

**Status and Distribution of Gangetic River Dolphins (*Platanista gangetica gangetica*)
and Other Aquatic Vertebrates in Saryu (Ghaghara) River, Uttar Pradesh, India**



Turtle Survival Alliance India

13th May 2021



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Executive Summary

Saryu River is among the major tributaries of the Ganga River system in northern India. This river flows through the Terai Arc Landscape recognized as one of the top 200 ecoregions of the world owing to high species and habitat diversity. Though hosting a range of aquatic fauna as freshwater turtles, Ganges River dolphin, Gharial, Smooth Coated otter, fishes and aquatic birds, the river's biodiversity potential has been at margin with last assessment conducted in 2015.

In this study, 119 km stretch of the Saryu River from *Chahlari ghat* to *Ayodhya* was surveyed between 18 to 22 February 2021 covering parts of *Bahraich, Sitapur, Barabanki, Gonda* and *Ayodhya* districts. Low-best-high figures of 106-107-127 Gangetic River Dolphin (*Platanista gangetica gangetica*) were estimated with a best estimated encounter rate of 0.90 dolphins/km. 69 discrete dolphin groups were identified with a mean group size of 1.72 (1-7). Sighting of dolphin groups with calves indicate breeding successes in certain stretches of the river. Through the number of dolphins sighted ($n=107$) was less than the previous study in 2015 ($n=133$), the individual encounter rate was much higher in comparison to the 2015 survey (0.72/km) suggesting improvements in population. Based on high encounter rate of GRD, three priority stretches for this species were also identified for further investigations.

There was significant increase in the gharial (*Gavialis gangeticus*) sightings with 174 observations in the present survey compared to 43 individuals recorded previously in survey conducted by TSA in March 2013, 16 individuals recorded in 2009 and only one in 2001. The observed individuals comprised of 43% females, 5% males and 52% juveniles. With frequent sightings on the sandy banks, the encounter rate for gharials was 1.46/km. In the upper stretch (0-40km), more mature adult and wild cohorts were observed while more juveniles and sub-adults were seen in the lower stretches indicating that release successes near Ghaghara-ghat.

In the lower two stretches (40-80km) and (80-120km), total - cattle tagged gharials were sighted, those were released from Kukrail Gharial Rehabilitation Centre as a part of current supplementation program. Tagged gharials seem to utilize the stretch up to 58 km downstream from their major release site (*Ghaghara ghat*) as no tagged gharial was observed in the upper stretch.

Though the survey was not primarily focused/equipped to determine the turtle distribution and abundance of the river, individuals of mainly *Pangshura* genus basking on the sandy and hard mud river banks along with two basking Softshells were observed. An in-depth survey needs to be conducted in order to estimate the turtle population in the river. Further, 18 species winter migrant birds along with 25 resident species were observed.

Fishing at 30 locations was identified as a direct threat to aquatic fauna in the survey stretch with anecdotal information on electric fishing by external fishing groups. A *Goshthi* cum awareness program was organized en route, jointly with the Barabanki Forest Department at *Ghaghara ghat* to sensitize the local fisher community on the importance of conserving the aquatic wildlife and available alternative livelihood options.

The findings of the survey yet again affirm the Saryu River as an important aquatic biodiversity hotspot that houses a significant number of aquatic wildlife; reiterating the need of its protection and regular assessments to monitor the changing trends population abundance.

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Introduction

Gangetic River basin is the largest basin in India extending through Nepal, India and Bangladesh and is home to a wide variety of relic, rare and threatened species. Ghaghara River recently renamed as Saryu is one of the major left bank tributaries of the Ganga River. Originating from the glaciers of *Mapchachungo* in Nepal, the river flows through the Terai Arc Landscape (TAL), an area recognized within 200 top most eco-regions (Semwal, 2005). Varied topography due to changing course of Saryu River, oxbows, sandy stretches, expansive network of alluvial braided channels and frequent meandering provides habitat for range of rare and threatened species of turtles, Gangetic river dolphin (*Platanista gangetica gangetica*), Gharial (*Gavialis gangeticus*) and Smooth Coated otters (*Lutrogale perspicillata*). Habitats along the river basin support diverse communities of riverine birds, economically important fishes and several endangered terrestrial mammals. The river has been recognized as a turtle priority area by Indian Turtle Conservation Program as it represents over 30 percent of the species of freshwater turtles and tortoises found in India (Singh and Horne, 2011).

The catchment of the river covers 19% of the area in Nepal, 5% in Bihar and 76% in Uttar Pradesh and provides livelihood for many economically deprived riparian communities. This fragile landscape thus faces an unprecedented amount of pressure from the highly dense and impoverished human population in the area. With increasing human population, unsustainable fisheries, large scale dredging, reduced water flow and a disregard for environmental impacts by governing agencies has further put this river system in jeopardy.

In terms of biodiversity assessments, Saryu River has received a lot less attention compared to other major rivers like Ganga, Yamuna and Chambal. Only five survey has been conducted since 1991 for assessing the aquatic fauna with the last survey conducted six years ago in Ghaghara River in 2015.

Table1: Details of survey conducted in Saryu (Ghaghara river) over the years.

Sl. No.	Period of Survey	Stretch of Survey	River length surveyed	No. of dolphins encountered	No. of gharials encountered	Surveyor/s
1	February/March 2001	Kailashpuri Barrage-Road Bridge Dohrighat	505	246	1	Basu
2	December 2009	Mallapur-Barabanki Bahraich road bridge	90	115	16	Basu and Singh
3	October 2012	Kailashpuri Bridge to Bali	505	231	NA	WWF India & UPFD
4	March 2013	Mallapur to Ayodhya ghat	150	NA	43	TSA India, GCA & UPFD
5	October 2015	Kailashpuri Bridge to Balia	518.72	317	NA	WWF India, TSA Inc & UPFD

*NA-Not Available

In view of the continuous decline of various species both in range and population size, the present survey aimed to document the current status of major river fauna such as Gangetic river dolphin,

gharial, birds and turtles sharing a common habitat. Additionally, Kukrail Gharial Centre jointly with TSA India has been releasing captive bred Gharials in Saryu River to augment their wild population. Since 2014, 307 captive bred Gharials have been released in Saryu river. Additionally in 2014 10 gharials were released via soft release and hard release strategy with radio transmitters attached to understand the survival and dispersal of these released animal. However, after that no such post release monitoring have been conducted. This survey was also focused on assessing the status of the captive bred gharials released in Saryu.

Table2: Captive bred gharials released in Saryu river from KGRC in recent years

Sl No	Date of release	Number of Gharials released	Release site
1	December 2020	40	Ghaghara ghat
2	May 2020	40	Near Tappe Sipah village
3	July 2020	40	Ghaghara ghat
4	March 2019	25	Ghaghara ghat
5	February 2016	35	Near Chudipurwa village
6	March 2015	65	Near Chudipurwa village
7	March 2014	62 (10 released with radio transmitter)	Near Chudipurwa village

Objectives

- To determine the current populations of Gangetic river dolphin in Saryu river
- To document the current status and abundance of Gharials based on visual encounters
- Rapid Assessment of other threatened key taxa such as turtles and aquatic birds
- To document various threats to aquatic biodiversity in said stretch



Figure 1 Flagging off of the survey on 18th February 2021 by Divisional Forest Officer (Bahraich), Mr. Manish Singh.

Study area

Saryu (Ghaghara) River rises in the glaciers of *Mapchachungo* in Nepal, north-west of *Taklakot* at an elevation of 4,800 m near *Manasarowar* Lake. The river is also known as Manchu and Karnali in Nepal. After flowing for about 72 km in a south-easterly direction, the river enters Nepal. Ghaghara enters India at *Kotia Ghat* near Royal Bardia National Park, *Nepal Ganj*, where it is known as the river Girwa for about 25 km. Below the *Girijapuri* barrage the river Girwa attains the name of the Ghaghara. The total catchment area of the Ghaghara river is 1,27,950 Sq.km, out of which 45 percent falls in India. The Ghaghara sub-basin of Ganga basin has a total catchment area of 58,634 Sq.km. The Suheli, Sharda on the right bank and Lower Sarju, Rapti and Kuano on the left bank are the other important tributaries of this river. The total length of Saryu river before its confluence with Ganga river (at *Doriganj* downstream of *Chhapra* town in Bihar) is 1,080 km.

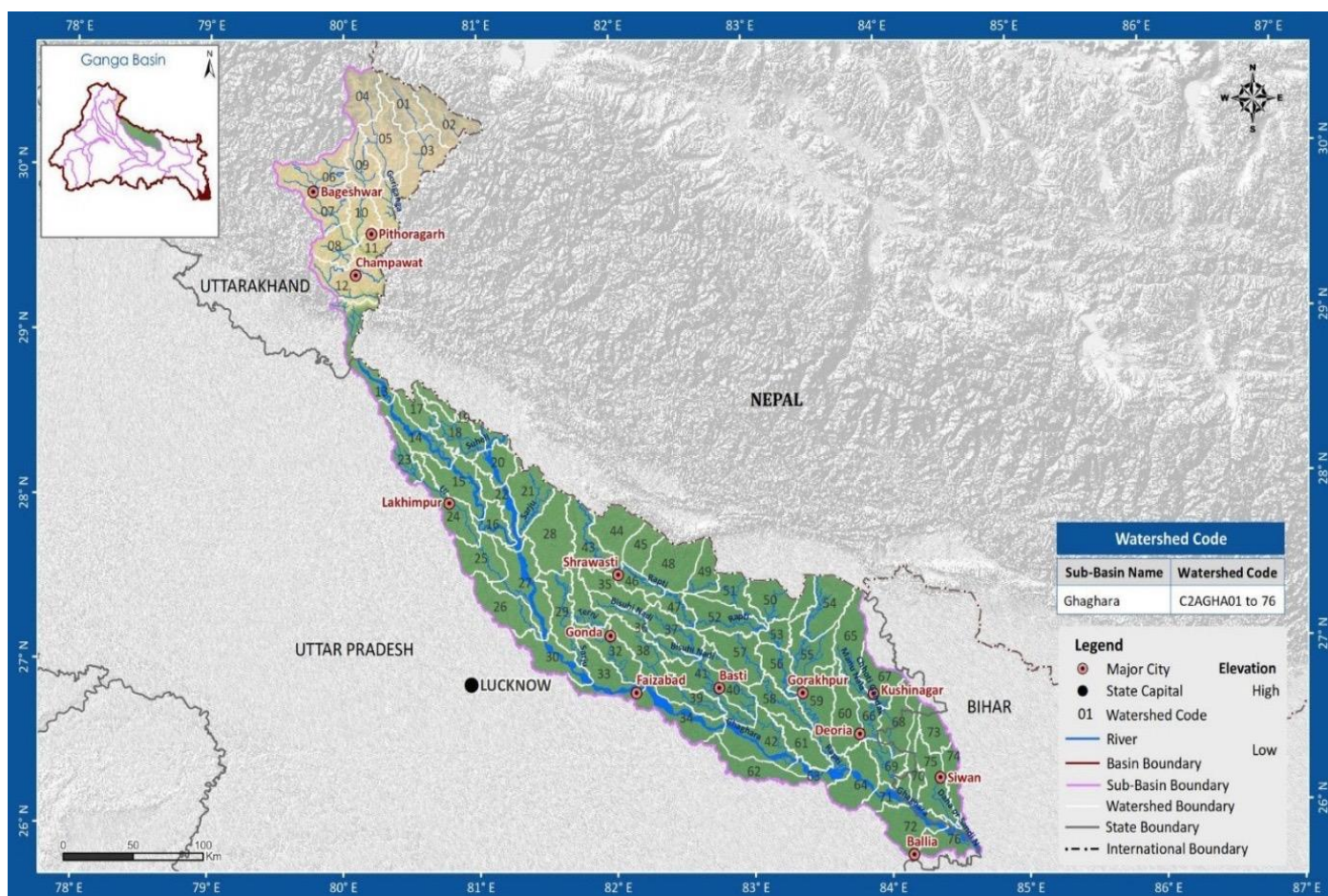


Figure 2 Saryu (Ghaghara) river basin. Source Ganga basin report 2012

The geographical extent of the Ghaghara sub-basin lies between 79°29' to 84°49' east longitudes and 25°47' to 30°31' north latitudes of the country, covering 31,503 Sq.km in Uttar Pradesh while crossing major districts like *Bahraich*, *Basti*, *Faizabad*, *Gonda* and *Lakhimpur Kheri*, *Ayodhya*. As per 2011 census, the total population in Ghaghara basin is 25,864,960 of which 42.6% individuals live below the poverty line and are dependent on the river for their livelihood. This river is also

among the most flood prone rivers in Uttar Pradesh and is notorious for instability of its banks due to continuous erosion in the flood season and bringing down and depositing a large amount of sediment load due to high relief and extensive erosion. This often leads to displacement of large tracts of land, leaving the riparian people landless.

The climate in the basin is sub-tropical and monsoonal. Winters (October to February) are cool and dry with light showers, summers (March to early June) being hot and dry. The highest mean maximum temperature is in the month of May (31.1 degree Celsius) while the lowest monthly mean temperature is in the month of January (10.9 degree Celsius). The average annual rainfall is 1000.30 mm dominated by monsoon rainfall in the months of June to September (87% of the total rainfall). Moreover, the Ghaghara sub basin has major irrigational projects as *Sharda-Sahayak* Irrigation Project with major associated structures like *Girija* Barrage, *Sarju* Barrage and *Rapti* barrage which diverts water for irrigation during lean season leading to large scale abstraction of water from the main channel.

Located in River Conservation Centre near the river in *Tapesipah* village, TSA-India Program has been working along Ghaghara River System since 2008. The project aims to protect key riverine species in this largely unprotected landscape. A detailed assessment of the information on new habitats, species assemblage and various threats to aquatic wildlife especially turtle populations is being generated to aid effective habitat management of species and long-term conservation. To further mitigate ecologically harmful activities, outreach programs are regularly conducted for various target groups in along Ghaghara-Sarju landscape.



Figure 3 The stretch of Saryu River covered during the present survey starting from Chehlari ghat to Ayodhya ghat.

Methods

For the current survey, 119 km stretch between *Chahlari* ghat (N 27.541079, E 81.341896) and *Ayodhya* Ghat (N 26.814793 E 82.921394) was studied spanning across *Baharaich*, *Sitapur*, *Gonda*, *Barabanki* and *Ayodhya* district (Figure 3) in 5 days from 18/2/2021 to 22/2/2021 on a six-seater motorboat. On an average distance of about 23.8 km was travelled per day along the flow of the river and the numbers of encountered dolphins, gharials, turtles and waterbird were recorded on pre-designed data-sheets. Survey was carried out from 0900hr in the morning until the dusk. Due to braiding of the river only major channel of the river was which was deep and navigable was surveyed. As minor shallow branches deep inhabitable by animals where depth ranged from 1 to 3 feet maximum.

Garmin echo 550c, fish finder was used to record the depth of the river, Garmin Etrex 20X was used to record the important sighting locations of the animals and a temperature recorder to record the waters temperature at important sighting locations. Two Canon Image stabilizer binoculars 8x25 IS were utilized for viewing the animals from a distance during surfacing or basking along with a Nikon p900 camera to record the important sightings for additional information and future reference.

For every important sighting, the GPS coordinates were taken with the time of sighting, water depth and temperature. The behaviour of the animal was also noted such as Basking (B), Surfacing (S) and Others (O). The habitat characteristics at the point of sighting was also recorded. The different habitat types characterized were Open Waters (OW), Mid River Rocks (MRR), River Bank (RB), Sand Bar (SB), Island (I), Rocky (R), Sandy (S), Hard Mud (HM) and Submerged/Sandy Islands (SI). Fish diversity was also recorded from fish catch by fishermen encountered during the survey.

Gharial Population Count

Gharials were visually detected by the observers and the behavior shown was recorded. The GPS coordinates of the sighting location was taken along with the maximum depth of the channel, the animal was located in/around. Sex identification (Male/Female/Unidentified) was attempted visualizing the size of their snout or the *ghara*, as the males have a larger one than females. Males have a clear protuberance at the tip of the snout, sub-adults/females for large individuals and juveniles for smaller specimen lack such protuberance. Additionally, the age classes were estimated (Adult ≥ 9 ft, Sub-Adult ≥ 6 ft-- ≤ 8 ft, Juvenile ≥ 4 ft-- ≤ 6 ft Yearling > 2 ft-- < 4 ft, Hatchling ≤ 2 ft) by observing the approximate sizes of the animal. The specific location of gharial and muggers was noted and classified as per the position such as 'in water', 'on sand bank/bar/island', 'or 'on mud banks.

Dolphin Count

Survey methods were followed according to (Smith and Reeves 2000). Three trained observers, one looking in the front, one towards the left and the other towards the right surveyed the river for any dolphin surfacing. The number of dolphins during each encounter and the GPS location of the spot where they first surfaced was recorded. The river depth was also noted down for these locations. The age classes (Adult, Sub-Adult, Calf) of the surfacing dolphins were also estimated

and recorded. Utmost care was taken to avoid double counts of the dolphin by maintaining close communication among the observers and also by recording simultaneous resurfacing of more than one dolphin, and by correcting the time interval between resurfacing of a single individual and adjusting the time taken by the boat to cover the distance. Boat speed was also maintained to ensure the same.

Turtle Population Count

As for gharials, the turtle population count was conducted via visual detection. Turtles were spotted during their surfacing or basking from a distance by binoculars. The species of turtle along with the behaviour was observed and recorded. The GPS coordinates and the depth of the river near the sighting location was also taken.

Bird Listing

During the survey, a separate observer kept record for the aquatic and floodplain birds using the binoculars and also through the naked eye. The birds were identified using Grimmet et al (1999) bird book while also keeping photo record for unidentified birds for later identification. The GPS location was recorded for all locations where large flock of birds was sighted. A checklist of the birds was prepared with the migratory/resident status of the species. Few commonly found birds such as Lesser cormorant, Pied Kingfisher and all land-based birds were left out of the checklist.

Fish and fisherman survey

In case of any chance encounter with fishermen or any fishing boats during the survey, the fish catch and the type of net used were also documented.



Figure 4 Team members documenting fish diversity during survey

Results

Distribution and status of Gangetic river dolphin

A total of 107 dolphins based on the best estimate were recorded in the 119km surveyed stretch of Saryu River. Low-best-high estimates for this stretch were 106-107-127 (Table 3). Individual encounter rate was 0.90 dolphins/km. The count per segment was seen to be influenced by river depth and meanders. Dolphins were observed in depths between 3.8ft to 26.3ft with majority (51.40%) of dolphins recorded in between 8.2ft to 15ft.

Table 3 Summary of dolphin sighting in Saryu River

Sl. No.	Date	Distance from start point	Low	Best	High	Adult	Sub-adult	Calves
1	18-Feb	2.17	2	2	2	2	0	0
2	18-Feb	2.56	2	2	2	2	0	0
3	18-Feb	4.2	1	1	2	1	0	0
4	18-Feb	5.03	1	1	1	1	0	0
5	18-Feb	5.43	2	3	4	3	0	0
6	18-Feb	7.6	1	1	1	1	0	0
7	18-Feb	7.78	2	2	2	2	0	0
8	18-Feb	8.5	1	1	1	1	0	0
9	18-Feb	9.6	1	1	1	1	0	0
10	18-Feb	10.3	3	3	5	3	0	0
11	18-Feb	11.4	1	1	1	1	0	0
12	18-Feb	11.4	3	3	6	3	0	0
13	18-Feb	14.1	1	1	1	1	0	0
14	18-Feb	17.1	1	1	1	1	0	0
15	18-Feb	17.4	3	3	3	3	0	0
16	19-Feb	19.5	7	7	10	5	0	2
17	19-Feb	23.1	1	1	1	1	0	0
18	19-Feb	23.2	4	4	4	4	0	0
19	19-Feb	25.9	1	1	1	1	0	0
20	19-Feb	27.8	1	1	1	1	0	0
21	19-Feb	31.3	1	1	1	1	0	0

22	19-Feb	33	1	1	2	1	0	0
23	19-Feb	35	1	1	1	1	0	0
24	19-Feb	35	1	1	1	0	1	0
25	19-Feb	37	3	3	3	3	0	0
26	19-Feb	40.5	2	2	2	2	0	0
27	19-Feb	40.7	2	2	2	2	0	0
28	19-Feb	41.7	2	2	2	2	0	0
29	19-Feb	42	1	1	1	0	1	0
30	19-Feb	52.6	3	3	3	3	0	0
31	20-Feb	53	1	1	1	1	0	0
32	20-Feb	58	1	1	1	1	0	0
33	20-Feb	58.8	2	2	2	2	0	0
34	20-Feb	59.6	1	1	2	0	1	0
35	20-Feb	61.08	1	1	1	0	1	0
36	21-Feb	65.2	1	1	1	1	0	0
37	21-Feb	66.8	1	1	1	1	0	0
38	21-Feb	67.5	4	4	6	3	0	1
39	21-Feb	69.3	5	5	6	3	0	2
40	21-Feb	71.7	2	2	2	2	0	0
41	21-Feb	71.5	1	1	1	0	0	1
42	21-Feb	73.9	1	1	1	0	1	0
43	21-Feb	75.6	2	2	2	2	0	0
44	21-Feb	76.9	1	1	1	0	0	1
45	21-Feb	74.9	1	1	1	1	0	0
46	21-Feb	79.8	1	1	1	1	0	0
47	21-Feb	79.9	1	1	1	1	0	0
48	21-Feb	81.1	1	1	2	1	0	0
49	21-Feb	83.9	2	2	2	2	0	0
50	21-Feb	84	3	3	3	2	0	1
51	21-Feb	85.1	1	1	1	1	0	0

52	21-Feb	86.6	1	1	2	1	0	0
53	22-Feb	88.1	1	1	1	1	0	0
54	22-Feb	90.8	3	3	4	3	0	0
55	22-Feb	94.8	1	1	1	0	0	1
56	22-Feb	96.8	2	2	2	1	0	1
57	22-Feb	98.8	1	1	2	1	0	0
58	22-Feb	108	2	2	2	1	0	1
59	22-Feb	112	1	1	2	1	0	0
60	22-Feb	117	1	1	1	1	0	0
61	22-Feb	117	2	2	2	2	0	0
62	22-Feb	118	1	1	1	0	0	1
Total			106	107	127	90	5	12

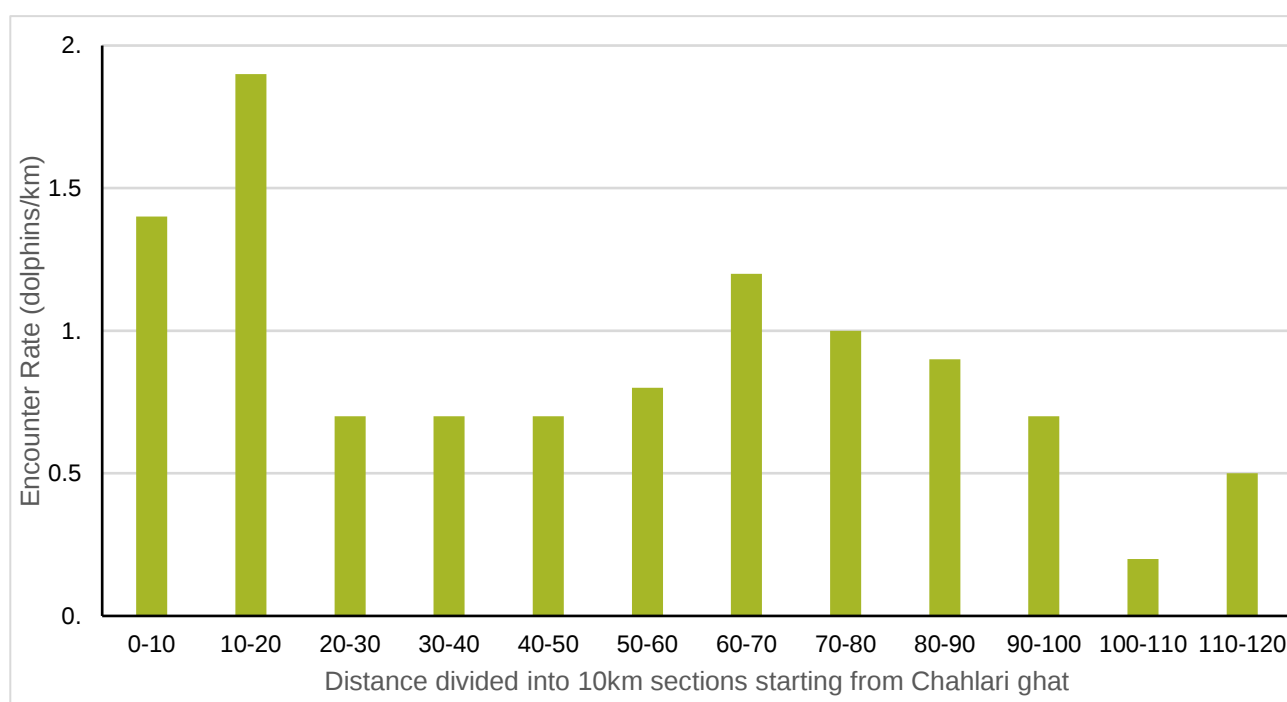


Figure 5: Encounter rate of Ganges river dolphins per 10km sections of the surveyed stretch in Saryu River

Dolphins were observed all through the 10km sections in the studied stretch. However, uneven distribution of dolphins was seen in the Saryu River. Examining the distribution in each 10km section the encounter rate varied from 0.2 to 1.9/km. Highest dolphin encounter rate was observed in 0-10km stretch followed by 10-20km and 60-70km stretch (Figure 5).

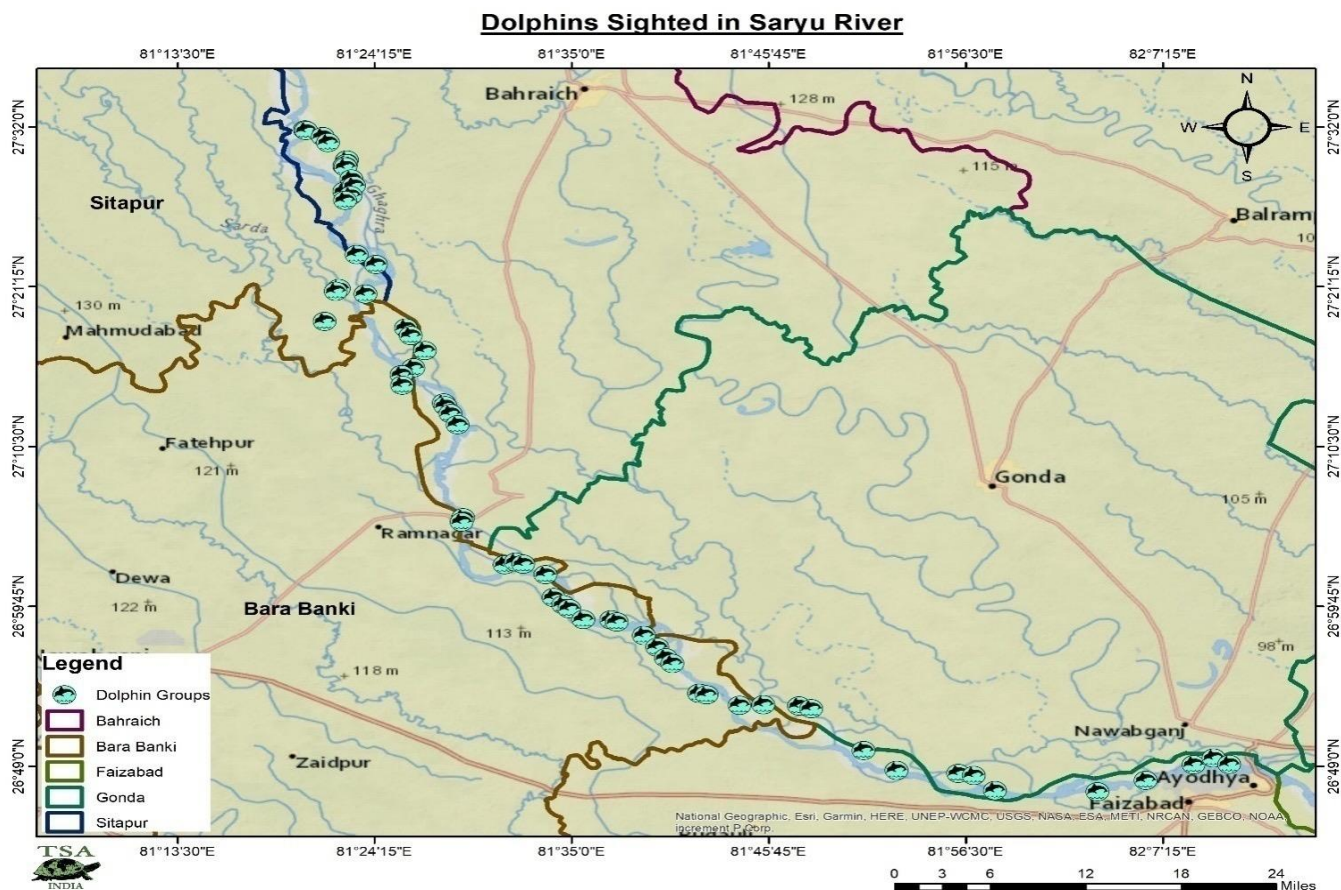


Figure 6: Ganges river dolphin distribution in the Saryu River as documented in the present survey

Maximum dolphins were recorded in *Bahraich* district (n=43) followed by *Barabanki* (n=35) and *Ayodhya* (n=11) followed by *Sitapur* and *Gonda* districts (n=9 at each) (Figure 6).



Figure 7: Three Ganges river dolphin priority points identified with highest number of sightings

Total 62 pods of dolphins were sighted in Saryu in which 6 pods had calves with at least one adult present. 4 singleton calves were observed where the accompanying adults were not sighted. Moreover, three dolphin priority points were identified during the survey where highest number of dolphins was sighted. These are between *Bhauri* to *Sonarakhi*, *Rampur* to *Barheikasba* and *Maraucha* to *Sarai Namoo* (Figure 7). Between *Bhauri* and *Sonarakhi* stretch dolphin were also observed preying fishes.



Figure 8: Ganges river dolphin seen surfacing in Saryu River during survey

Distribution and status of Gharials in Saryu River

A total of 174 Gharials were recorded in the studied stretch comprising of 47 adults, 54 subadults, 71 juveniles and 2 yearlings based on the boat counts. Animals were mainly sighted basking on the sand banks facing the river and tend to dive in the water at any sign that they perceived as a threat. On sighting any group of animals, the boat was stopped at a distance to take stationary counts. Gharials were found using mainly the sandy river banks and mid river island. The depth in those areas varied between 4 to 23.4 ft. The encounter rate was recorded to be 1.46/km for the entire stretch. The animals observed in the entire studied stretch comprised of 43% females, 5% males and 52% of juveniles.

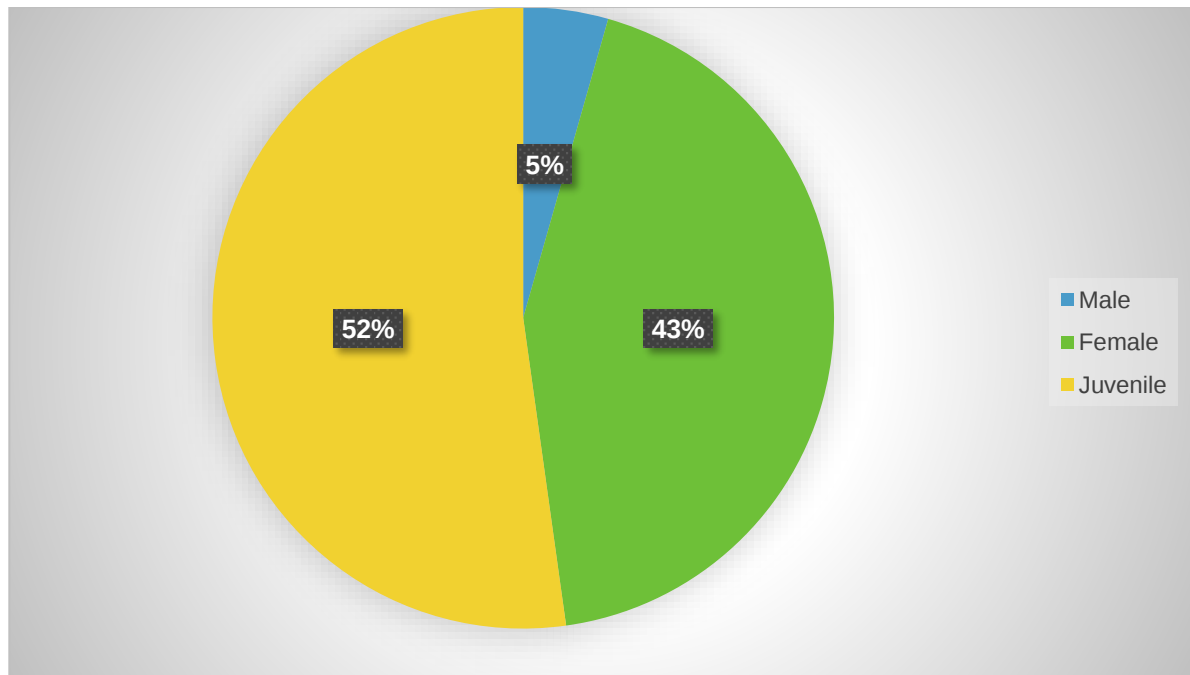


Figure 9: Male, female and juvenile gharials recorded in the studied stretch of Saryu River

The highest proportion of gharials was recorded between village *Dhanauli* and *Nayapurwa* (Upper stretch) with 59% of the total observations. The same stretch supported 89.79% of the observed adult population including both males and females indicating strong viability for substantial breeding (Figure 9,10). Additionally, juveniles constituted 46.37% of the population indicating suitable growing conditions and habitat suitability.

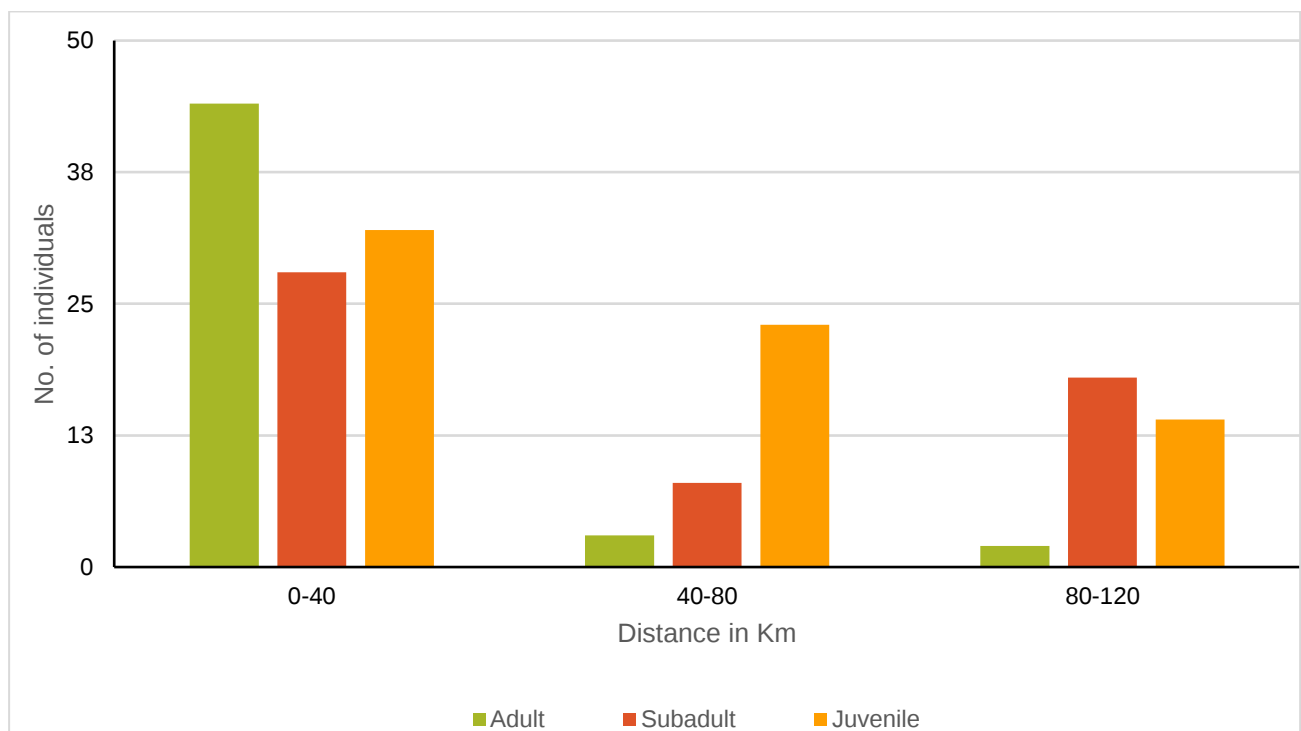


Figure 10: Observations of gharials in the upper, middle and lower stretch of the studied area in Saryu River

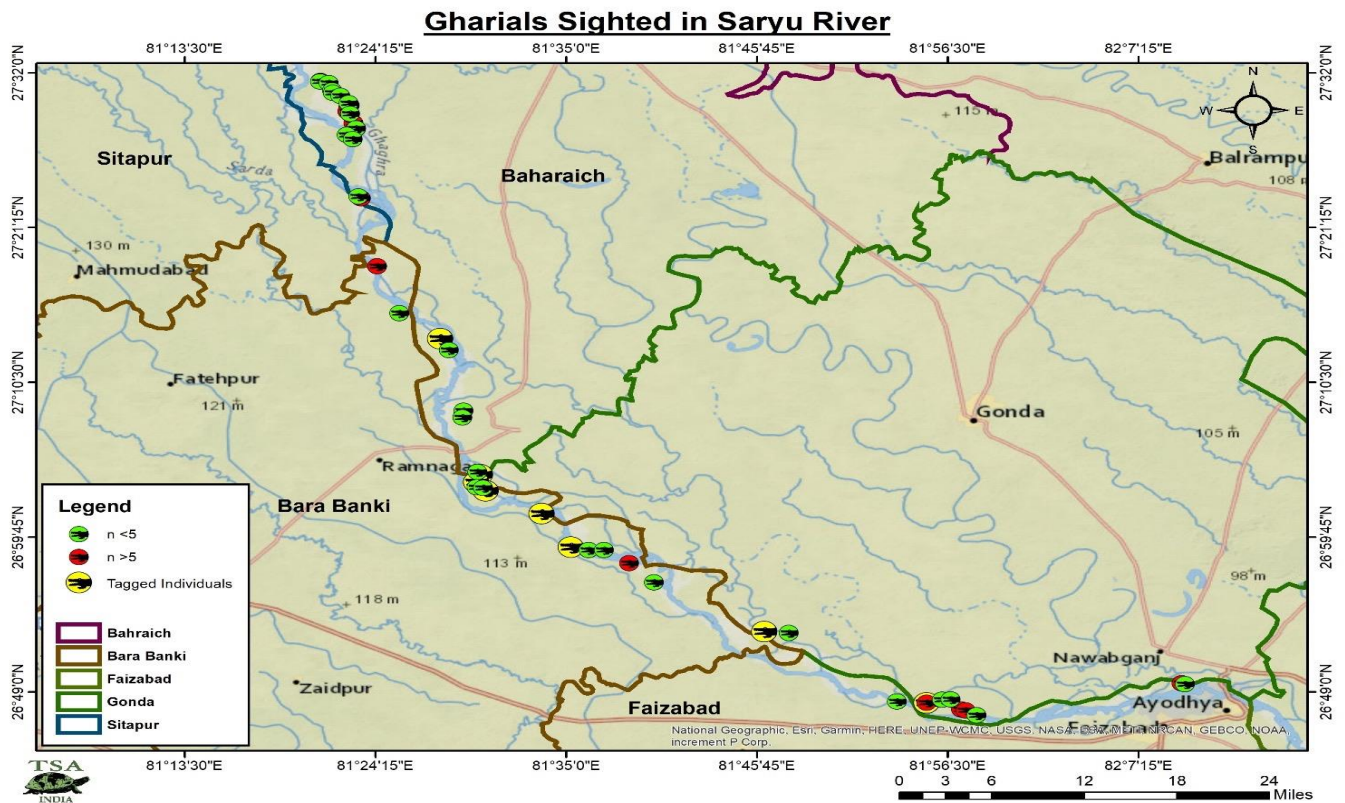


Figure 11: The points of gharial sighting in Saryu river

Eight marked gharials (4 subadult, 4 juvenile), captive bred and released in the Saryu River from Kukrail Gharial Rehabilitation Centre as a part of reintroduction program were sighted in the surveyed stretch. All these marked animals were sighted only in the middle and lower stretch.



Figure 12: A tagged gharial released in the year 2020 in the Saryu River observed basking in the sandy bank

Turtle survey

Freshwater turtles representing mainly *Pangshura* genus were sighted along with that Indian Flapshell Turtle (*Lissemys punctata*) and Indian Softshell Turtle (*Nilssonina gangetica*) and two unrecognized species were also recorded during the survey. The animals were mainly recorded basking between 1200hrs to 1500hrs. *Pangshuras* (*Pangshura smithii*) were sighted in most abundance mainly basking on sandy banks and on highly sloped river bank formed of hard mud substrate and fallen branches.



Figure 14: Turtles basking along with gharials in the Saryu River

Additional observation on avifauna

43 species of water birds were recorded in the 119 km stretch of the Ghaghara River and its floodplains. Out of this 18 were migratory species such as Osprey, Pallus Gull, Common Greenshank, Little Stint etc. Flocks of the vulnerable Sarus Crane, Common crane and Lesser whistling duck, a species with decreasing population trend was also observed.

Table 3 Checklist of the birds observed during the present survey. R= Resident (25 species); M= Migratory (18 species)

Sl. no.	Common Name	Scientific Name	Status
1	Asian Open bill	<i>Anastomus oscitans</i>	R
2	Bar-headed Goose	<i>Anser indicus</i>	M
3	Black Kite	<i>Milvus migrans</i>	R
4	Black-headed Ibis	<i>Threskiornis melanocephalus</i>	R
5	Black-necked Stork	<i>Ephippiorhynchus asiaticus</i>	R
6	Black-winged Stilt	<i>Himantopus himantopus</i>	R
7	Common Crane	<i>Grus grus</i>	M
8	Common Greenshank	<i>Tringa nebularia</i>	M
9	Common Pochard	<i>Aythya ferina</i>	M
10	Common Teal	<i>Anas crecca</i>	M
11	Darter	<i>Anhinga melanogaster</i>	R
12	Egyptian Vulture	<i>Neophron percnopterus</i>	R
13	Eurasian Curlew	<i>Numenius arquata</i>	M
14	Eurasian Spoonbill	<i>Platalea leucorodia</i>	R
15	Eurasian Thicknee	<i>Burhinus oedicnemus</i>	R
16	Eurasian Widgeon	<i>Anas penelope</i>	M
17	Gadwall	<i>Anas strepera</i>	M
18	Garganey	<i>Anas querquedula</i>	M
19	Greater Cormorant	<i>Phalacrocorax carbo</i>	R
20	Grey Heron	<i>Ardea cinerea</i>	R
21	Intermediate Egret	<i>Mesophoyx intermedia</i>	R
22	Lesser-whistling Duck	<i>Dendrocygna javanica</i>	R
23	Little Cormorant	<i>Phalacrocorax niger</i>	R
24	Little Stint	<i>Calidris minuta</i>	M
25	Mallard	<i>Anas platyrhynchos</i>	M
26	Northern Pintail	<i>Anas acuta</i>	M
27	Northern Shoveler	<i>Anas clypeata</i>	M
28	Osprey	<i>Pandion haliaetus</i>	M
29	Painted Stork	<i>Mycteria leucocephala</i>	R

30	Pallas fishing eagle	<i>Haliaeetus leucoryphus</i>	R
31	Pallas Gull	<i>Larus ichthyaetus</i>	M
32	Pied kingfisher	<i>Ceryle rudis</i>	R
33	Red-naped Ibis	<i>Pseudibis papillosa</i>	R
34	Red-wattled Lapwing	<i>Vanellus indicus</i>	R
35	River Lapwing	<i>Vanellus duvaucelii</i>	R
36	Ruddy Shelduck	<i>Tadorna ferruginea</i>	M
37	Sarus crane	<i>Grus antigone</i>	R
38	Small Pratincole	<i>Glareola lactea</i>	R
39	Spot-billed duck	<i>Anas poecilorhyncha</i>	R
40	Steppe Eagle	<i>Aquila nipalensis</i>	M
41	Tufted duck	<i>Aythya fuligula</i>	M
42	White breasted kingfisher	<i>Halcyon smyrnensis</i>	R
43	Wooly necked stork	<i>Ciconia episcopus</i>	R



Figure 15: Various bird species recorded during the present survey. Clockwise from top left: Common Crane, Ruddy Shelduck, Sarus crane and Painted Stork

Additional observation on encountered fish species

Documentation of fish diversity was not feasible considering the scope of the present survey. However, fishermen boat encountered in the survey were checked for any fishes in their fishing gears. Only four species (*Eutropiichthys vacha*, *Rita rita*, *Cirrhinus reba* and *Labeo catla*) were caught in the nets (Figure 16); however, the secondary information was obtained from the fishermen about the various species present in Saryu.



Figure 16: *Labeo catla* captured in fishermen nets

Threats

Fishing was identified as the major threat, directly affecting the aquatic fauna in Saryu River. Various types of nets, widely being used across the width of the river may be responsible for entangling and drowning dolphins, gharials and turtles. As fish constitute a predominant portion in the diet of dolphins and gharials and aquatic birds, increase fishing activity may also affect the availability of diet for these species. Fishing activity was observed being carried out individually or in groups. Total 30 fishing locations (Figure 17) were documented in the studied stretch. Fishermen mainly use wooden boats to cast gill nets and drag nets made of nylon. The nets are generally cast into the river early in the morning and collected back with catch at dusk. Riparian agriculture is another significant threat. The fertility of the river bank encourages widespread encroachment onto the riparian and exposed channel of the river. Riparian agriculture was found extensively on both the banks along the whole section of the river.

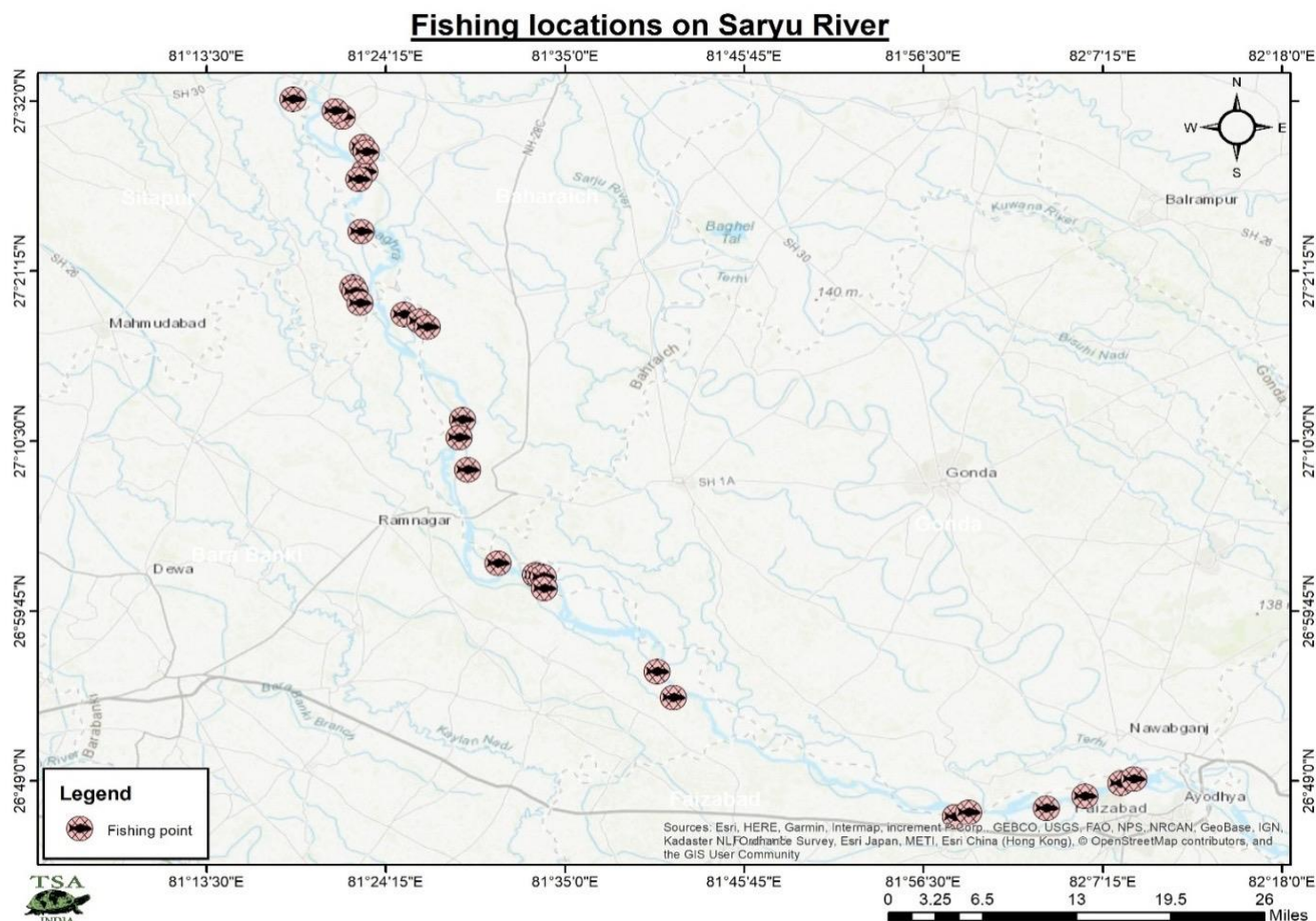


Figure 17: Map showing the fishing locations recorded during the present survey

Community awareness program

A *Goshthi* cum awareness program was organized en route, jointly with the Barabanki Forest Department at *Ghaghara ghat* on 20th February to sensitize the local fisher community on the importance of conserving the aquatic wildlife and available alternative livelihood options (Figure 18). The program was organized targeting fishermen of *Tappe Sipah* village, in Bahraich district who are mostly involved in fishing along the studied stretch. Altogether 50 fishermen participating in the event were made aware about aquatic biodiversity of Saryu River and their roles in the ecosystem. They were also sensitized about the detrimental effects of various kinds of nets being used by them. Sub divisional Magistrate, Ramnagar Sub-division Mr. Rajiv Sukla shared his views on the need to conserve river water and its ecosystem. He appealed fishermen to decrease fishing activity during the breeding season. Divisional forest Officer, Barabanki, Dr. N.K. Singh encouraged the fishermen to take up alternative initiatives like fish farming through various government schemes so that fishing pressure in rivers can be reduced. Fishermen also shared their views on the issue and mentioned that barricading section of river for fishing by different stakeholders is leading to isolation of fish population and halting their movement.



Figure 18: Fishermen awareness program organized by Barabanki Forest Division and TSA India

During the survey, the team halted in few villages along the river having high density of dolphins and gharials. The team interacted and sensitize children, other riparian community members about the aquatic diversity of the Saryu River. Resource materials (in Hindi) with information on turtles, dolphins and gharials were distributed among children. They were also apprised about the need to conserve and their role and importance in the ecosystem



Figure 19 IEC materials distributed among kids in riparian village to raise awareness about aquatic diversity

Discussion

Regular and comprehensive surveys are imperative for determining the population trends in any concerned species as well as for informing scientifically backed decisions on conservation planning and management. Like any other rivers in the country the riverine ecosystem of the Saryu is getting severely compromised with increased human activities. Despite being a prime but largely unprotected habitat of some of the rarest and threatened aquatic wildlife, the river is often overlooked and has received very less attention in terms of biodiversity assessment or scientific expeditions or surveys. This has led to a gap in terms of knowledge and status of major aquatic fauna in this important river.

In the present survey 107 dolphins were (best estimate) in 119 km stretch between *Chahlari* ghat and Ayodhya with an encounter rate of 0.90/km. In this roughly identical stretch three surveys have been conducted with sighting of 48, 115 and 133 dolphins in 2001, 2009 and 2015 respectively (Basu 2001; Basu & Singh 2009; WWF unpublished data 2015) Last survey documented the presence of 133 dolphins in a 183 km stretch from Sharada Ghaghara confluence till Faizabad (Ayodhya) with an encounter rate of 0.72 dolphins/km. Comparison of encounter rate from the sighting record of the previous surveys with the recent one suggests that the population of Gangetic river dolphin is stable in the site. Clearly this calls for a dedicated survey focusing on Gangetic river dolphin (employing internationally recognised methods like tandem boat count) every year in Saryu River to understand the population trend. Additionally, as dolphins stranded in the irrigational canal network are also released in the Saryu River, a dedicated research is required to understand the survival and dispersal of the released animals.

Katerniaghat Wildlife Sanctuary (on Girwa River) holds the second largest Gharial population in India with an estimated population of about 85 mature adults that are reproductively active. This population has been studied quite extensively since 1970s and seems to have remained relatively constant since then. However, downstream from Katerniaghat reservoir and upstream from the Gangetic tributaries, a minor population of mature adult gharials is said to be located in the middle and lower stretches of the Ghaghara River whose nesting/recruitment has not been properly documented. During a survey conducted by UPFD in 2001 only one juvenile gharial was encountered (Basu, 2001). Later, 16 and 43 gharials were documented in surveys conducted between Mallapur and Ayodhya in 2009 and 2013 respectively (Basu & Singh 2009; Singh & Dixit, unpubl data 2013). However, in the present study conducted in the same stretch as in year 2013, a total 174 gharials comprising 47 adults, 54 subadults, 71 juveniles and 2 yearlings were sighted. The upper stretch (between *Dhanauli* and *Nayapurwa*) recorded the maximum number of adults and juveniles. The augmentation in the current gharial numbers in this stretch could be a result of the gharials (mainly juveniles) dispersing through the barrage at Katerniaghat during high water episodes or when water is let out from the dam. Further the current increase in number indicates that this population may be a result of natural recruitment after successful in-situ reproduction. This however warrants a detailed study on understanding the relation of the Katernighat animals with the wild adults observed during this survey.

Saryu river was also identified as a potential release site for Gharials in 2014 based on historic distribution and confirmed presence of gharial as well as less disturbances in terms of fishing, sand mining, riverside agriculture, nesting and basking site availabilities, unpolluted water, availability of fishes and high abundance of other sympatric aquatic vertebrates such as dolphins and turtles. To augment the wild gharial population Kukrail Gharial Rehabilitation Centre, Lucknow conducts rear and release programs. Since, 2014 Endangered Species Project (ESP) of Uttar Pradesh Forest Department with active assistance from TSA is working towards setting up a satellite population in the Ghaghara River. In line to this objective, 307 captive bred gharials have been marked and released in Ghaghara River over the years. In the present survey, 8 tagged juveniles were sighted. Tagged gharials were seen to utilize the area from their site of release (*Ghaghara ghat*) till 58 km downstream. No tagged gharials were observed in the upper stretch of studied area. Most of the captive bred gharials were observed to be basking in groups with wild gharials. The wild gharials were observed to be much more conscious of any human activities and tend to dive in water if anything threatened them but tagged ones continued basking indicating familiarity with human presence.

Most tagged animals presumably couldn't be identified due to distance, poor weather conditions or gharials diving into water after being startled by the boat movement. One of the gharials with cattle tag attached was clearly identified with number 125 released in 2020 in Saryu River. However other tagged gharials couldn't be identified as only one side of the gharials were visible and unless both the sides are photographed an individual's identity couldn't be ascertained. Thus, it is recommended in addition to scute cutting gharials should also be marked with cattle tags with numbers on both sides before release for better identification during survey. Further, no muggers were encountered in the present survey as compared to 2 muggers' sightings in 2013 and one in 2001, indicating Saryu has a very marginalized habitat for mugger crocodiles.

Though the survey was not primarily focused/equipped to determine the turtle abundance of the river, the method was only inclined towards documenting sightings of basking turtles. Only *turtles of Genus Pangshura* were recorded in large number basking along the bank of the entire studied stretch along with one individual each of *L. punctata* and *N. gangetica*. An in-depth survey is recommended along the Saryu River in order to get appropriate estimates of the turtle diversity.

With the Saryu River being one of the largest affluents of the Ganges River, and housing a wide range of threatened aquatic wildlife, its conservation and the conservation of all the organisms associated with it is of utmost importance. Saryu River also happens to be one of the most important commercial waterways of Uttar Pradesh, putting a lot of pressure on the health of the river. However, direct observations for the major threats faced by the wildlife in Saryu River, especially dolphins, gharials and turtles are fishing with large fishing gears, sand mining and river-bed agriculture.

Encroachment of agricultural lands into the river bed and the use of chemicals for intensive bank cultivation also add to the threats faced by the river and its inhabitants. Additionally, barricading of the river by fishermen nets and accidental drownings in it are major threats to the survival of aquatic species like the Gangetic river dolphins and the various freshwater turtle species. Overfishing in the river also leads to a depleted prey base that threatens species like Gharials and

river dolphins. A detailed study is needed to quantify impact of direct and indirect threats on aquatic fauna of Saryu River.

Recommendations

- Regular and rigorous monitoring to assess demographic trends of aquatic fauna mainly for Gharials and dolphins. All monitoring should follow scientifically accepted, uniform study techniques.
- Post release monitoring of the captive bred gharials released in the river. Future restocking should be determined only after assessing the fate of previously released individuals.
- Implementation of conservation cum management plan in the identified priority areas for gharials and dolphins through sensitization of riparian communities, reduction in fishing and regulations on fishing gears.
- Implementation of participatory community conservation program involving fishermen and other communities closely associated with aquatic fauna and their habitats through alternative livelihood programs.
- To integrate conservation of aquatic fauna with local livelihoods, dolphin based eco-tourism can be initiated in the Ghaghara river. Volunteers from local fishermen community can be trained to take tourist in boat rides to view dolphins along with other aquatic fauna of Ghaghara river.
- Assessment of fishing related mortalities and developing sustainable fishery management plan and reducing fishing interference through strict implementation of National Inland Fisheries and Aquaculture Policy (NIFAP 2019) and rules and regulations pertaining to states fishery act (UP Fisheries Act 1948) in critical habitat of gangetic dolphins and gharials.

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