Status of Ganges River dolphins in Kosi River in Supaul District, Bihar

January 2019

With notes on other riverine biodiversity

Submitted to the

District Forest Officer, Supaul Forest Division

Department of Environment and Forest, Bihar, India

By

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Head University Department of Botany
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Research Team

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Final Report

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We wish to sincerely thank Mr. Sunil Kumar Sharan, Divisional Forest Officer, Supaul Forest Division, for awarding the assignment, "**Status of Ganges River dolphins in Kosi River in Supaul District, Bihar**" and for organizing the required fund and logistical support to conduct the survey. We also wish to thank Mr. Suresh Prasad Gupta, Range Forest Officer, Mr. K. K. Jha, Forester, Mr. Upendra Prasad Mehta, Forest Guard and Md. Hasmul, Dolphin watcher of Supaul Forest Division who accompanied our team in river survey and for their prompt help and coordination of field logistics throughout the survey. Thanks are also due to Mr. Deepak, driver of the jeep and Mr. Aryan Kumar, Field Assistant travelling with us as shore party with our luggage & food stuff and boatmen of our survey boat without whom help the survey would not have been completed.

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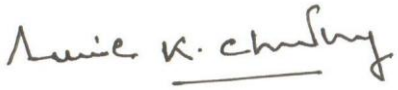
We sincerely thank Mr. Bharat Jyoti, the then Chief Wildlife Warden Bihar and Conservator of Forest, Purnea Circle for taking initiative for this survey. Their support and encouragement raised the morale of our survey team to complete the survey.

We sincerely thank the Head, University Department of Botany, T. M. Bhagalpur University for providing space, Lab and Library facilities for this survey.

Our thanks are also due to fishers and other local people who provided us relevant information on the dynamic nature of River kosi and on other river biodiversity.



Project Coordinator

ABBREVIATIONS

DO	Dissolved Oxygen
TDS	Total Dissolved Solid
°C	Degree Centigrade
km	Kilometer
m	Meter
GPS	Global Position System

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Introduction

The Ganges River Dolphin *Platanista gangetica gangetica* is an endangered species of river dolphin that is found only in Ganga-Brahmaputra basin across India, Nepal, and Bangladesh. It is one of the five known species of river dolphins that live exclusively in freshwater conditions. Owing to the murky nature of the river habitat that it thrives in, this species has lost the functionality of its eyes. It navigates and searches for food using echolocation by emitting ultrasonic click-sounds. It has been listed as a Schedule-1 species in India's Wildlife Protection Act 1972 following its decline in population and distribution by 1980s. In 2010, this species was also declared as a **National Aquatic Animal of India**. The best recent estimates of the population of the Ganges River Dolphin range within 3000-4000 individuals and further detailed studies are ongoing.

Dams and Barrages have been built on almost all the rivers in the Gangetic basin, which have altered the natural flow and availability of water for riverine wildlife. They have further fragmented the river dolphin populations across the Gangetic basin which might hinder their gene flow and long-term viability of the population. Apart from low water availability, anthropogenic pressures such as channelization, embankment construction, and chemical pollution are known to be some major threats for this species (Smith and Smith, 1998; Choudhary *et al.,* 2006; Smith and Braulik 2012).

Supaul is situated at 25037'-26025' N latitude and 86022' – 87010' E Longitude. The district is a part of the Kosi division and covers an area of 2,420 sq km. The district is bounded by Nepal in the north, Saharsa in the south, by Araria district in the East and on the west by Madhubani district. The Kosi River, an important northern tributary of the Ganga River, originates at an altitude of 7000 m above msl in the Tibet Himalayas and is the third largest Himalayan River, after the Indus and the Brahmaputra. The river Kosi flows through the western parts of the district and is considered as the sorrow of not only this district, but for whole of the Bihar state. Tilyuga Chhaimra, Kali, Tilawe, Bhenga, Mirchaiya, Sursar are the tributaries to River Kosi. It is one of the most dynamic river systems in the world.

1.1 Climate and Rainfall

The area has warm and humid climate with high temperature and medium to high rainfall. The temperatures are lowest during December-January with an average minimum of 8ºC to 10ºC and maximum of 24ºC to 25ºC. The temperatures in the hottest months of April to June are minima 23ºC to 25ºC and maxima 35ºC to 38ºC. The normal rainfall for the district stands at 1404 mm. Most of the rainfall (80% to 90%) is received from mid-June to mid-October. The late September - October rains (locally known as ‘Hathia’) are very crucial to agriculture in the region and their timing and distribution make all the difference between plenty and scarcity.

1.2 Geomorphology

Supaul district forms a part of the Kosi megafan. The river is known for its notorious shifting and channel abandonment approximately in every 25 years. The

district is subjected to frequent flooding related to either shifting of the river Kosi or bank over-topping/breaching by floodwater. Sweeping of the river in the megafan has created the alluvial landscape with abandoned channels and the flood plains. The abandoned channels exhibit sand bodies of huge dimension, often exposed or buried under thin veneers (~1.0 m) of mud. They also characterize the depressions in the megafan surface, which are prone to water-logging. Often the channels are occupied by mis-fit channels of smaller dimension. During lean period, these channels get water from the aquifers. These smaller channels rework and redistribute the flood plain sediments, and hence contribute in the evolution of the flood plain architecture. The land surface in the district slopes southward with 30-35 cm/km at the northern half, while it is 45-55 cm/km at the southern half with an average value of ~ 40 cm/km. The reach segment of the Kosi River within the district Supaul is wide (6 to 8 km) and highly braided in nature.

Recently, a few surveys have been conducted to assess the status of river dolphins in the River Kosi (Sinha and Sharma, 2003; Kelkar *et al*., 2015, Choudhary *et al.*, 2016). This report is based on a survey of approximately 87 km stretch of Kosi flowing through Supaul district of Bihar and provides new information on the distribution and abundance of river dolphins in the Kosi River and also highlights the habitat-use and prevalent anthropogenic pressures for this species in the river within Supaul district. Recommendations based on our findings are included in the last section of this report.

Materials and Methods

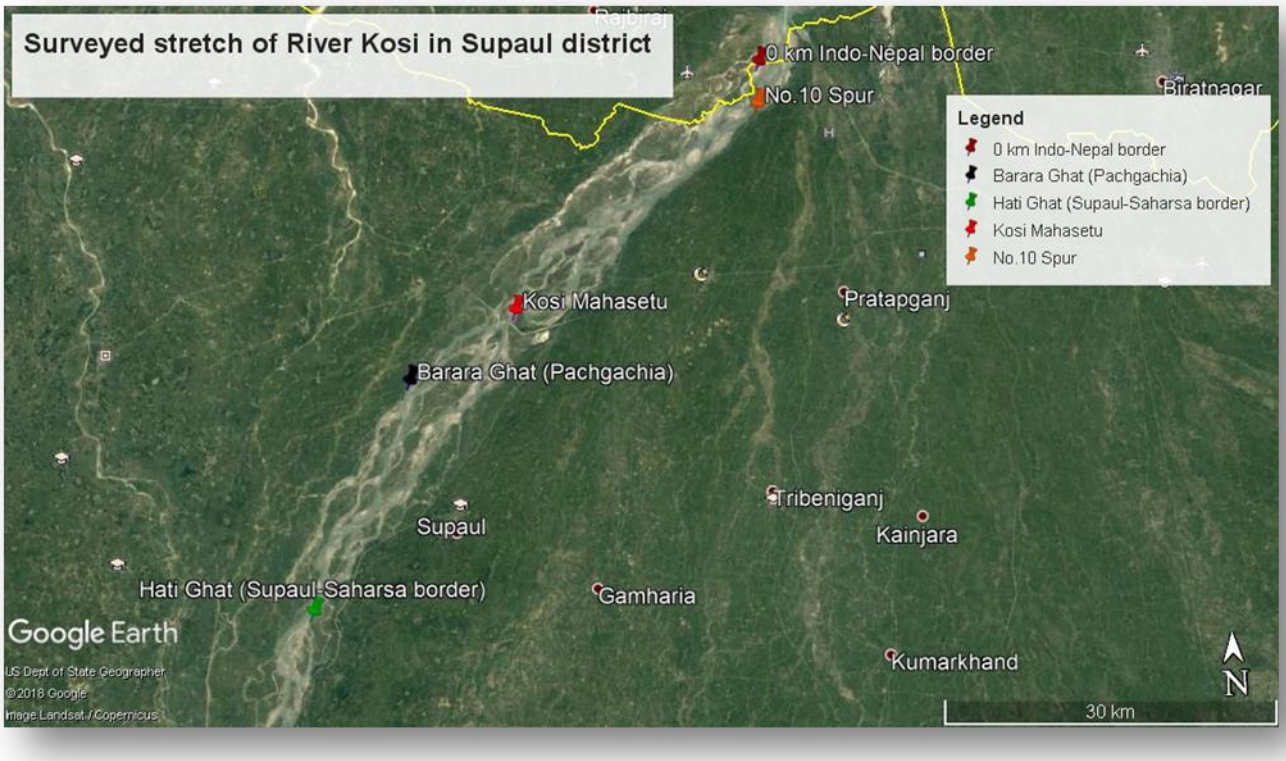
2.1 Study Area

The survey was conducted in the Kosi river from 21st January 2019 to 26th January 2019. We surveyed a total of 86.98Km in Supaul district from HatiGhat on Supaul-Saharsa border till 0 Km marker on the Indo-Nepal border. The river channel is highly braided and forms multiple mid-channel alluvial islands in its course (Gaurav et al. 2014). The discharge of Kosi ranges from 800 cumecs (m^3/s) in the dry-season (March) to 15000 cumecs in August which is the monsoon flooding peak (Gaurav et al. 2014). The region receives over 1500 mm of annual rainfall and the temperature ranges from 2°C in winter to 40°C in the peak summer.

The Kosi river forms one of the largest alluvial sediment deposits in the world and is considered to be among the most dynamic riverscapes. The flooding events lead to a tremendous loss of human life and property due to which it is also called as 'Sorrow of Bihar' (Chakraborty et al. 2010). Although the construction of Birpur Barrage has reduced the frequency of flooding, it has also made flooding effects unpredictable and floods of dangerously high intensity might actually increase because of the embankments, according to experts. Further, the control over river flow has led to a reduction in the river flows in the dry-season, which impacts the exchange of nutrients and water between the river and the adjacent floodplain.

Although the embankments and barrage-led flood control may have benefitted agriculture in the short term, fisheries and biodiversity seem to have been negatively affected due to a reduction in river flow and biological productivity. According to barrage athourities the month of January is one of the leanest months when the river receives the least amount of water from the barrage release.

Figure- 1: Map showing the study area in Supaul district



2.2 River Dolphin Survey

The river stretch passing through Supaul was surveyed using a mechanized country boat. A team of three trained observers (two on the sides and one central data

recorder) recorded dolphins and estimated the distance and angle of the sightings (Reeves 2000, Choudhary et al. 2006). Locations of the boat at all the sightings were logged in a handheld Global Position System (GPS, Garmin etrex 30).

Figure-2: Survey Team Members in the River Kosi

The locations of the dolphins were then estimated using known location of the boat at the time of sighting and the distance and the angle of each dolphin sighting in software R-3.3 (R Core Team 2018). These locations were then plotted on a LandSat 8 OLI TIRS satellite image which was downloaded freely from USGS Earth Explorer (www.usgs.earthexplorer.gov) using software QGIS 3.0.3 Girona (www.qgis.org). Dolphin stage-classes (Calf, Sub-adult or Adult) were estimated based on the

observation of size-class for each sighting. By recording simultaneous resurfacings of more than one dolphin, care was taken to avoid double count of dolphins. Encounter rates of dolphins were then calculated for each of the surveyed stretches. To maximize the counting accuracy the boat speed was maintained at 3-5 Km/h to ensure sufficient time to detect surfacing.

2.3 Habitat Variables

One trained observer was deployed to record habitat variables at each kilometer of the surveyed stretch. For depth profile of the river, we used a chart plotter that was set to record depth at every 6 second interval (Garmin GPSMap 585 Plus). Water temperature, Dissolved Oxygen (DO), pH, conductivity, Total Dissolved Solids (TDS) and some other parameters of water quality were recorded at different point/Ghats from where the survey started and ended each day. Further, the observer also recorded anthropogenic activity such as fishing boats and ferry boats.

2.4 Other Biodiversity

Biodiversity, like other river fauna such as birds, turtles, and signs for gharials, crocodiles and otters for the entire survey length of the river were recorded by an experienced observer other than the three dolphin observer.

3

RESULTS AND DISCUSSION

3.1 Gangetic dolphin abundance

A total of 82 dolphins were recorded during the upstream survey in 86.98 km of the Kosi river stretch that was sampled in the Supaul district between Hati-Ghat on Supaul-Saharsa district border and 0 km marker on the Indo-Nepal border (Table 1). The encounter rate of dolphins was 0.95 per kilometer for the river length surveyed in Supaul. The average depth of the river stretch that was surveyed in Supaul was found to be 1.8±0.96. The dolphins were mostly recorded in sections of the river with an average depth of 1.8±0.96. This indicates that there isn't adequate water depth to allow dolphin movement. We observed that the dolphins were mostly localized due to the hydrological barriers formed due to low depth when a subsequent downstream survey was done (Figure 1). Out of the 82 individuals that were sighted, 50 were adults, 29 were sub-adults and 3 were calves. The sighting of calves this time again indicates that the breeding population of dolphins is present in the River Kosi, however we need long-term observations and monitoring to have proper idea of the breeding behavior of the dolphins in Kosi. Our observations indicate that ecologically adequate water depth should be maintained even during the dry-season to allow long term persistence of dolphin populations in the Kosi. For this authority of the Birpur Barrage would be required to release adequate water during the dry-season (March-

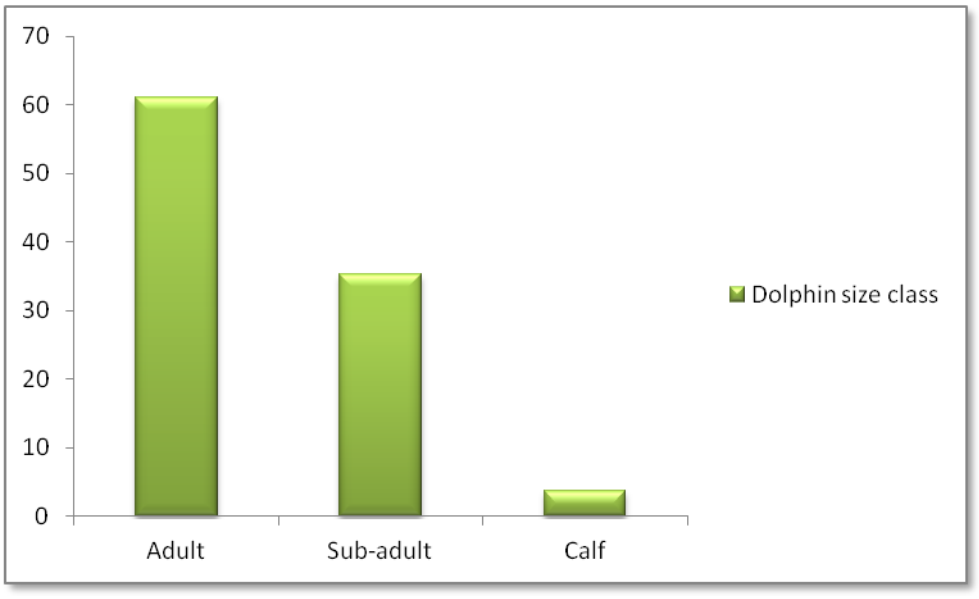


Figure – 3: Percent size class of dolphins sighted in the River Kosi in Supaul district in Jan 2019

April). We suggest that long-term monitoring is essential to devise efficient management strategies to ensure the long-term survival of this species in this river Kosi. Further, maintenance of adequate water flow and depth is crucial for this species and appropriate measures should be taken to ensure this.

Table 1: Dolphins recorded in the Kosi River between 0 Km marker and Hati Ghat for Supaul district during upstream survey (Jan. 2019)

S. No.	Date of Survey	Survey from	Survey to	Distance (km) between the two places	Dolphin Count (Upstream)	Adult	Sub-Adult	Calf	Unclassified
1	21-01-2019	No.10 Spur N 26º 26′ 44″ E 86º 53′ 40”	0km Indo-Nepal Border N 26º 28′ 54″ E 86º 53′ 52″	5.5	6	5	1	0	0
2	24-01-2019	Hati Ghat N 26º 02′ 35″ E 86º 27′ 58″	Barara Ghat (Pachgachhia) N 26º 13′ 39″ E 86º 33′ 36″	29	38	20	15	3	0
3	25-01-2019	Barara Ghat	Siani cigratta Village N 26º 22′ 01″ E 86º 45′ 03″	31.22	23	18	5	0	0
4	26- 01-2019	Siani cigratta	No.10 Spur	21.26	15	7	8	0	0
Total distance surveyed and dolphin counts				86.98	82	50	29	3	0

Table 2: Dolphins recorded in the Kosi River between 0 Km marker and Hati Ghat for Supaul district during downstream survey (Jan., 2019)

S. No.	Date of Survey	Survey from	Survey to	Distance (km) between the two places	Dolphin Count (Upstream)	Adult	Sub-Adult	Calf	Unclassified
1	21-01-2019	0 km Indo-Nepal border	No.10 Spur	5.5	2	2	0	0	0
2	22-01-2019	No.10 Spur	Kosi Mahasetu	38.72	25	21	3	0	1
3	23-01-2019	Kosi Mahasetu	Hati Ghat	42.00	39	22	14	3	0
Total distance surveyed and dolphin count				86.22	66	45	17	3	1

3.2 Birds

A total number of 37 species of birds were recorded in the present survey in river Kosi flowing within Supaul district. These included some Threatened bird species (IUCN) , i.e. Lesser Adjutant Stork *Leptoptilos javanicus*, Woolly-necked Stork *Ciconia episcopus*, River Lapwing *Vanellus duvaucelli* and Eurasian Curlew *Numenius arquata* (Table 3. Altogether 1446 no. of birds were counted during the survey. During this survey we recorded 11 new species of birds that were not seen during the April 2018 survey, and 12 species of birds which were seen in April 2018 survey were not seen in the present survey.

3.3 Turtles and other Reptilians

Freshwater turtles *Pangshura smithii* were seen in good numbers in the river stretch surveyed. A total of 55 turtles were recorded, all were seen basking on sandbars. However, no signs of Gharials, crocodiles (mugger) or otters were seen during the survey but many highly suitable habitats for the Gharials were observed in the Birpur Range.

We could not record the fish species in this survey as there was severe cold during the survey period and fishermen did not turn up with fish catch at the survey starting point in the morning hours on survey days. In fact, very few fishers were present in the river and we could not give time to record these species as the focus of the survey team was on estimation of dolphin abundance. The listing of other biodiversity including fish was based on opportunistic survey in the survey plan. Moreover winter days were shorter and we were not in a position to dedicate much time on documenting other biodiversity.

Table 3. Bird species recorded in River Kosi in Supaul District (Jan. 2019)

S. No	Species	IUCN Status
1	Asian Openbill *Anastomus oscitans*	LC
2	Common Greenshank *Tringa nebularia*	LC
3	Little Egret *Egretta garzetta*	LC
4	Gadwall *Mareca strepera*	LC
	Bank Myna *Acridotheres ginginianus*	LC
5	Intermediate Egret *Mesophoyx intermedia*	LC
	Garganey *Anas querquedula*	LC
6	Lesser Adjutant *Leptoptilos javanicus*	**VU**
7	Pied Kingfisher *Ceryle rudis*	LC
8	Red-naped Ibis *Pseudibis papillosa*	LC
	Whiskered Tern *Chlidonias hybrid*	LC
	Lesser Whistling-duck	LC
	Common Pochard *Aythya ruferina*	VU
9	Great Egret *Ardea alba*	LC
10	Little Cormorant *Microcarbo niger*	LC
11	Red-wattled Lapwing *Vanellus indicus*	LC
	Large-billed Crow *Corvus macrorhyncus*	LC
12	Northern Pintail *Anas acuta*	LC
13	Indian Pond Heron *Ardeola grayii*	LC
14	River Lapwing *Vanellus duvaucelli*	**NT**
15	Grey Heron *Ardea cinarea*	LC
16	Black Kite *Milvus migrans*	LC
17	Ruddy Shelduck *Tardoma ferruginea*	LC
18	White-throated Kingfisher *Halcyon smyrnensis*	LC
	White-eyed Buzzard *Butas turteesa*	LC
19	Eurasian Curlew *Numenius arquata*	**NT**
20	Himalayan Griffon *Gyps himalayensis*	**NT**
	Little Tern *Sternula albifrons*	LC
21	Pallas's Gull *Ichthyaetus ichthyaetus*	LC

22	Striated Heron *Butroides striata*	LC
23	Woolly-necked Stork *Ciconia episcopus*	VU
24	Black-winged Kite *Elanus caeruleus*	LC
	Brown-headed Gull *Larusbrunni cephalus*	LC
	Eurasian Wigeon *Mareca Penelope*	LC
25	Graylag Goose *Anser anser*	LC
	Greater Coucal *Centro pussinensis*	LC
26	Black stork *Ciconia nigra*	LC
27	Mallard *Anus platyrhynchos*	LC
28	Common teal *Anus crecca*	LC
29	Red crested pochard *Netta rufina*	LC
30	Bar headed goose *Anser indicus*	LC
31	Common Merganser *Mergus merganser*	LC
32	White wagtail *Motacilla alba*	LC
33	Peregrine falcon *Falco peregrinus*	LC
34	Common kestrel *Falco tinnunculus*l	LC
35	Great cormorant *Phalacrocorax carbo*	LC
36	Great crested grebe *Podiceps cristatus*	LC
37	Osprey *Pandion haliaetus*	LC

* LC= Least Concern, VU= Vulnerable, NT= Near Threatened

**Bird names in red font are the once recorded during April 2018 survey but not seen during January 2019 Survey.

3.4 Habitat Variables and River Water Quality

The surveyed river length consisted mostly of sandy banks interspersed with grassland. Agro-practices were observed adjacent to the river bank. Ferry boats were encountered at the rate of 0.09/km of the river length surveyed while the Fishing boats were encountered at the rate of 0.03/km. There was no intensive fishing. The overall disturbance by country boats including both ferry and fishing boats in the surveyed river stretch was found low. Most ferry boats were operated by a bamboo pole. We noticed only a few country motor boat near Hati suggesting very low disturbance by motor boat traffic.

Surface water samples of the river were collected at four sites spread over in the surveyed river stretch i.e. at 0 km marker (Indo – Nepal border), near 10 no. Spur, near 17 no. Spur and at Kosi Mahasetu. The depth of the river was 1.85±0.96 m at 0 km marker (Indo – Nepal border) and the average depth of the river in the surveyed stretch was found in the range of 0.2 – 18.44 m. The results of analyses of water variables suggest that the river was saturated with dissolved oxygen, the values in the range of 12.8 – 13.6 mg/L. pH in the range of 6.9 – 7 suggested that the river water was slightly acidic to neutral. Total Dissolved Solids were recorded in low values (66 – 67 mg/L) and conductivity values were moderate (132 – 134 µS/cm). The present results suggest that the river water quality is fair and the river seems to be in healthy condition. No adverse impact of anthropogenic activities on the river was visible.

Table 4. Water quality of River Kosi at 4-sampling sites in Supaul District (Jan. 2019)

Sampling sites /Water variables	**0 km (Indo – Nepal border)**	**No.10 Spur**	**No. 17 Spur**	**Kosi Mahasetu**
Ambient Temp. (ºC)	18.7	18.2	17.7	16.1
Conductivity (uS/cm)	132	133	133	134
TDS (g/L)	67	67	67	66
Dissolved Oxygen (mg/L)	13.2	13.6	13.6	12.8
pH (Units)	7.0	6.9	6.9	6.9

4

Summary and Recommendations

We recorded 82 dolphins in 86.22 km stretch of the Kosi river that was surveyed. While approximately 60.9% of the sightings were of adult dolphins, sighting of 3 calves during the survey was a good indication. The increase in dolphin sighting from the previous survey in April 2018 (n=60) is probably due to the presence of the dolphins in the main channel rather than in all those channels where there is not enough water during this month which is considered one of the leanest periods of the year, when the water level in the rivers is the lowest. Dolphins might have migrated to the main channel from the side channels, braided channels or anabranches, where the low water level makes the habitat unsuitable for the dolphins to move around whereas during the high water level period like in the month of April (water level high also due to closer of the Kosi canals originating from the Barrage where maintenance work was being done during the April 2018 survey) dolphins might venture into the different channels for foraging and other activities. However, we believe further long-term observations need to be made to confirm if the population breeds in the Kosi river stretch in Supaul district. Very low encounter rate of ferry boats and fishing boats in the river indicated low impact from such activities; however more study/survey is/are required for a proper assessment of threats. The dolphins were recorded mostly in sections of river where the average depth was two meters or more (mean recorded depth for dolphin = 2.04 ± 1.11 m). However, the average thalweg depth of River Kosi under Supaul district was lower than the required threshold depth as suggested in the

report submitted to the Forest Department for the 2016 survey. These low depths may lead to fragmentation of the dolphin population by forming hydrological barriers and hence it is required to maintain a minimum ecological flow for the long-term benefit of the species. We suggest that long-term monitoring measures should be taken up by the Forest Department to devise efficient management strategies to ensure the survival of this species in the Kosi River.

The avian diversity was rich and included IUCN Red List species such as Lesser Adjutant Stork *Leptoptilos javanicus*, Woolly-necked Stork *Ciconia episcopus*, River Lapwing *Vanellus duvaucelli* and Eurasian Curlew *Numenius arquata.* No bird hunting or bird poaching was observed. Freshwater turtles *Pangshura smithii* were seen in good numbers but no signs of Gharials, crocodiles (mugger) or otters were seen during the present survey. However, many suitable habitats for the Gharials were observed in the Birpur Range. For proper documentation of turtles and Gharials in River Kosi, a dedicated survey for these species is required.

We could not record fish species because of time constraints.

River banks were mostly sandy and floodplain with sparse vegetation of grasslands. In floodplain agriculture and animal husbandry was common practice. The river water was found satisfactory. All the water variables analysed were found within the permissible limit of BIS. Local people were found ignorant of the fact of importance of dolphins.

Recommendations

1. **Maintaining minimum ecological river flow and depth**: The overall depth in Supaul stretch of Kosi River is extremely low which is a major barrier to its movement. It is recommended that the Supaul Forest Division may request the Birpur barrage authorities to plan for better dry-season flows. A minimum depth of 2 meters or above is required for unhindered movements of dolphins in the river.
2. **Long-term Monitoring of Dolphins and other Biodiversity:** The Supaul stretch of the Kosi is diverse and relatively pristine. Long-term monitoring of river dolphin populations and other fauna such as reptiles and birds should be done. We recommend a monthly survey for monitoring of dolphins and other biodiversity, however at least two surveys every year are a **must and should be** conducted in the Dry-season (March-April) and Post-monsoon (November). Also, independent surveys for monitoring reptiles and birds should be conducted. We also believe that an independent survey for investigating the breeding population of gharials in the River Kosi should be conducted in early summer months.
3. **Local awareness and Mass-media**: Education and Awareness program and other outreach activities about the need and importance of protecting and conserving river biodiversity including dolphins should be organized for local stakeholders including fishers, farmers, local people of villages adjacent to river, students of local schools and colleges and others, and for that suitable education and awareness tools should be used. We recommend use of posters, street-plays, documentaries and field tours for people to make the most out of these awareness campaigns.

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Survey of River Kosi in Supaul District

2019

Status of Ganges River dolphins in Kosi River, Supaul District, Bihar

Survey conducted by: T. M. Bhagalpur University, Bhagalpur

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Mr. Hamsul: Dolphin Watcher

Dolphin survey team

Ruddy shelduck (Brahminy)

Pallas Gull and a Great Cormorant

Flock of Great Cormorant

Eurasian Curlew

Lesser Adjutant Stork

Pangshura smithii turtles

Greylag geese

Bar headed geese

Woolly necked stork

Common Merganser

Red crested pochard

Bamboo pole ferry crossing

Bamboo pole ferry crossing

Motorized ferry crossing

Fishers with fishing boat

Fisher fishing by wading

Research team with Birpur range officials