Catch Per Unit Effort (CPUE) of different sampling gear for freshwater turtles during intensive surveys during the study period.

Trapping method	Total Effort (hrs)	Species encountered	CPUE
3" gill net	330	–	0
4" gill net	330	Lissemys punctata	0.003
6" gill net	330	–	0
8" gill net	330	–	0
Box traps X 2	400	Pangshura tentoria	0.0025

A map was visualized in QGIS software and prepared showing the 20 sampling locations during the study as well as the capture or sighting locations of all turtle species encountered during the study as shown in Figure 3.4.
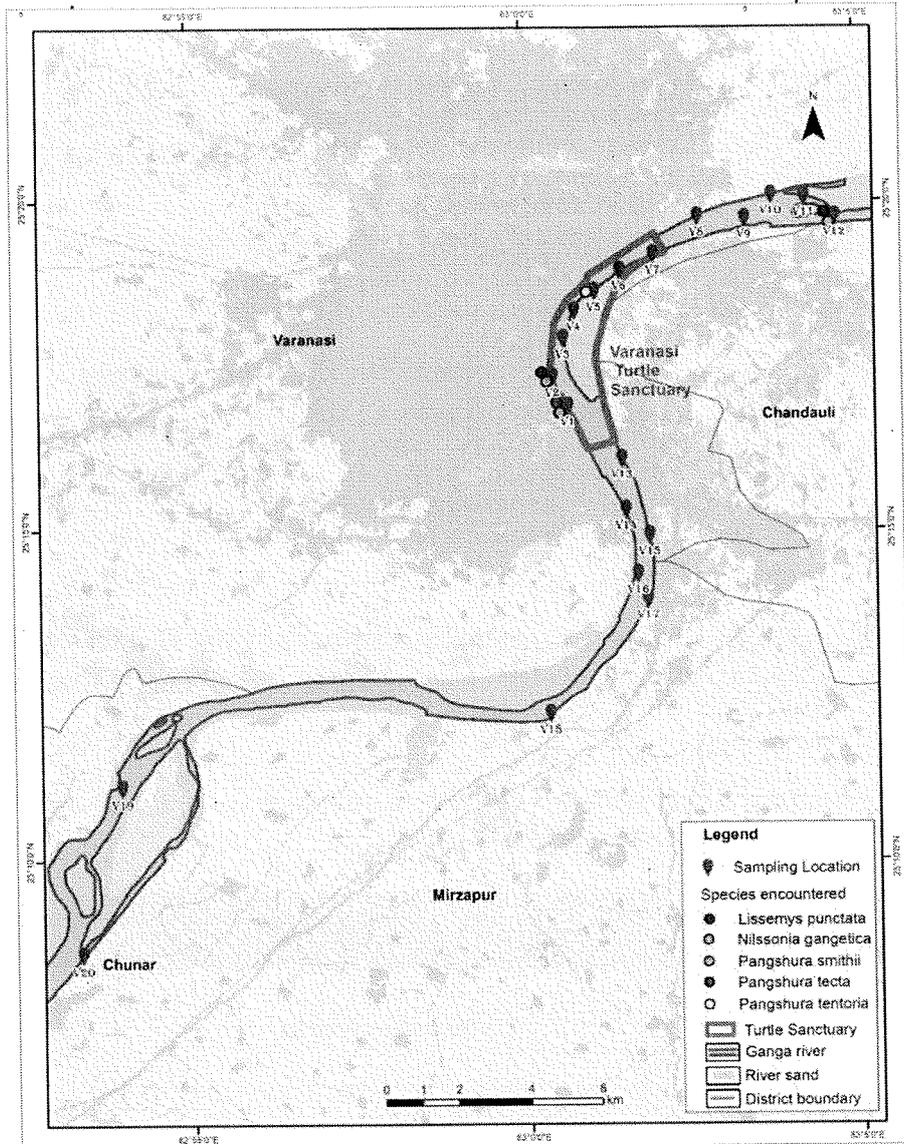
Figure 3.4 Map of Sites sampled during ecological assessment of freshwater turtles in and around TWS and species encountered during the study period April to May 2018

3.1.3.3 Fish

A total of 45 fish species belonging to 38 genera, 16 family and five orders were recorded during the study (Appendix II). Maximum species were reported from the Cyprinidae and Bagridae families (Figure 5). The fish species *G. chapra*, *P. chola*, *C. carpio*, *S. seenghala*, *J. coiter* and *M. armatus* were the most common species at every site. *P. sophore* and *G. giuris* were only recorded up and down stream of TWS, respectively. Fish species such as *E. vacha*, *C. garua*, *S. silondia*, *C. gachua* and *C. striata* were not recorded in upstream but in the TWS and downstream of it.
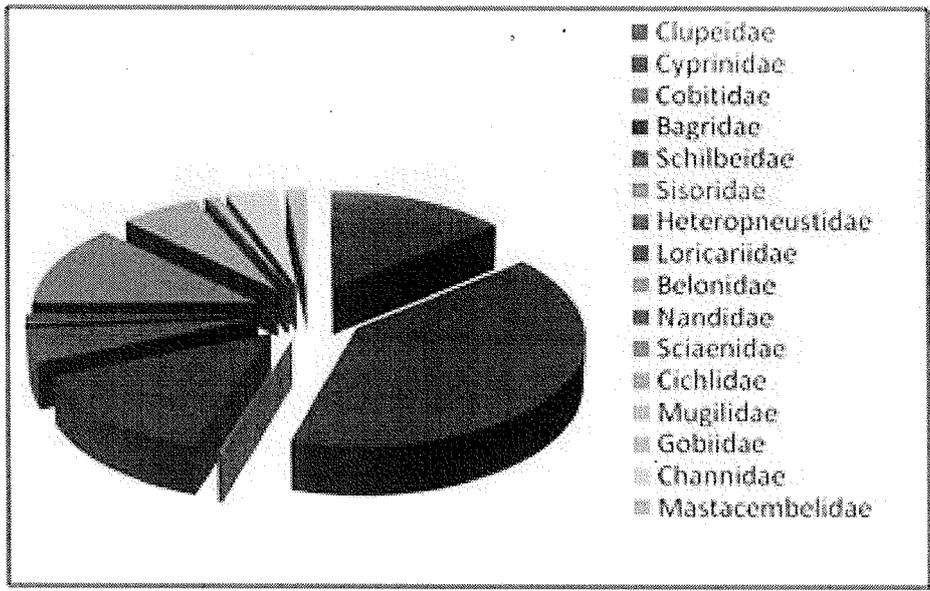
a. Families of fish diversity in the entire study stretch (25 km)
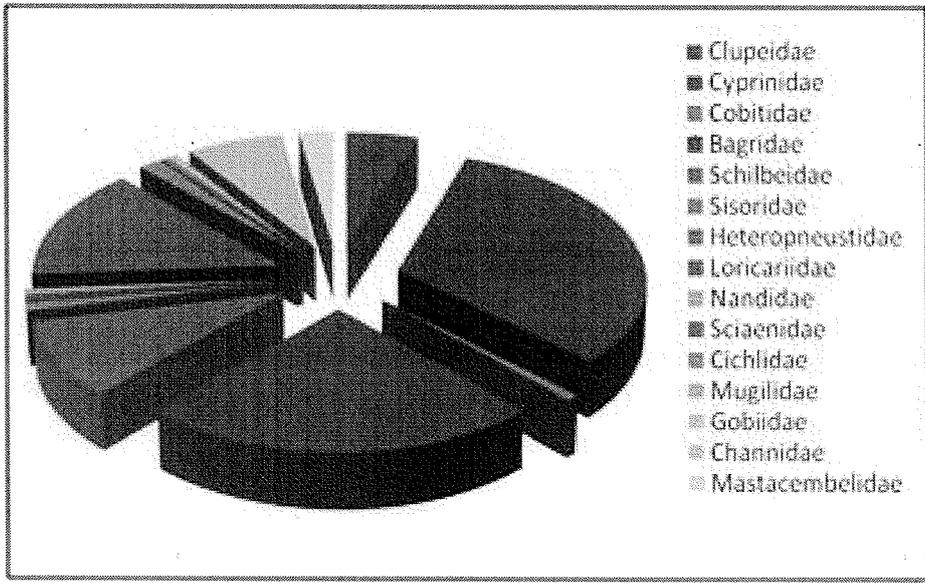
b. Families of fish diversity in TWS

Figure 3.5 Representation of families of fish diversity captured in River Ganga during ecological assessment in and around TWS for the study period April to May 2018 (a & b)

CPUE for fish captured during the study period is given in Table 3.4. CPUE was higher inside the Turtle Wildlife Sanctuary as compared to upstream and downstream of the sanctuary. Specifically sites V4 and V5 which are in close proximity to the Burning Ghats of Varanasi had the maximum CPUE for fish with CPUE of 1.72 and 1.75 respectively.

Table 3.4 CPUE of fish captured during ecological assessment in and around TWS for 20 sampling sites during the study period April to May 2018

Sites	Fish abundance	Total Effort (hrs) (E)	No. of nets (n)	E*n	CPUE (fish/hr)
TWS	382	56	35	280	1.36
Downstream of TWS	207	40	25	200	1.04
Upstream of TWS	329	64	40	320	1.03

3.1.3.4 Riverine birds

A checklist of all riverine birds observed during the motor boat surveys during the study period April to May 2018 was prepared (Appendix III). A total of 28 species were observed of which four species are in Threat Categories. A nesting site of the Indian Skimmer (*Rynchops albicollis*) was identified at site V18 (25.203380°N, 83.005940°E) approximately 6 km upstream of the TWS along the River Ganga. Five pairs of Indian Skimmer and 14 pairs of Little tern (*Sternula albifrons*) and their nests were found to be breeding at the same site on a single sand island at a distance of 250 m from the right river bank. A breeding and nesting site of four pairs of River Lapwing (*Vanellus duvaucelii*) a Near Threatened Species was found at site V16 (25.238538°N, 83.028424°E).

3.1.3.5 Aquatic mammals

During the study, presence of the Gangetic river dolphin (*Platanista gangetica*) which is an Endangered and Schedule I species protected under The Wild Life (Protection) Act, 1972, was observed in stretches V13 to V18 upstream of the TWS. Groups comprising of 2-4 individuals were encountered on two occasions during motor boat surveys and were observed to be surfacing for 5-10 minutes. The sites where the Ganges river Dolphin were encountered had low fishing activity and less anthropogenic disturbances.

3.1.3.6 Habitat assessment

A habitat matrix (Table 3.5) was prepared for all the 20 sites sampled for the parameters riverbank slope, river width, percentage cover of riparian vegetation, land-cover types of river bank. The sites were graded form 1 to 5 based on their nesting habitat quality and overall aquatic habitat quality taking into account various anthropogenic disturbances at each site as well. Sites V18 Narayanpur, V19 Adalpur and V20 Chunar were recorded to have the best nesting and aquatic habitat quality as a combination of suitable aquatic habitat parameters, nesting habitat availability and least disturbance and anthropogenic threats. The banks of the TWSwas observed to have high anthropogenic disturbances throughout the day and night due to motor boat and tourist activities as well as farming on the right bank in certain areas of the sanctuary.

Table 3.5 Habitat characteristics at 20 sampling sites during ecological assessment in and around TWS during study period April to May 2018.

	Site	River width (m)	River bank slope (°)	% river bank vegetation	No. of sand islands	Landcover type (agriculture, scrub, grassland, sand)	Nesting habitat quality (1-5)	Overall aquatic habitat quality (1-5)
Turtle Wildlife Sanctuary	V1	403	5	5	0	Sand	1	1
	V2	340	5	5	0	Sand	1	1
	V3	268	10	5	0	Sand	1	1
	V4	300	15	5	0	Sand	2	1
	V5	347	15	10	0	Sand	1	1
	V6	370	5	5	0	Sand	2	1
	V7	442	20	20	0	Sand	2	1
Downstream of TWS	V8	560	10	40	0	Scrub	2	2
	V9	678	35	60	0	Scrub	3	3
	V10	315	30	90	1	Grassland+scrub	3	3
	V11	542	25	5	1	Sand	3	3
	V12	354	5	10	2	Sand	3	3
Upstream of TWS	V13	662	15	80	0	Grassland	1	1
	V14	423	15	90	0	Grassland+scrub	1	1
	V15	400	15	90	0	Grassland	3	2
	V16	420	10	70	1	Sand	3	2
	V17	442	15	10	3	Sand	4	3
	V18	210	25	5	2	Sand	5	4
	V19	384	15	5	4	Sand	5	4
	V20	400	40	10	2	Sand	4	4

Score for nesting, habitat assessment: 5 – very good, 4 – good, 3 – moderate, 2 – poor, 1 – No habitat

3.1.4 Discussion

During this study period despite robust sampling in the summer season using a variety of survey methods, capture rates for turtle species was low, indicating a low abundance of turtles in the TWS as seen from the total CPUE <0.005. This study recorded only five out of 11 species of freshwater turtles and three species encountered within the TWS *P. tecta, N. gangetica* and *L. punctata* are Schedule I species. VES indicate that there are a few adult sized Ganges Softshell

, *N. gangetica* species that are often seen in sites inside the TWS. Low encounters rate of 0.27 turtles/km is attributed to poor aquatic habitat quality and high anthropogenic disturbances within the TWS. There were no captures of the head started species which have been released into the sanctuary such as *B. dhongoka* and *B. kachuga* over the years.

Sites upstream of the sanctuary have ideal sand island habitats for the nesting of freshwater turtles as well as riverine birds such as Indian Skimmer, Little Tern, River Lapwings, in areas of low human disturbance. 28 species of riverine birds was observed from the study area, with nesting of five species including that of threatened birds such as Indian Skimmer and River Lapwings. Presence of the endangered Gangetic river dolphin is also reported from the same sites upstream of the sanctuary, in areas of low anthropogenic disturbances.

A total of 45 fish species belonging to 38 genera, 16 family were recorded within the study area. Moreover, new distribution of three fish species *Sisor rhabdophorus*, *Silonia silondia* and *Badis badis* were recorded which were not previously reported in this stretch. Earlier studies by Sarkar et al. (2012) had reported a total of 64 species belonging to 13 families from middle stretch of river Ganga Allahabad to Varanasi (140 km, approx.). Higher CPUE of 1.36/hr in the TWS indicates the sanctuary is effective in maintaining a diverse population of fish and this might be due to the effects of the fishing ban inside the Sanctuary limits.

The bathymetric map of the study area suggests low water depths upstream of the TWS during summer months, but sufficient water depths downstream, which can be due to the large stable sand bank on the right bank of the TWS which maintains the hydrology and the channel width of the river with slight fluctuations in water depth throughout the year. The poor aquatic habitat quality in the TWS can be attributed to the large footfall of tourists visiting Varanasi especially for the tourist attraction of Ganga Aarti. The 7 km stretch of TWS on the left bank has high levels of human interventions and modification, with approximately 80 Ghats causing high anthropogenic disturbances. The right bank of the TWS has intensive cucurbetaceous crop cultivation. Livelihood of people living in villages along the banks of the TWS depends on fishing and there is intensive fishing in the study area with large gill nets and drag nets of various mesh sizes.

3.1.5 Conclusions

Very low encounter rate of turtles in TWS indicates high human disturbance leading to habitat alterations within a very small Protected Area. Sites along the TWS in the left bank are seen to have the least suitable habitat for turtles with high anthropogenic disturbances such as cemented ghats, intense ferry and boat activity, pollution, and human presence along the river. The sand bar in the right bank of the Sanctuary, though is an excellent habitat for turtles and breeding birds, is also under severe anthropogenic pressure. Higher diversity and catch of fish species from the TWS is indicative of restriction on fishing in the sanctuary.

CHAPTER IV

4.1 Prioritize the river stretches for conservation planning

4.1.1 Introduction

Rivers harbour a rich diversity of species, complex mosaic of habitats and substantial ecosystem services (Schroter et al., 2005), creating a strong imperative for their protection and restoration. Woefully escalating human demands has led to overexploitation; water pollution; flow modification; degradation of habitat of these vital ecosystems and continuing declines in their condition demonstrate an urgent need for increased conservation measures (Abell, 2002; Rodrigues et al., 2004; Kingsford & Neville, 2005; Revenga et al., 2005). River conservation and management is integral to the interests of all humans, nations and governments (Dudgeon et al., 2006). The Ganga River, due to its varied geo-morphological features (mosaic of habitats) and fluvial processes supports various life forms, and acting as a repository of substantial ecosystem services. However, the Ganga River is subject to severe competition among multiple stakeholders leading to disruption of its physical habitat and biodiversity. Recognizing the fact, it is imperative to adopt a new paradigm for protection of its biodiversity and habitat that may be successfully achieved through prioritization of conservation areas through systematic conservation planning (Moilanen et al., 2008).

Riverine landscape are heterogenous in space and time (complex mosaic of habitat types), that is widely believed to sustain various faunal assemblages and influence species richness (Rahbek & Graves, 2001; Robinson & Ward, 2002). To evaluate the conservation value of such dynamic and heterogenous systems, site-scoring approaches currently dominate the methodology (Boon, 2000; Dunn, 2003). The present study in the dynamic Ganga River ecosystem addressing conservation prioritization of stretches, adopted a similar approach based on individual site (sampling blocks) scores. Stretches or sampling blocks are evaluated independently from each other using multiple criteria such as biological parameters, habitat composition and biotic parameters with scores then combined into an index (score) of the conservation value of each segment or blocks of the Ganga River. Stretches with top conservation values are then taken into consideration for prioritization.

The study was carried out with the following objectives (a) To prepare a biodiversity profile the Ganga River between Bijnor and Ballia, (b) Generate a score matrix for these stretches through multiple scaling of biological, habitat and anthropogenic parameters, and (c) prioritize the stretches between Bijnor and Ballia for the conservation of aquatic wildlife of Ganga River.

4.1.2 Methodology

4.1.2.1 Rapid ecological assessment

The Wildlife Institute of India under its NMCG sponsored project "Biodiversity Conservation and Ganga Rejuvenation" is carrying out the rapid ecological assessment of the Ganga River for its biodiversity value. The assessment covers five Ganga River States. Under this project,

the data generated for the State of Uttar Pradesh was used to derive the sites for conservation based on the occurrence of species of conservation concern.

In Uttar Pradesh State, boat surveys were carried out during the month of May to June 2018 from Bijnor to Ballia using an inflatable rubber boat driven by 40 HP Outboard Engine, travelling downstream at a constant speed of 8-10 km/hr. 26 districts of Uttar Pradesh covering approximately 1390 km stretch of Ganga River was covered in this survey (Figure 4.1). During the survey, to characterize the river stretches data on habitat parameters such as water depth, channel width, presence of sand banks and sand bars and water quality was collected. Simultaneously, data on sighting of aquatic wildlife such as river dolphins, crocodiles, turtles, resident breeding birds and their numbers were carried out through visual encounter method (Bibby et al., 1992; Smith & Reeves, 2000b). The locations of aquatic wildlife were recorded using a GPS (Garmin eTrex 30). Anthropogenic disturbances, which may affect the occurrence of species such as sand mining, fishing activities in terms of number of nets deployed, fishing boats, riverbed agriculture, point source water pollution and number of township along the Ganga River were collected.
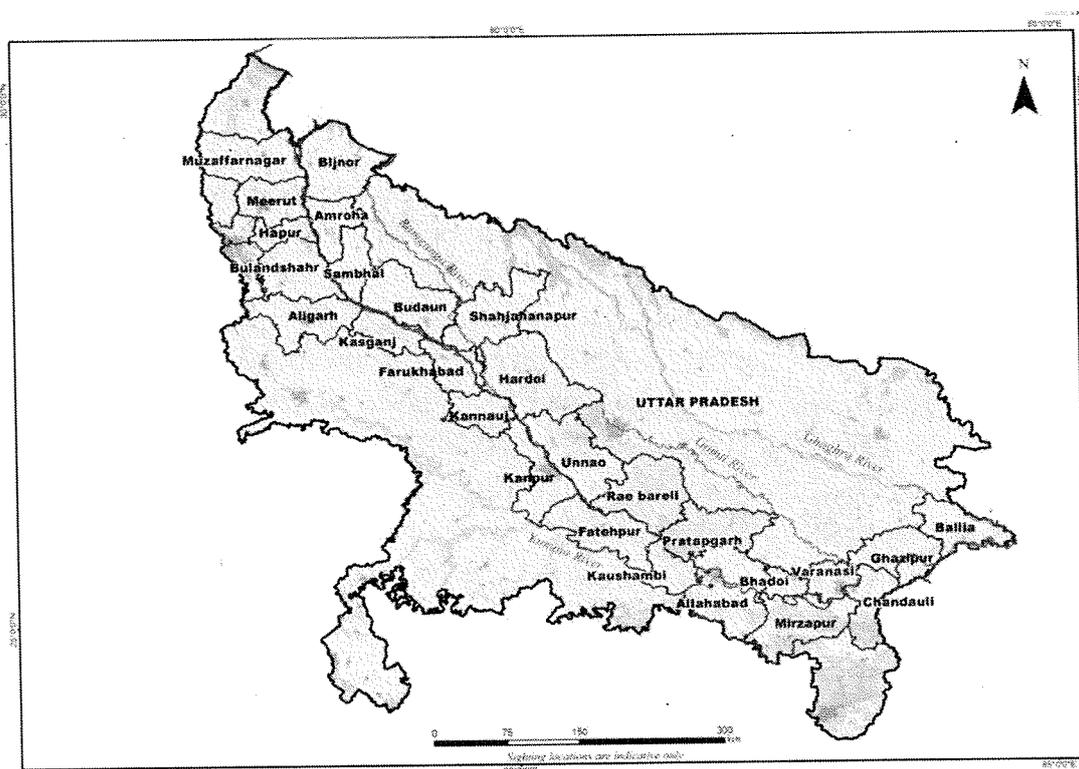
Figure 4.1: The study stretch and the Districts of Uttar Pradesh along the Ganga River

The data were transferred to a Land use/Land cover (LULC) map prepared by National Remote Sensing Centre, Hyderabad to derive the distribution of species of conservation concern along River and threats to their long-term survival. Based on the distribution of sighting locations of species, habitat heterogeneity of the stretch and threat parameters a score matrix was developed. On the basis of scores obtained by each identified stretches the priority stretches were identified.

Three different sampling units such as 1 km (for TWS), 5 km and 10 km linear blocks were initially selected for assessment of biological values of the Ganga River between Bijnor and Ballia. All 3 units were thoroughly evaluated taking into consideration species diversity, habitat heterogeneity and conservation importance to decide the minimum viable units that will be effective in conservation of major aquatic taxa of the Ganga River. Linear blocks of 1 km and 5 km were spatially very short to represent complex habitat mosaics and diverse faunal assemblages of the river. Considering this, the entire survey stretch was divided into 10 km linear blocks and each block was considered as a sampling unit for aquatic habitat characterization. Three parameters i.e., (a) Biological, (b) Habitat characteristics and (c) Anthropogenic parameters were selected and sampled within each sampling units to assess the efficacy score of the blocks. A fix scale was allocated to each parameter and was given scores on the basis of its physical and ecological attributes.

All three parameters were scored from a total score of 10. Biological parameter was assigned a highest score of 5 (50% weightage) as high biodiversity define good habitat quality. It was followed by habitat characteristics which were assigned a score of 3 (30% weightage). Least score of 2 (20% weightage) was assigned to anthropogenic parameters.

4.1.2.2 Assessing influential habitat drivers

Kruskal's Multidimensional Scale analysis was carried out to predict the pattern of proximities (i.e., similarities or distance) among set of objects such as presence of dolphin, gharial, mugger, turtles and nesting birds with habitat parameters such as channel depth, river bed agriculture, sand mining, presence of towns/ villages, boat and fishing net to assess concurrently influencing habitat drivers.

4.1.2.3 Score matrix

Biological indicators

Five parameters were shortlisted within biological indicators such as (a) dolphin individual count, (b) Nests count of breeding birds (c) Gharial individual count (d) Mugger individual count and (e) turtle species count along with individual count. Further, these parameters were ranked based on their ecological roles and conservation importance and weighed against a total score of 50 (in multiplication of 10 to avoid decimal value).

The highest score was assigned to dolphin count (16) as it is the umbrella species and indicator of the aquatic system health of the Ganga River. Individual counts of dolphin was divided into five categories (1-5; 6-10; 11-15, 16-35 and >36) and scoring was given according to congregation. Second highest weightage was given to gharial presence (13 out of 50) as their presence indicates habitat quality of the Ganga River. The ranking was based on three group sizes (4 individuals; 2 individuals and single individual). The resident breeding birds of the Ganga River indicates a wide array of habitats therefore nest and chicks count of breeding birds was assigned a third highest rank (11 out of 50) in score matrix. Total Nest (Nest +Chicks) was classified into 11 classes (0-15; 16-30; 31-45, 46-60, 61-75, 76-90, 91-105, 106-120, 121-135,

136-150 and >150) and ranking was given accordingly. Mugger and turtle presence was, assigned a lowest score (5 out of 50) for both the groups in ranking as they are generalist species and adds more to diversity of Ganga River. The best scores of three biological parameters were pooled and standardized into a single score ranging from 1-5 scale.

Habitat characteristics

The parameter included the crucial hydrology factors such as water depth, meanders and mid-channel islands as they influence species abundance and distribution of the Ganga River. The factors (water depth, meanders and river islands) were ranked and their weightage was calculated from a total score of 30. Water depth was assigned a highest score of 20 (out of 30) as it is an essential requirement for the survival of aquatic species. Further, water depth was categorized into 9 depth classes (0-1 m, 1.1- 2 m, 2.1-3 m, 3.1-4 m, 4.1-5 m, 5.1-6 m, 6.1-7 m, 7.1-8 m and 8.1-9 m) and percentage of each depth classes were calculated. Meanders and river islands are typical geo-morphological features of Ganga River and provide suitable habitats to diverse array of aquatic species. Therefore, both the factors were assigned a score of 5 each out of 30.

Anthropogenic influences

Four human-induced factors were identified such as (a) presence of river bed agriculture (b) the number of fishing nets and boats, (c) riverside villages and ghats and (d) presence of mining sites and ranked based on their impacts on biodiversity of Ganga River. All factors were inversely scored and least weightage was given to fishing activity (fishing nets and fishing boats) as they are most degradative and pose direct threat to the survival of aquatic species. Fishing nets and fishing boats count was categorized into six classes i.e., (0- no fishing and boating, <50, 51-100, 101-150, 151-200 and 201-250) and was calculated from a total score of 6. Similarly, riverside villages and ghats were divided into 6 classes (0 -No town/village and ghats; 1-3, 3-5, 5-7 and >7). The other factors such as presence of riverbed agriculture and mining pose similar threats to nesting turtles and breeding birds and given similar scores in the matrix. The presence of riverbed agriculture and mining sites was classified into four classes (0-No agriculture; 1-Moderate; 2-High disturbance) and (0- no mining; 1-2; 3-4 and >5) respectively.

For the final score, Biological indicator score, Habitat characteristics score and Anthropogenic influence scores were added to get a total score out of 100. The sites were then ranked and plotted based on its final score. A conservation score graph was also generated based on adjacency matrix.

4.1.3 Findings

4.1.3.1 Biodiversity profile of the study stretch

Gangetic river dolphins were encountered in considerable numbers between Hastinapur Wildlife Sanctuary and the following Ramsar site from Brijghat to Narora. Due the lack of connectivity to the lower stretch caused by the Narora Barrage, the dolphin populations remain

isolated from the downstream river. The numbers remain low after Kacchla owing to the reduced water levels. The habitat quality degrades further near Kannauj and Kanpur due to the pollution caused by these major cities. A surge in the dolphin sightings is observed after Allahabad *sangam* as a result of increase in the water volume and river depth.
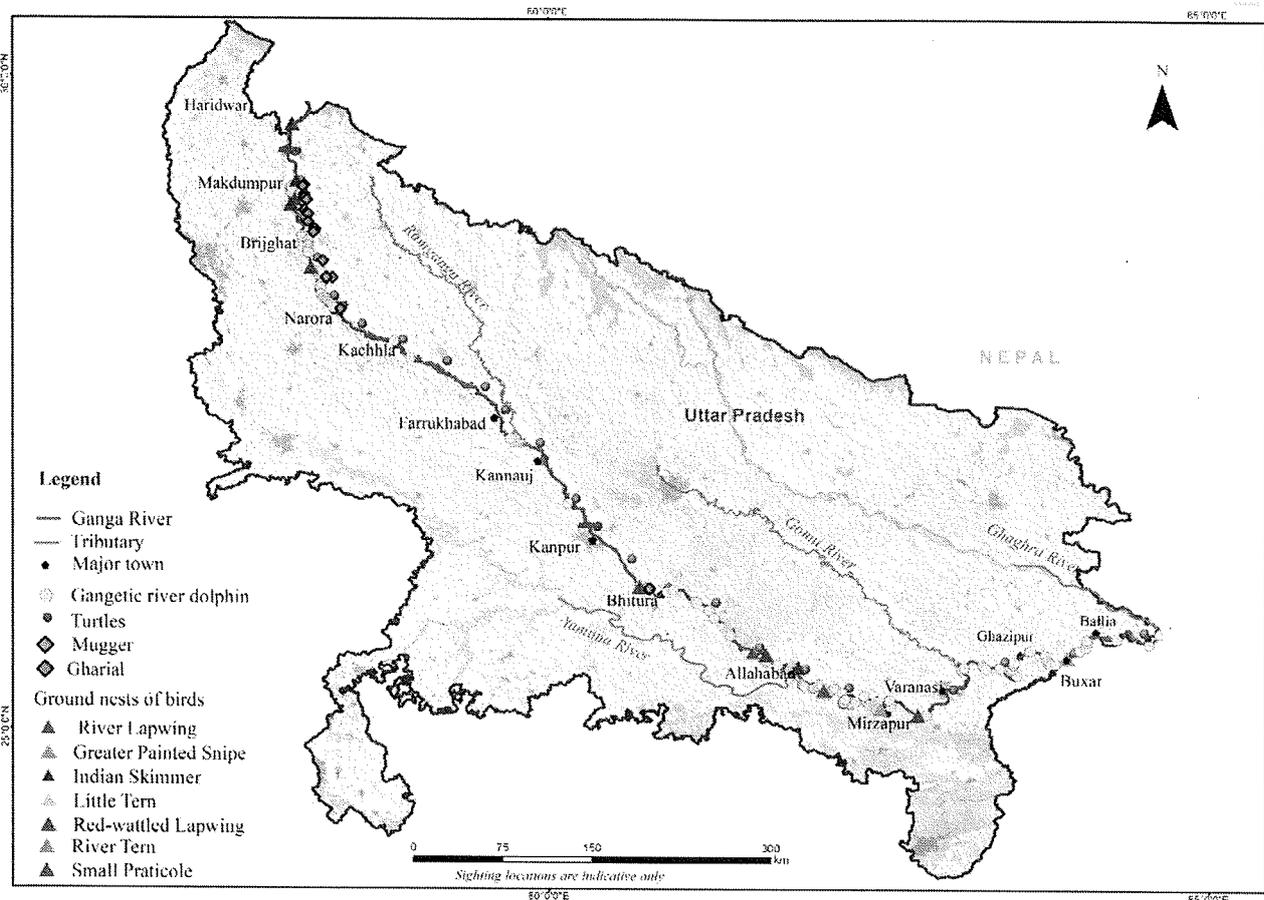

Figure 4.2 Distribution of Gangetic river dolphin, gharial, nesting riverine birds, mugger and turtles based of rapid ecological assessment from Bijnor to Ballia

Though there were few encounters of turtles, they were uniformly sighted along the entire stretch. The sightings of Mugger and Gharial occurred only within the Ramsar site, maximum sightings being from the Hastinapur Wildlife Sanctuary. Nests and chicks of ground nesting birds were found in few sites in the Hastinapur Wildlife Sanctuary and also in the Ramsar site region. The next stretch with ground nesting birds was sighted in the river islands before Allahabad and Mirzapur and Chunar (Figure 4.2).

4.1.3.2 Influential habitat drivers

The habitat parameters that influence species distribution in the studied stretch are sand mining, channel depth, fishing activities, presence of village/town and riverbed agriculture. Only channel depth positively influences the species distribution. The influencing habitat drivers determining species distribution and presence are sand mining, depth, fishing net and boat, presence of town/village, and presence of river-bed agriculture. The analysis (Kruskal's stress (1) =0.183) revealed that dolphin presence was directly influenced by channel depth

irrespective of sand mining and fishing and boating. Again dolphin presence was affected by riverbed agriculture and presence of villages and town at the close proximity of the river. Presence of gharial, mugger, turtle species and birds nest was negatively influenced by presence of boats and fishing nets and there was no positive impacts of channel depth on turtle presence (Figure 4.3).
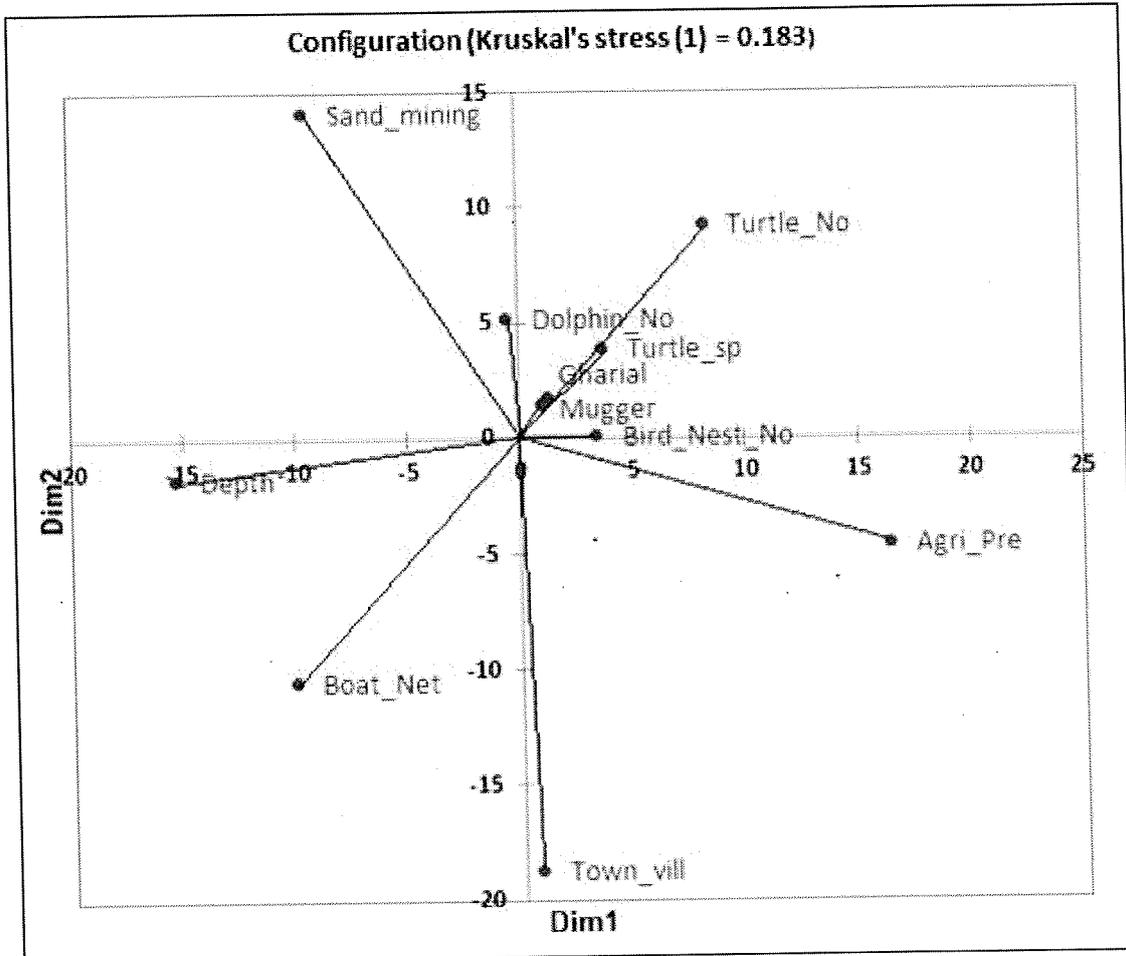
Figure 4.3 Two dimensional plots showing representation of similarities between set of objects (dependent &independent).

4.1.3.3 Biological indicator score

About 97% of the stretch obtained a biological score of less than 1. This was because the abundance of species was less than ideal, owing to various restrains in terms of the habitat parameters of water and steady anthropogenic pressure (Table 4.1).

Only 2.8% of the stretch secured a score between 1 and 2 owing to the presence of dolphins, bird nestings and turtles, gharial, muggers and other riverine species in high numbers. None of the stretches obtained the highest score of 2. This could be explained due to the fact that no ideal stretches were found to exist on ground with abundant richness of all species (Figure 4.4).

4.1.3.4 Habitat characteristic score

The scoring assessment revealed that 74% of the stretch (103 sampling blocks) fall within the scale of 1 .This could be attributed to the fact that, these stretches were devoid of high water depth classes, meanders and river islands. 23.74% (33 sampling blocks) of the stretch lie within the scale of 2 and only 2.16% stretch (3 sampling blocks) hold biological value above 2 attributing to high water depth classes, presence of meanders and island and low anthropogenic pressure (Table 4.1, Figure 4.5).

4.1.3.5 Anthropogenic influence score

All the sites scored more than 1 in terms of anthropogenic pressures as no site was found on field without any disturbance. Hence all the sampling blocks fell in the range of 1 – 2 (Table 4.1, Figure 4.6).

Table 4.1 The proportion of the linear stretches of the entire Ganga River in Uttar Pradesh according to matrix score

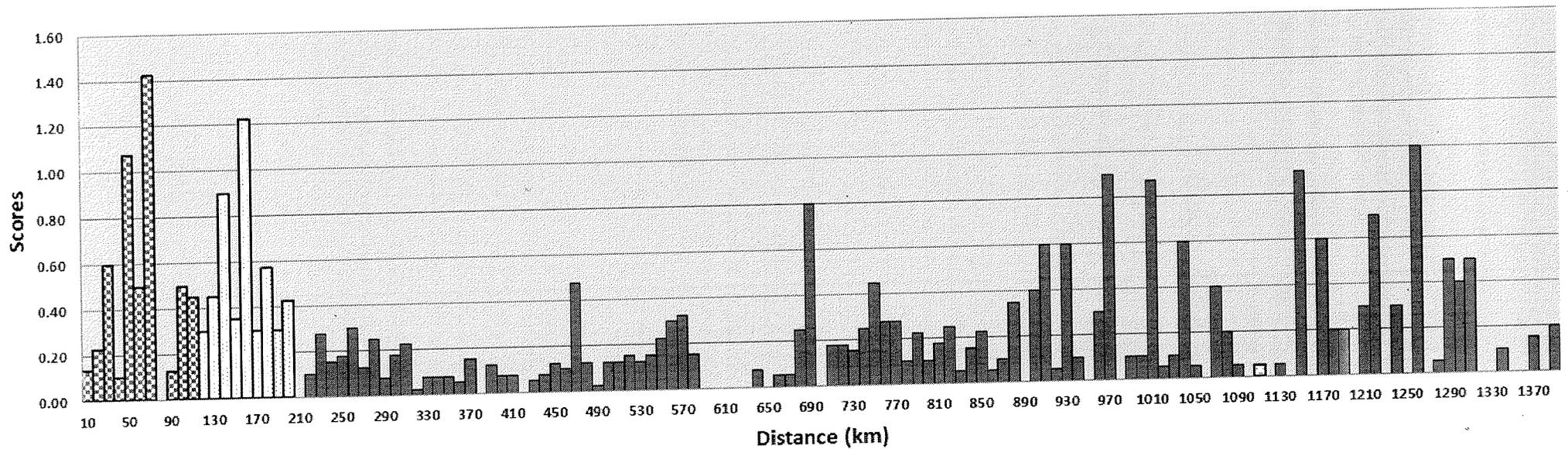| Scores	Sampling blocks			Length (km)			Proportion of total stretch in UP (%)		
	Biological	Habitat	Anthropogenic	Biological	Habitat	Anthropogenic	Biological	Habitat	Anthropogenic
> 2	0	3	0	0	30	0	0	2.16	0
1 - 2	4	33	139	40	330	1390	2.88	23.74	100
> 1	135	103	0	1350	1030	0	97.12	74.10	0

Figure 4.4 Score of biological indicators of Ganga River between Bijnor & Ballia, Uttar Pradesh
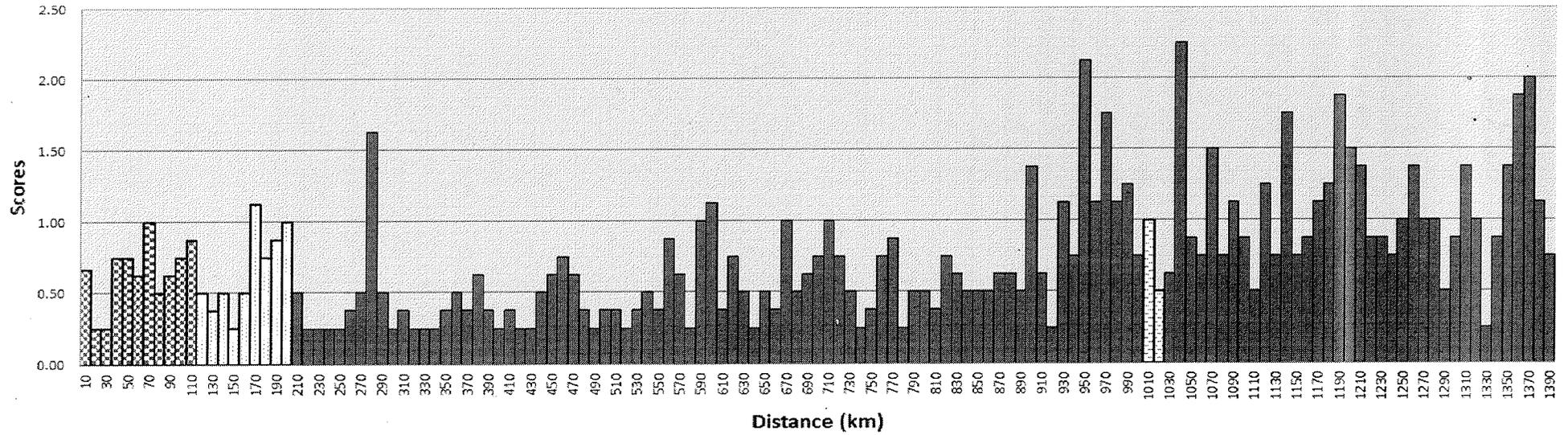
Figure 4.5 Score for habitat characteristics of Ganga River between Bijnor & Ballia, Uttar Pradesh

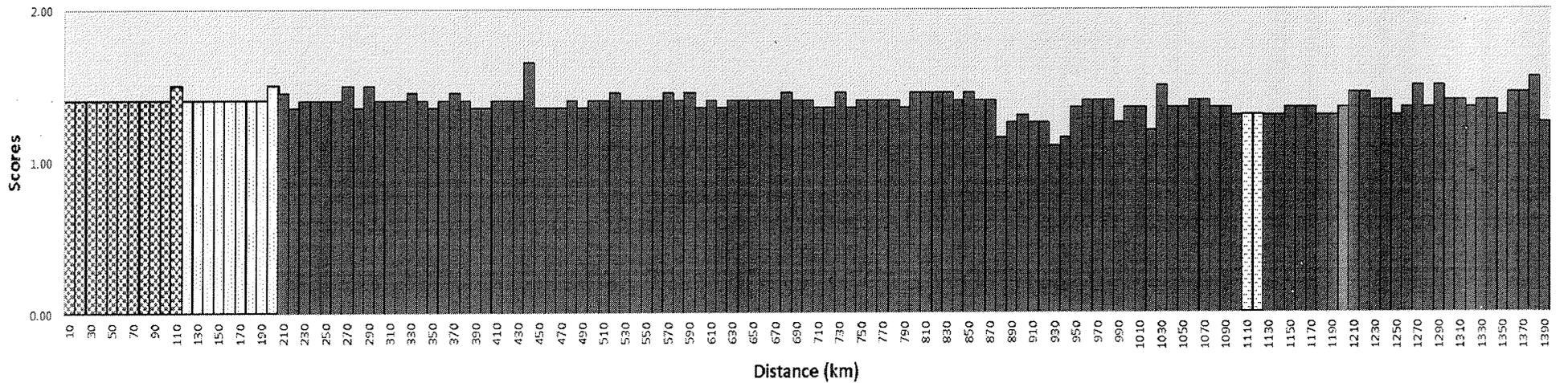Figure 4.6 Score for anthropogenic influence on Ganga River between Bijnor & Ballia, Uttar Pradesh

Our analyses revealed that the overall prioritization score of sampling units fall within the range of 1.55 to 4.20 (Table 4.4). The score of 4 or >4 was represented by only two sampling units followed by 18 units within the range of 3-4, 80 units within the range of 2-3 and 39 units lie within the range of 1-2 score (Figure 4.7 to 4.10). The reason behind getting score of 4.20 (less than 45%) could be attributed to presence of anthropogenic pressures, absence of suitable habitat parameters and minimum representation of all taxa in each sampling units.

Table 4.4 Combined matrix score

Scores	Sampling blocks	Length (km)	Proportion of total stretch in UP (%)
> 4	2	20	1.44
3-4	18	180	12.95
2-3	80	800	57.55
< 2	39	390	28.06

Figure 4.7 Prioritization score (combined score of Biological, Habitat & Anthropogenic parameters) of Ganga River between Bijnor & Ballia, Uttar Pradesh

Figure 4.8 Prioritization score (combined score of Biological, Habitat & Anthropogenic parameters) of >2 of Ganga River between Bijnor & Ballia, Uttar Pradesh
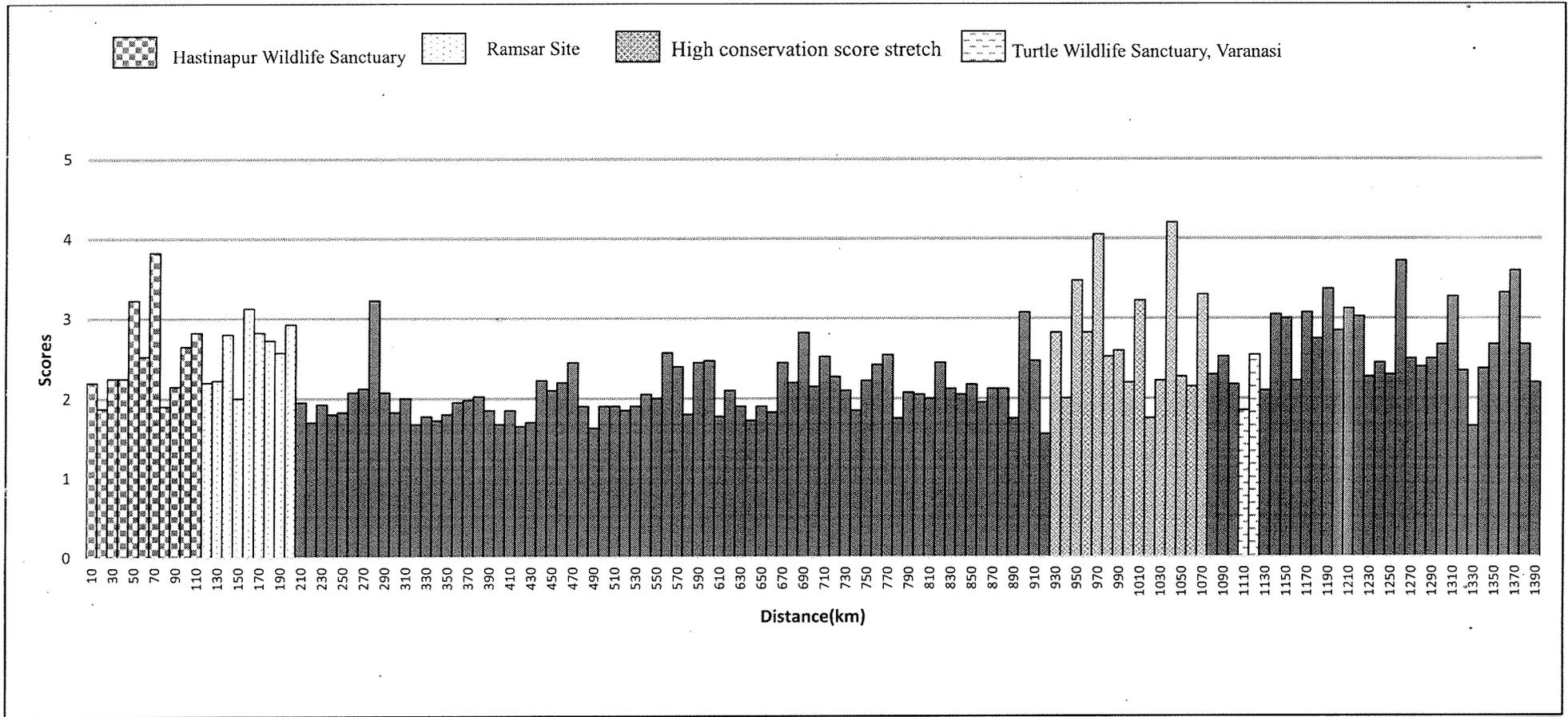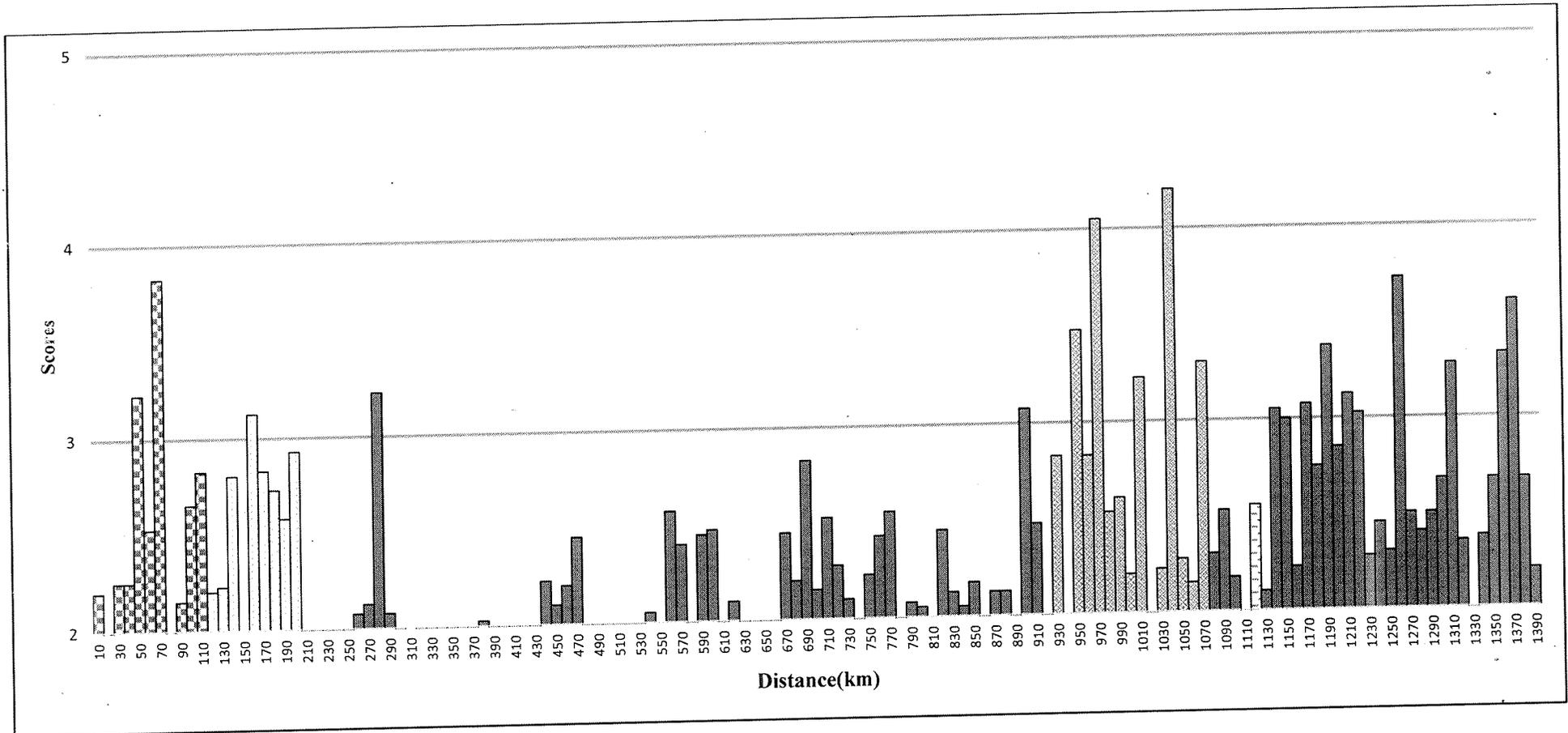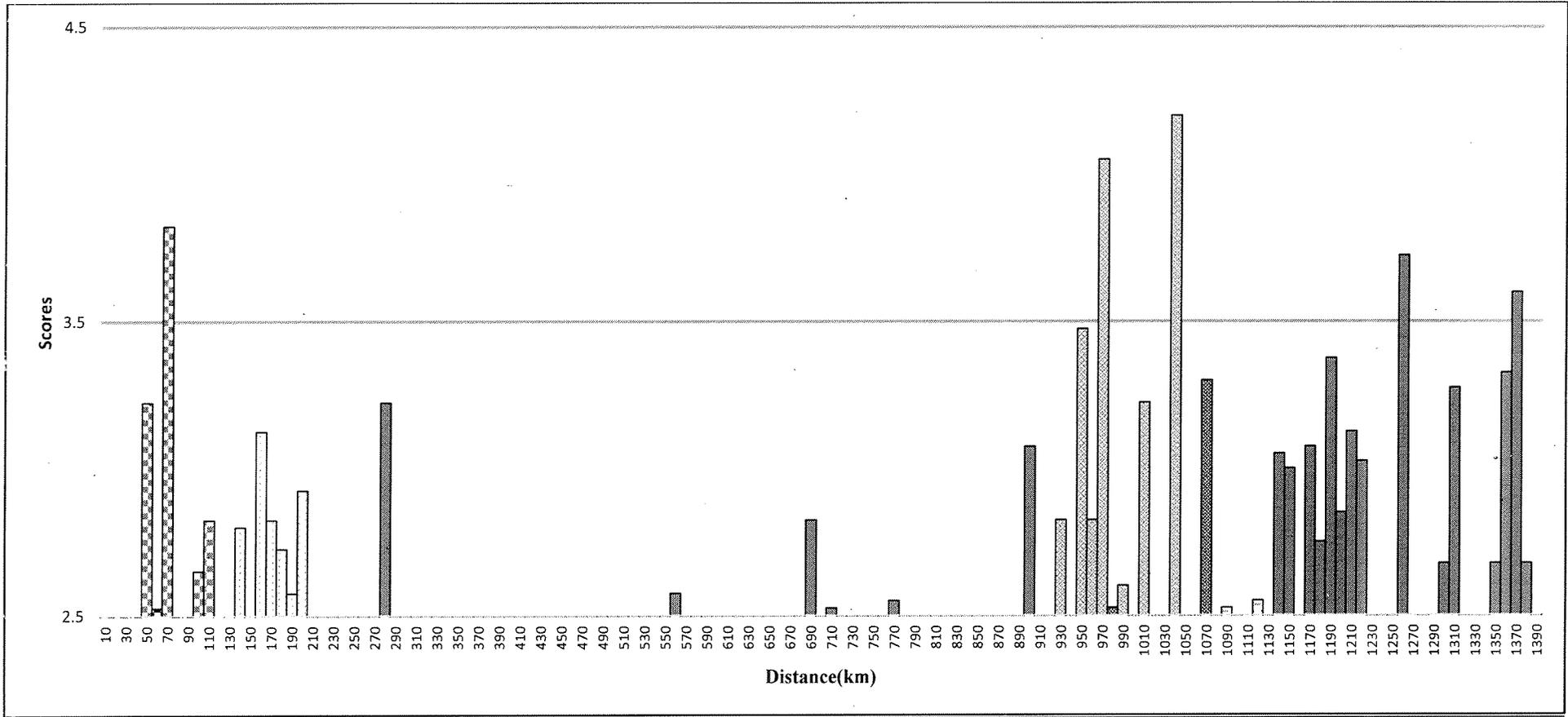
Figure 4.9 Prioritization score (combined score of Biological, Habitat & Anthropogenic parameters) of >2.5 of Ganga River between Bijnor & Ballia, Uttar Pradesh
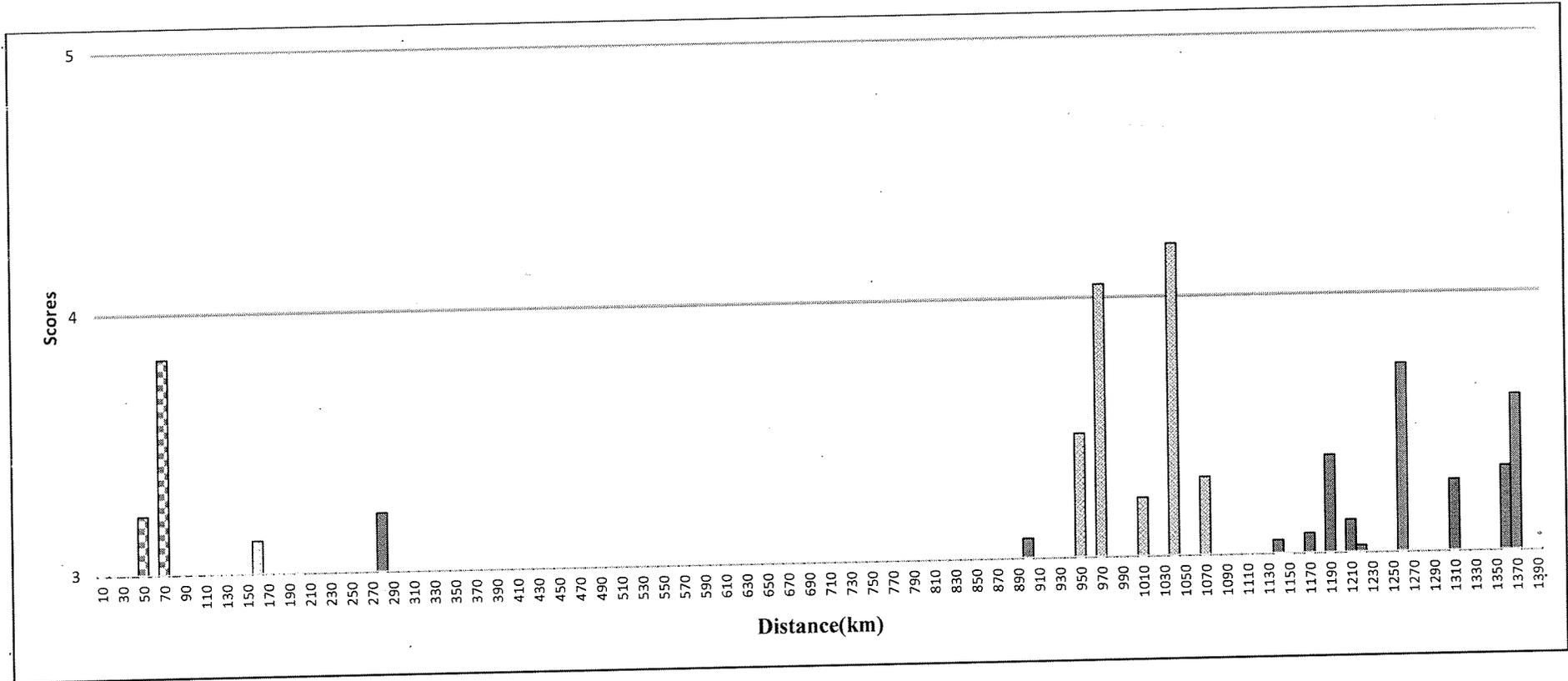
Figure 4.10 Prioritization score (combined score of Biological, Habitat & Anthropogenic parameters) of sampling units above score of 3 of Ganga River between Bijnor & Ballia, Uttar Pradesh

4.1.4 Conclusions

It is evident from the results that each stretch has its unique set of habitats characteristics, species composition and threat levels. In a broader prospective, the study reinforces the idea that the synergies between species richness, habitat heterogeneity and biotic pressure plays central role in prioritizing conservation value of select stretches of Ganga River. As evident from the assessment, the creation of protected areas does help in species conservation, along the Ganga River. However; the area should be large, covering diverse habitat types and minimal threats. Based on the combined score the stretch from downstream Newada in Allahabad district to Adalpur in Mirzapur district, a total of 140 km may be considered as conservation priority area. It is suggested that this area may be brought under the purview of Wild Life (Protection) Act, 1972 by declaring it as a wildlife sanctuary for the conservation of aquatic biodiversity of the Ganga River in Uttar Pradesh. Since the ecological characteristics and wildlife values vary along this 140 km stretch on account of anthropogenic pressures, harmonization for excluding some areas having high anthropogenic pressures on account of intense cultural-religious uses may be required, and to be done by the Uttar Pradesh Forest Department.

CHAPTER V

5.1 Summary of findings

1. The spatial assessment using remote sensing data for the period 1974 to 2016 revealed no significant changes in river channel and the extent of sand deposition in the TWS. However, ~28% increase in the vegetation cover was observed which could be attributed to the protection accorded to the riparian areas by the Forest Department and expansion of agricultural areas on the landward side.

2. Only five freshwater turtle species were encountered in TWS out of the 13 species reported from the Ganga River. Capture rates for turtle species were low in the TWS, indicating low abundance of turtles during the sampling period and high anthropogenic disturbance within TWS.

3. A total of 45 fish species belonging to 38 genera, 16 family were recorded from the TWS and adjacent stretches. New record of three fish species *Sisor rhabdophorus, Silonia silondia* and *Badis badis* were made in this stretch. Higher CPUE of 1.36/hr in the TWS indicates the sanctuary is effective in maintaining a diverse population of fish and this might be due to the effects of the fishing ban inside the Sanctuary limits.

4. Presence of the endangered Gangetic river dolphin was confirmed from the same site upstream of the Sanctuary, in areas of low anthropogenic disturbances. Sites upstream of the sanctuary have ideal sand island habitats for the nesting of freshwater turtles as well as riverine birds such as Indian Skimmer, Little Tern, River Lapwings, in areas of low human disturbance. 28 species of riverine birds was observed from the study area, with nesting of five species including that of threatened birds such as Indian Skimmer and River Lapwings.

5. The bathymetric map of the study area suggests low water depths upstream of the TWS during summer months, but adequate water depths towards downstream.

6. The habitat parameters that influence species occurrence and distribution in the studied stretch are sand mining, channel depth, fishing activities, presence of village/town and riverbed agriculture. Only channel depth positively influences the species occurrence and distribution..

7. Based on the scoring matrix, the highest biological score was recorded at Hastinapur Sanctuary following Ramsar site from Brijghat to Narora, due to its protected status accorded under Wild Life (Protection)_ Act, 1972 and Environment (Protection) Act, 1986 (Ramsar Site).

8. Habitat characteristic score (channel depth, meanders and river islands) was high downstream of Allahabad till Ballia as the stretch persistently maintain high depth classes due to water availability, meanders and river islands representing complex mosaic of habitats.

9. The anthropogenic parameter scores were almost similar in the entire stretch from Bijnor, barrage to Ballia as river bed agriculture was prominent in the upper stretch whereas fishing, sand mining and villages & towns were prevalent in the lower part of the stretch.

10. Based on the combined score the stretch from downstream Newada in Allahabad district to Adalpur in Mirzapur district, a total of 140 km may be considered as conservation priority area and notified as a Wildlife Sanctuary under the provision of Wild Life (Protection) Act, 1972. Since the ecological characteristics and wildlife values vary along this 140 km stretch on account of anthropogenic pressures, harmonization for excluding some areas having high anthropogenic pressures on account of intense cultural-religious uses may be required, and to be done by the Uttar Pradesh Forest Department.

REFERENCES

Bashir, T., A. Khan, P. Gautam, S.K. Behera. 2010. Abundance and prey availability assessment of Ganges river dolphin (*Platanista gangetica gangetica*) in a stretch of upper Ganges river, India. *Aquatic Mammals*, 36 (1) (2010), pp. 19-26

Basu, D. 1993. Pilot Study on biology and ecology of Crowned River Turtle "*Hardella thurjii*" in Gomti River in UP, India. (Report submitted to Dr Jeffery W. Lang; Biology Department, University of North Dakota, Grandfork, USA, pp 19.)

Bour R. 2008. Global diversity of turtles (Chelonii; Reptilia) in freshwater. *Hydrobiologia*. 595:593–598

Buhlmann, K. A. *et al.* 2009. A Global Analysis of Tortoise and Freshwater Turtle Distributions with Identification of Priority Conservation Areas. *Chelonian Conservation and Biology.* 8(2):116–149.

Das, I. 1995. Turtles and Tortoises of India. Oxford University Press, Oxford.

Das, D. and Sharma, S. K. 2009. An assessment of the impact of tourism development at Varanasi: perspectives of local tourism businesses. *International Journal of Tourism Policy.*Vol. 2, No. 3

Das, S. 2011. Cleaning of the Ganga. *Journal Geological Society of India*. Vol.78, pp.124-130

Debnath, J., Das, N., Ahmed, I., and Bhowmik, M. (2017). Channel migration and its impact on land use/land cover using RS and GIS: A study on Khowai River of Tripura, North-East India, The Egyptian Journal of Remote Sensing and Space Science, Volume 20, Issue 2, Pages 197-210

Glorioso, B.M., Vaughn, A.J., Waddle, J.H. 2010. The aquatic turtle assemblage inhabiting a highlyaltered landscape in southeast Missouri. *Journal of Fish and Wildlife Management.*1(2):161–168; e1944-687X.

Hussain, S. A. 2009. Basking site and water depth selection by gharial *Gavialis gangeticus* Gmelin 1789 (Crocodylia, Reptilia) in National Chambal Sanctuary, India and its implication for river conservation. *Aquatic Conservation: Marine and Freshwater Ecosystems*. Volume19, Issue2. Pages 127-133

Lenhart, C.F., Naber, J. R., and Nieber, J.L. 2013. Impacts of Hydrologic Change on Sandbar Nesting Availability for Riverine Turtles in Eastern Minnesota, USA. *Water* 5, 1243-126.

Liner, A.E. 2006. Wetland predictors of amphibian distributions and diversity within the Southeastern U.S. Coastal Plain. M.Sc. thesis, University of Georgia, Athens,Georgia, U.S.A.112 p.

Mishra, D. and Singh, B.K. (2017). Classification and assessment of land use land cover in Bara Tahsil of Allahabad District using Sentinel-2 satellite imagery

Mittermeier, R.A. *et al.* 2015. Turtle Hotspots: An Analysis of the Occurrence of Tortoises and Freshwater Turtles in Biodiversity Hotspots, High-Biodiversity Wilderness Areas, and Turtle Priority Areas. *Chelonian Conservation and Biology.* 14(1): 2–10.

Noureen, U., Khan, A. and Arshad, M. 2012. Exploring illegal trade in freshwater turtles of Pakistan. *Records: Zoological Survey of Pakistan*. 21: 19-24

Rao, R.J. 1998. Status of crocodiles and freshwater turtles in the Chambal River and Ganga River- a comparative analysis. *Cobra*. 33:31-34.

Sarkar, U. K., Pathak, A. K., Sinha, R. K., Sivakumar, K., Pandian, A. K., Pandey, A., Dubey, V. K. and Lakra, W. S. 2012. Freshwater fish biodiversity in the River Ganga (India): changing pattern, threats and conservation perspectives. *Reviews in Fish Biology and Fisheries*. 22:251–272

Singh, S. *et al.* 2009. An Evaluation of Distribution, Status and Abundance of Freshwater Turtles in Uttar Pradesh. In: Freshwater Turtles and Tortoises of India. *ENVIS Bulletin: Wildlife and Protected Areas*, Vol. 12(1). Vasudevan, K. (Ed.). Wildlife Institute of India, Dehradun, India. pp.177.

Bibby, C., Burgess, N. D., & Hill, D. A. (1992). Bird Census Techniques, Academic Press, London.

Rahbek, C., & Graves, G. R. (2001). Multiscale assessment of patterns of avian species richness. *Proceedings of the National Academy of Sciences*, *98*(8), 4534-4539.

Robinson, C. T., Tockner, K., & Ward, J. V. (2002). The fauna of dynamic riverine landscapes. Freshwater Biology, 47(4), 661-677.

Smith, B.D. & Reeves, R.R. (2000b) Survey methods for population assessment of Asian river dolphins. In Biology and Conservation of Freshwater Cetaceans in Asia, Occasional Papers of the IUCN Species Survival Commission no. 23 (eds R. R. Reeves, B. D. Smith and T. Kasuya), pp. 97-115. IUCN, Gland, Switzerland.

Abell R. (2002). Conservation biology for the biodiversity crisis: a freshwater follow-up. Conservation Biology, 16, 1435–1437.

Boon P.J. (2000). The development of integrated methods for assessing river conservation value. Hyderobiologia, 422/423, 413–42.

Dudgeon D., Arthington A.H., Gessner M.O. et al. (2006). Freshwater biodiversity: importance, threats, status and conservation challenges. Biological Reviews, 81, 163–182.

Dunn H. (2003). Can conservation assessment criteria developed for terrestrial systems be applied to river systems. Aquatic Ecosystem Health & Management, 6, 81–95.

Kingsford R.T. & Neville J. (2005). Scientists urge expansion of freshwater protected areas. Ecological Management & Restoration, 6, 161–162.

Moilanen, A., Leathwick, J., & Elith, J. (2008). A method for spatial freshwater conservation prioritization. Freshwater Biology, 53(3), 577-592.

Revenga C., Campbell I., Abell R., de Villiers P. & Bryers P. (2005). Prospects for monitoring freshwater ecosystems towards the 2010 targets. Philosophical transactions of the Royal Society of London Series B-Biological Sciences, 360, 397–413.

Rodrigues A.S.L., Akcakaya H.R., Andelman S.J. et al. (2004). Global gap analysis: priority regions for expanding the global protected-area network. Bioscience, 54, 1092–1100.

Schroter D., Cramer W., Leemans R. et al. (2005). Ecosystem service supply and vulnerability to global change in Europe. Science, 310, 1333–1337.

Morphometric data of freshwater turtles encountered by sampling through VES, gill nets and box traps during ecological assessment in and around TWS from April to Amy 2018.

Capture Date	Site	Species	Age Class (A/SA/Juv)	Sex	SCL (cm)	SCW (cm)	PL (cm)	PW (cm)	SH (cm)	TL (cm)
11/05/2018	V5	*Pangshura tentoria*	SA	M	77.93	59.79	78.81	37.93	40.97	-
17/05/2018	V2	*Pangshura smithii*	SA (Dead)	M	65.50	51.54	58.80	29.10	27.98	6.17
21/05/2018	V12	*Lissemys punctata*	SA	M	94.30	77.47	94.86	-	32.10	-

A- Adult, SA- Sub-Adult, Juv- Juvenile,
SCL- Straight Carapace Length, SCW- Straight Carapace Width, PL- Plastron Length,
PW- Plastron Width, SH- Shell Height, TL- Tail Length

Fish diversity in and around TWS during ecological assessment from April to May 2018

S.No	Family	Species	Abundance		
			TWS	Upstream of TWS	Downstream of TWS
1	Clupeidae	Gudusia chapra	9	30	62
2		Gonialosa manmina	8	8	7
3		Setipinna phasa	2	1	2
4	Cyprinidae	Labeo rohita	0	0	1
5		Labeo calbasu	0	0	2
6		Labeo bata	3	0	3
7		Bangana dero	1	0	0
8		Cirrhinus reba	2	1	0
9		Chagunius chagunio	3	6	0
10		Cyprinus caprio	67	18	46
11		Crossocheilus latius	1	2	0
12		Systomus sarana	2	0	0
13		Puntius sophore	0	0	24
14		Puntius chola	23	7	57
15		Pethia conchonius	3	2	9
16		Puntius genus unidentified	0	0	3
17		Osteobrama cotio	0	0	4
18		Salmophasia bacaila	7	3	0
19		Amblipharyngodon mola	0	0	2
20		Aspidoparia genus UID	6	0	0
21		Aspidoparia morar	2	1	20
22	Cobitidae	Botia dario	3	0	0
23	Bagridae	Sperata aor	1	1	0
24		Sperata seenghala	85	33	7
25		Mystus cavasius	3	2	0
26		Rita rita	0	0	2
27		Rita genus UID	0	0	1
28	Schilbeidae	Eutropiichthys vacha	29	10	0
29		Clupisomfa garua	6	2	0
30		Silonia silondia	1	0	0
31	Sisoridae	Bagarius bagarius	0	0	1
32		Sisor rhabdophorus	4	0	0
33	Heteropneustidae	Heteropneustes fossilis	1	1	0
34	Loricariidae	Pterygoplichthys disjunctivus	1	0	0
35	Belonidae	Xenentodon cancila	0	2	1
36	Nandidae	Badis badis	3	1	0
37	Sciaenidae	Johnius coiter	51	7	63
38	Cichlidae	Oreochromis niloticus	6	55	0
39	Mugilidae	Rhinomugli corsula	1	0	0
40	Gobiidae	Glossogobius giuris	3	0	6
41	Channidae	Channa gachua	34	13	0
42		Channa striata	2	0	0
43	Mastacembelidae	Mastacembelus armatus	5	1	6
44		Macrognathus aral	1	0	0
45		Macrognathus pancalus	3	0	0
	Total Abundance		382	207	329

Check list of riverine birds observed during motor boat surveys from March to May 2018.

S.No.	Common name	Scientific name	Conservation Status (BLI 2018)
1	Bar-headed Geese	*Anser indicus*	LC
2	Ruddy Shelduck	*Tadorna ferruginea*	LC
3	Little Grebe	*Tachybaptus ruficollis*	LC
4	Painted Stork	*Mycteria leucocephala*	NT
5	Asian Openbill	*Anastomus oscitans*	LC
6	Indian Pond Heron	*Ardeola grayii*	LC
7	Grey Heron	*Ardea cinerea*	LC
8	Cattle Egret	*Bubulcus ibis*	LC
9	Little Egret	*Egretta garzetta*	LC
10	Indian Black Ibis	*Pseudibis papillosa*	LC
11	Indian Cormorant	*Phalacrocorax fuscicollis*	LC
12	Little Ringed Plover	*Charadrius dubius*	LC
13	Lesser Sand Plover	*Charadrius mongolus*	LC
14	Red-Wattled Lapwing	*Vanellus indicus*	LC
15	River Lapwing	*Vanellus duvaucelii*	NT
16	Common Sandpiper	*Actitis hypoleucos*	LC
17	Common Greenshank	*Tringa nebularia*	LC
18	Spotted Redshank	*Tringa erythropus*	LC
19	Small Pratincole	*Glareola lactea*	LC
20	Indian Skimmer	*Rynchops albicollis*	VU
21	Brown-headed Gull	*Chroicocephalus brunnicephalus*	LC
22	River Tern	*Sterna aurantia*	NT
23	Little Tern	*Sternula albifrons*	LC
24	Osprey	*Pandion haliaetus*	LC
25	Egyptian vulture	*Neophron percnopterus*	EN
26	Black kite	*Milvus migrans*	LC
27	Pied Kingsfisher	*Ceryle rudis*	LC
28	White-Breasted Kingfisher	*Halcyon smyrnensis*	LC

Scores for all parameters from Bijnor barrage to Sitab Diara in Uttar Pradesh

Sl. No.	Stretch (from Bijnor Barrage)	Biological Score (Out of 5)	Habitat Score (out of 3)	Anthropogenic Score (Out of 2)	Final Score (Out of 10)
1	0-10	0.13	0.67	1.40	2.20
2	10-20	0.23	0.25	1.40	1.88
3	20-30	0.60	0.25	1.40	2.25
4	30-40	0.10	0.75	1.40	2.25
5	40-50	1.08	0.75	1.40	3.23
6	50-60	0.50	0.63	1.40	2.53
7	60-70	1.43	1.00	1.40	3.83
8	70-80	0.00	0.50	1.40	1.90
9	80-90	0.13	0.63	1.40	2.15
10	90-100	0.50	0.75	1.40	2.65
11	100-110	0.45	0.88	1.50	2.83
12	110-120	0.30	0.50	1.40	2.20
13	120-130	0.45	0.38	1.40	2.23
14	130-140	0.90	0.50	1.40	2.80
15	140-150	0.35	0.25	1.40	2.00
16	150-160	1.23	0.50	1.40	3.13
17	160-170	0.30	1.13	1.40	2.83
18	170-180	0.58	0.75	1.40	2.73
19	180-190	0.30	0.88	1.40	2.58
20	190-200	0.43	1.00	1.50	2.93
21	200-210	0.00	0.50	1.45	1.95
22	210-220	0.10	0.25	1.35	1.70
23	220-230	0.28	0.25	1.40	1.93
24	230-240	0.15	0.25	1.40	1.80
25	240-250	0.18	0.25	1.40	1.83
26	250-260	0.30	0.38	1.40	2.08
27	260-270	0.13	0.50	1.50	2.13
28	270-280	0.25	1.63	1.35	3.23
29	280-290	0.08	0.50	1.50	2.08
30	290-300	0.18	0.25	1.40	1.83
31	300-310	0.23	0.38	1.40	2.00
32	310-320	0.03	0.25	1.40	1.68
33	320-330	0.08	0.25	1.45	1.78
34	330-340	0.08	0.25	1.40	1.73
35	340-350	0.08	0.38	1.35	1.80
36	350-360	0.05	0.50	1.40	1.95
37	360-370	0.15	0.38	1.45	1.98
38	370-380	0.00	0.63	1.40	2.03
39	380-390	0.13	0.38	1.35	1.85

| Sl. No.	Stretch (from Bijnor Barrage)	Biological Score (Out of 5)	Habitat Score (out of 3)	Anthropogenic Score (Out of 2)	Final Score (Out of 10)
40	390-400	0.08	0.25	1.35	1.68
41	400-410	0.08	0.38	1.40	1.85
42	410-420	0.00	0.25	1.40	1.65
43	420-430	0.05	0.25	1.40	1.70
44	430-440	0.08	0.50	1.65	2.23
45	440-450	0.13	0.63	1.35	2.10
46	450-460	0.10	0.75	1.35	2.20
47	460-470	0.48	0.63	1.35	2.45
48	470-480	0.13	0.38	1.40	1.90
49	480-490	0.03	0.25	1.35	1.63
50	490-500	0.13	0.38	1.40	1.90
51	500-510	0.13	0.38	1.40	1.90
52	510-520	0.15	0.25	1.45	1.85
53	520-530	0.13	0.38	1.40	1.90
54	530-540	0.15	0.50	1.40	2.05
55	540-550	0.23	0.38	1.40	2.00
56	550-560	0.30	0.88	1.40	2.58
57	560-570	0.33	0.63	1.45	2.40
58	570-580	0.15	0.25	1.40	1.80
59	580-590	0.00	1.00	1.45	2.45
60	590-600	0.00	1.13	1.35	2.48
61	600-610	0.00	0.38	1.40	1.78
62	610-620	0.00	0.75	1.35	2.10
63	620-630	0.00	0.50	1.40	1.90
64	630-640	0.08	0.25	1.40	1.73
65	640-650	0.00	0.50	1.40	1.90
66	650-660	0.05	0.38	1.40	1.83
67	660-670	0.05	1.00	1.40	2.45
68	670-680	0.25	0.50	1.45	2.20
69	680-690	0.80	0.63	1.40	2.83
70	690-700	0.00	0.75	1.40	2.15
71	700-710	0.18	1.00	1.35	2.53
72	710-720	0.18	0.75	1.35	2.28
73	720-730	0.15	0.50	1.45	2.10
74	730-740	0.25	0.25	1.35	1.85
75	740-750	0.45	0.38	1.40	2.23
76	750-760	0.28	0.75	1.40	2.43
77	760-770	0.28	0.88	1.40	2.55
78	770-780	0.10	0.25	1.40	1.75
79	780-790	0.23	0.50	1.35	2.08
80	790-800	0.10	0.50	1.45	2.05
81	800-810	0.18	0.38	1.45	2.00

Sl. No.	Stretch (from Bijnor Barrage)	Biological Score (Out of 5)	Habitat Score (out of 3)	Anthropogenic Score (Out of 2)	Final Score (Out of 10)
82	810-820	0.25	0.75	1.45	2.45
83	820-830	0.05	0.63	1.45	2.13
84	830-840	0.15	0.50	1.40	2.05
85	840-850	0.23	0.50	1.45	2.18
86	850-860	0.05	0.50	1.40	1.95
87	860-870	0.10	0.63	1.40	2.13
88	870-880	0.35	0.63	1.15	2.13
89	880-890	0.00	0.50	1.25	1.75
90	890-900	0.40	1.38	1.30	3.08
91	900-910	0.60	0.63	1.25	2.48
92	910-920	0.05	0.25	1.25	1.55
93	920-930	0.60	1.13	1.10	2.83
94	930-940	0.10	0.75	1.15	2.00
95	940-950	0.00	2.13	1.35	3.48
96	950-960	0.30	1.13	1.40	2.83
97	960-970	0.90	1.75	1.40	4.05
98	970-980	0.00	1.13	1.40	2.53
99	980-990	0.10	1.25	1.25	2.60
100	990-1000	0.10	0.75	1.35	2.20
101	1000-1010	0.88	1.00	1.35	3.23
102	1010-1020	0.05	0.50	1.20	1.75
103	1020-1030	0.10	0.63	1.50	2.23
104	1030-1040	0.60	2.25	1.35	4.20
105	1040-1050	0.05	0.88	1.35	2.28
106	1050-1060	0.00	0.75	1.40	2.15
107	1060-1070	0.40	1.50	1.40	3.30
108	1070-1080	0.20	0.75	1.35	2.30
109	1080-1090	0.05	1.13	1.35	2.53
110	1090-1100	0.00	0.88	1.30	2.18
111	1100-1110	0.05	0.50	1.30	1.85
112	1110-1120	0.00	1.25	1.30	2.55
113	1120-1130	0.05	0.75	1.30	2.10
114	1130-1140	0.00	1.75	1.30	3.05
115	1140-1150	0.90	0.75	1.35	3.00
116	1150-1160	0.00	0.88	1.35	2.23
117	1160-1170	0.60	1.13	1.35	3.08
118	1170-1180	0.20	1.25	1.30	2.75
119	1180-1190	0.20	1.88	1.30	3.38
120	1190-1200	0.00	1.50	1.35	2.85
121	1200-1210	0.30	1.38	1.45	3.13
122	1210-1220	0.70	0.88	1.45	3.03
123	1220-1230	0.00	0.88	1.40	2.28

Sl. No.	Stretch (from Bijnor Barrage)	Biological Score (Out of 5)	Habitat Score (out of 3)	Anthropogenic Score (Out of 2)	Final Score (Out of 10)
124	1230-1240	0.30	0.75	1.40	2.45
125	1240-1250	0.00	1.00	1.30	2.30
126	1250-1260	1.00	1.38	1.35	3.73
127	1260-1270	0.00	1.00	1.50	2.50
128	1270-1280	0.05	1.00	1.35	2.40
129	1280-1290	0.50	0.50	1.50	2.50
130	1290-1300	0.40	0.88	1.40	2.68
131	1300-1310	0.50	1.38	1.40	3.28
132	1310-1320	0.00	1.00	1.35	2.35
133	1320-1330	0.00	0.25	1.40	1.65
134	1330-1340	0.10	0.88	1.40	2.38
135	1340-1350	0.00	1.38	1.30	2.68
136	1350-1360	0.00	1.88	1.45	3.33
137	1360-1370	0.15	2.00	1.45	3.60
138	1370-1380	0.00	1.13	1.55	2.68
139	1380-1390	0.20	0.75	1.25	2.20

PHOTO PLATE 1

Freshwater Turtles encountered during the study
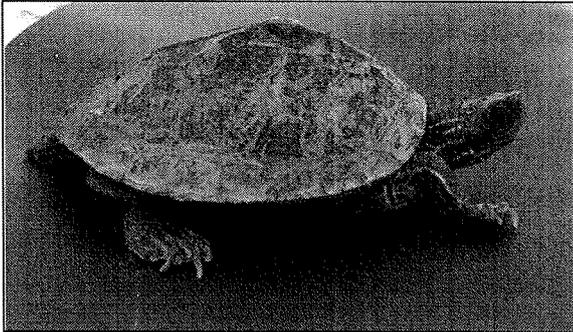
Indian Tent Turtle *Pangshura tentoria*
captured in TWS
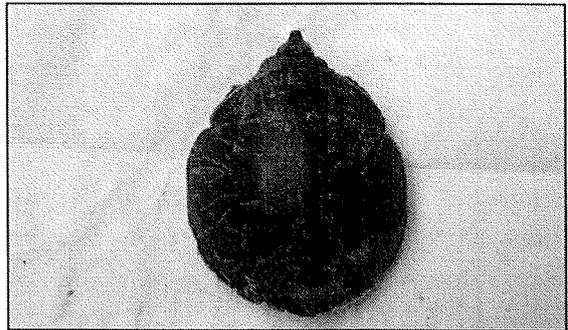
Flapshell Turtle *Lissemys punctate*
captured in TWS
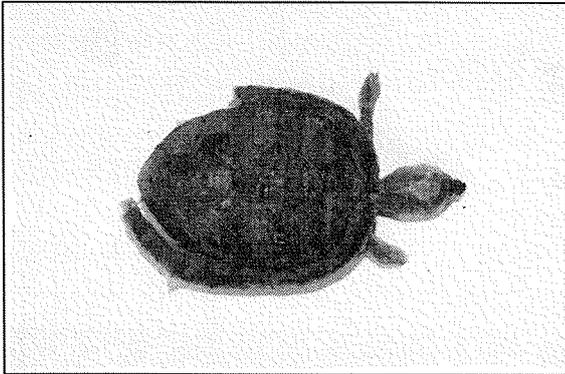
Brown Roofed Turtle *Pangshura smithii*
(Dead) encountered during VES

Ganges Softshell Turtle *Nilssonia gangetica*
encountered during VES

PHOTO PLATE 2
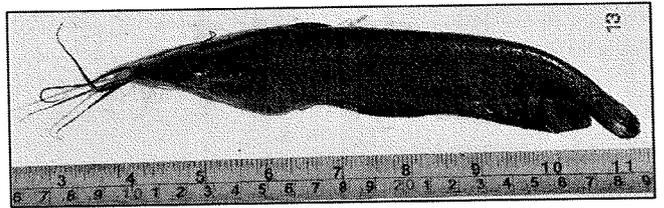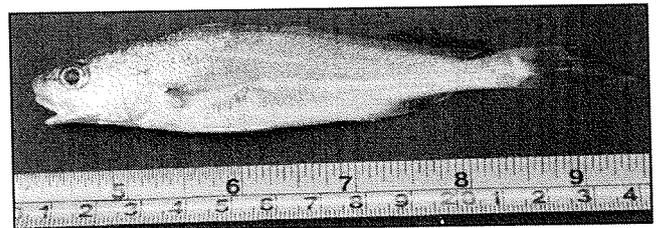
Significant Fish species captured during the study
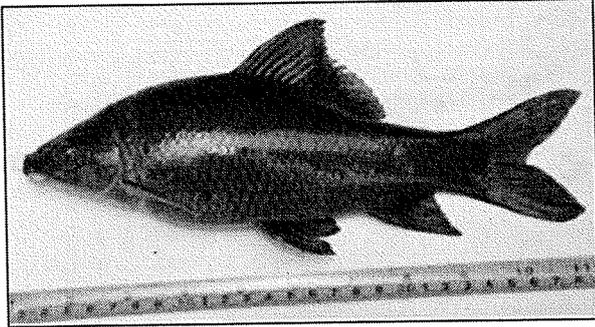
Labeo calbasu
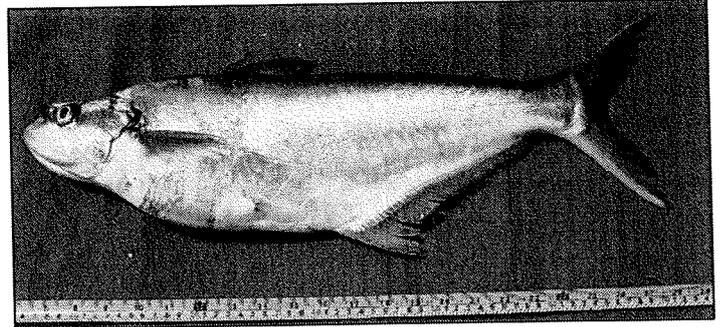
Silonia silondia
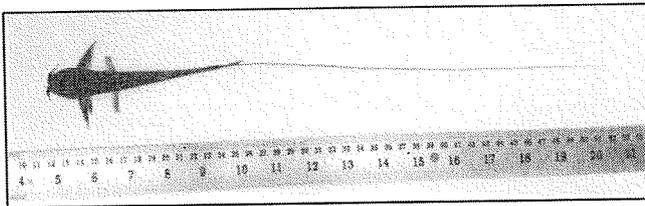
Sisor rhabdophorus

Heteropneustes fossilis
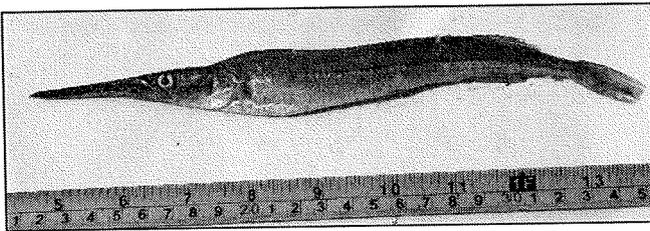
Xenentodon cancila

Johnius coiter

Significant Riverine bird species and their nesting recorded during the study

Four pairs of Indian Skimmer nesting
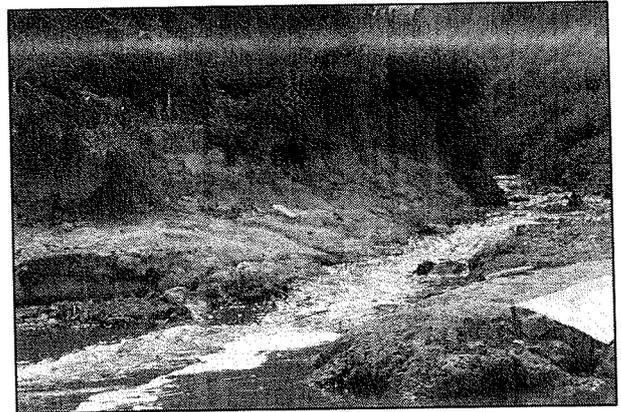

Nest of Indian Skimmer

River Lapwing chick

(64)

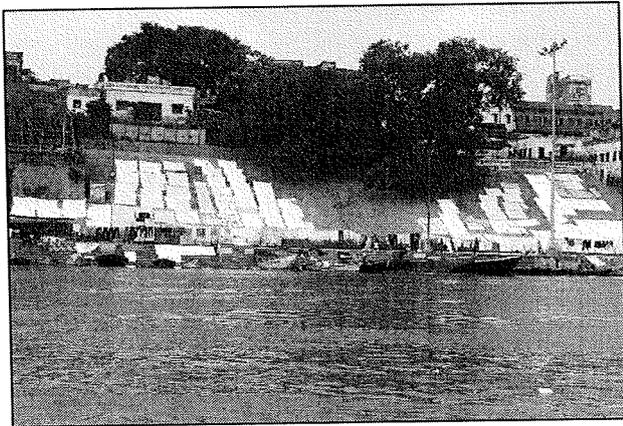Anthropogenic pressures observed during the study area from April to May 2018:
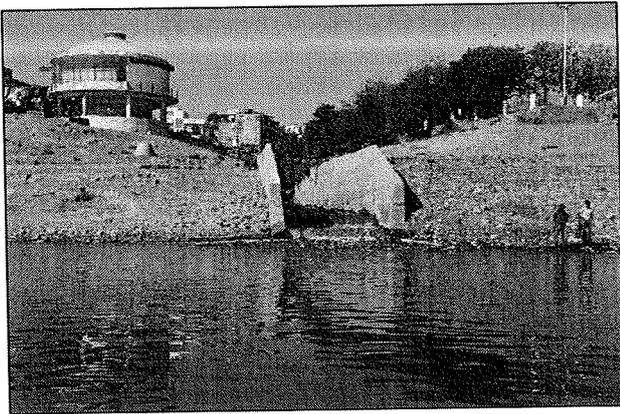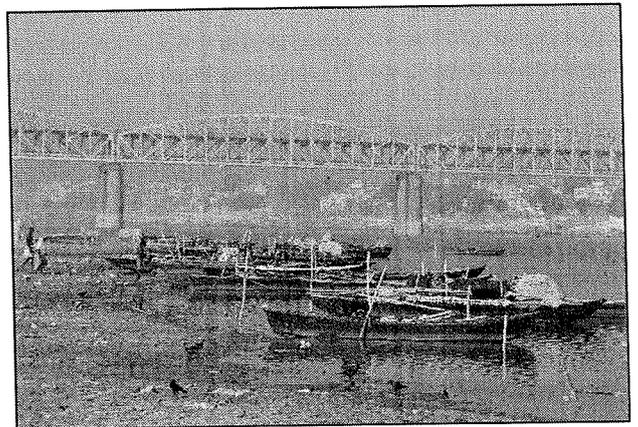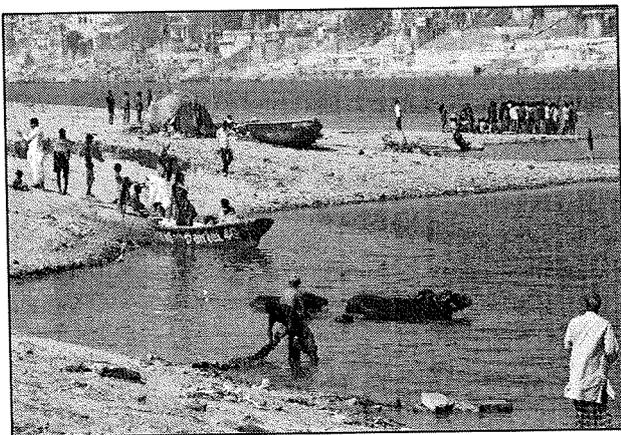

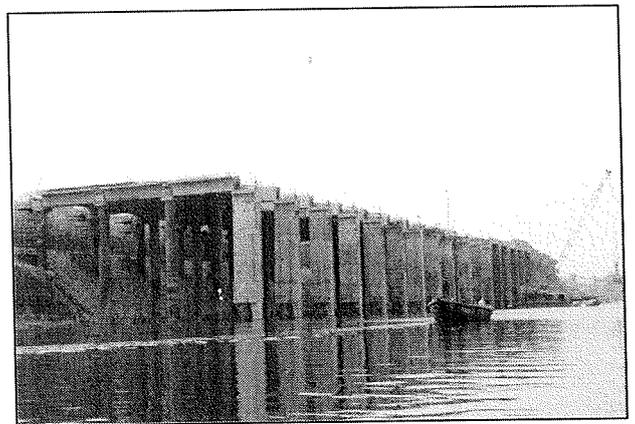Assi *nala* (drain) inside the TWS

An open drain near Ramnagar

View of Ghats inside the TWS

Fishing boats near Suzabad

Pilgrims bathing inside the TWS

Construction of Jetty near Ramnagar

Notification for declaration of Turtle Wildlife Sanctuary, Varanasi, Uttar Pradesh

उत्तर प्रदेश शासन
वन अनुभाग-3
संख्या: 4170/14-2-62/09
लखनऊ: दिनांक 21 दिसम्बर, 1989

अधिसूचना

चूंकि राज्य सरकार की राय है कि यह क्षेत्र जिसका ब्यौरा नीचे दी गयी अनुसूची में दिया गया है, वन्य जीव और उनके पर्यावरण का संरक्षण, संवर्धन और विकास करने के प्रयोजन के लिए पर्याप्त पारिस्थितिक, प्राणिजात, प्राकृतिक और प्राणिजातीय महत्व का है,

अतएव, अब, वन्य जीव (संरक्षण) अधिनियम, 1972 (अधिनियम संख्या 53 सन् 1972) की धारा 18 की उपधारा (1) के अधीन शक्ति का प्रयोग करके, राज्यपाल वाराणसी शहर के निकट गंगा नदी की मध्य धारा के किनारे के लगभग 7 किलोमीटर तक फैले क्षेत्र को कछुआ वन्य जीव विहार, वाराणसी घोषित करते हैं।

अनुसूची

जिला	नदी का नाम	उक्तार्थ वन्य जीव विहार का क्षेत्र
वाराणसी	गंगा	अपने दोनों तटों से सीमान्त गंगा नदी के मध्य धारा के किनारे का लगभग सात किलोमीटर क्षेत्र

सीमायें—
ऊर्ध्व प्रवाह सीमा— रामनगर किला।
अधः प्रवाह सीमा— रायवारीय रेल एवं सड़क पुल।

आज्ञा से,
जे० पी० गुप्ता
सचिव।

संख्या: 4170(1)/14-2-62, तददिनांकित।

प्रतिलिपि अधिसूचना के अंग्रेजी अनुवाद की प्रतिलिपि सहित अधीक्षक, मुद्रण एवं लेखन सामग्री विभाग, लखनऊ को इस आशय से प्रेषित कि वे कछुआ अधिसूचना को दिनांक उत्तर प्रदेश भाग-4 खण्ड "ख" में असाधारण गजट के दिनांक 23.12.1989 के अंक में प्रकाशित कर दें तथा उसकी 50 प्रतियां शासन को भेजने का कष्ट करें।

आज्ञा से,
[हस्ताक्षर]
य० प्र० विधियाल
प्रदेश सचिव

.......2/——

{66}

{ 120 }

{ 2 }

संख्या: 41-0111/14-3-62/खाद्य विभाग।

प्रतिलिपि निम्नलिखित को सूचनार्थ एवं आवश्यक कार्यवाही हेतु प्रेषित:-

1- प्रमुख वन संरक्षक, उत्तर प्रदेश, लखनऊ।
2- अपर मुख्य वन संरक्षक, उत्तर प्रदेश, लखनऊ।
3- मुख्य वन्य जीव प्रतिपालक, उत्तर प्रदेश, लखनऊ।
4- आयुक्त, वाराणसी मण्डल, वाराणसी।
5- वन संरक्षक, एवं क्षेत्रीय निदेशक, पूर्वी क्षेत्र, 1, 11 वाराणसी।
6- जिलाधिकारी, वाराणसी।
7- निजी अनुभाग-1।

आज्ञा से,

(एन.सी. निगम)
श्री अनुभाग अधिकारी

MAP OF
PROPOSED CLOSED
AREA FOR
REHABILITATION OF
TURTLES NEAR
VARANASI

55

References:
Proposed closed area for rehabilitation of turtles
in the Ganga river near Varanasi (Sanctuary)

(True Copy)

578

68
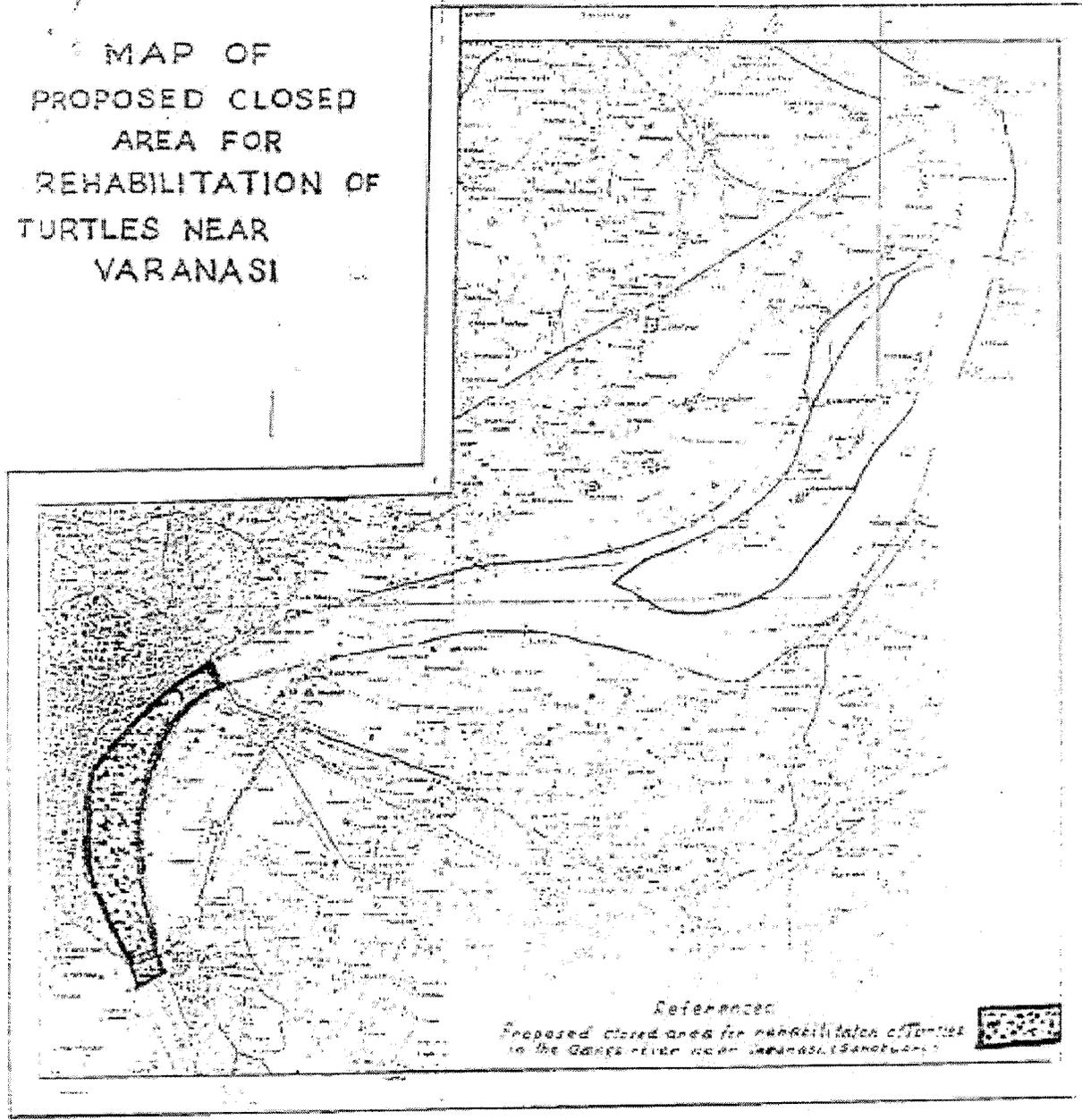
 Gmail

rahul pratap <rahulpratap.adv@gmail.com>

Advance Service Compliance Affidavit in O.A. No. 203 of 2023 Tushar Goswami Vs. Union of India & Ors.

1 message

---

rahul pratap <rahulpratap.adv@gmail.com>   Fri, Dec 22, 2023 at 2:43 PM
To: advanuradhamishra09@gmail.com, dmvar@nic.in, secy-mowr@nic.in, dg@nmcg.nic.in, mscb.cpcb@nic.in, pccf-up@nic.in, eincididuplu-up@nic.in, up327@ifs.nic.in, vdavaranasi@gmail.com, chairman@uppcb.in, tiwariamit22@yahoo.com, info@uppcb.in, saurabhtiwarihighcourt@gmail.com, officeofchandrachud@gmail.com, pradeepmisra@yahoo.com, gigicgeorge.adv42@yahoo.in

Dear Sir,

Please find attached Copy of the Compliance Affidavit in the O.A. No. (c) No. 203 of 2023 with N.D.O.H 06.02.2024 in the above captioned matter.

Kindly accept the advance service of the same.

Regards By

(Rahul Pratatp)
Advocate for the Respondent No.1 (MoEF&CC)
A-46, First Floor, Defence Colony,
New Delhi -110024
Mob:- 9910727778
Email ID:- rahulpratap.adv@gmail.com

📄 **Compliance Affidavit in Tushar Goswami.pdf**
8829K