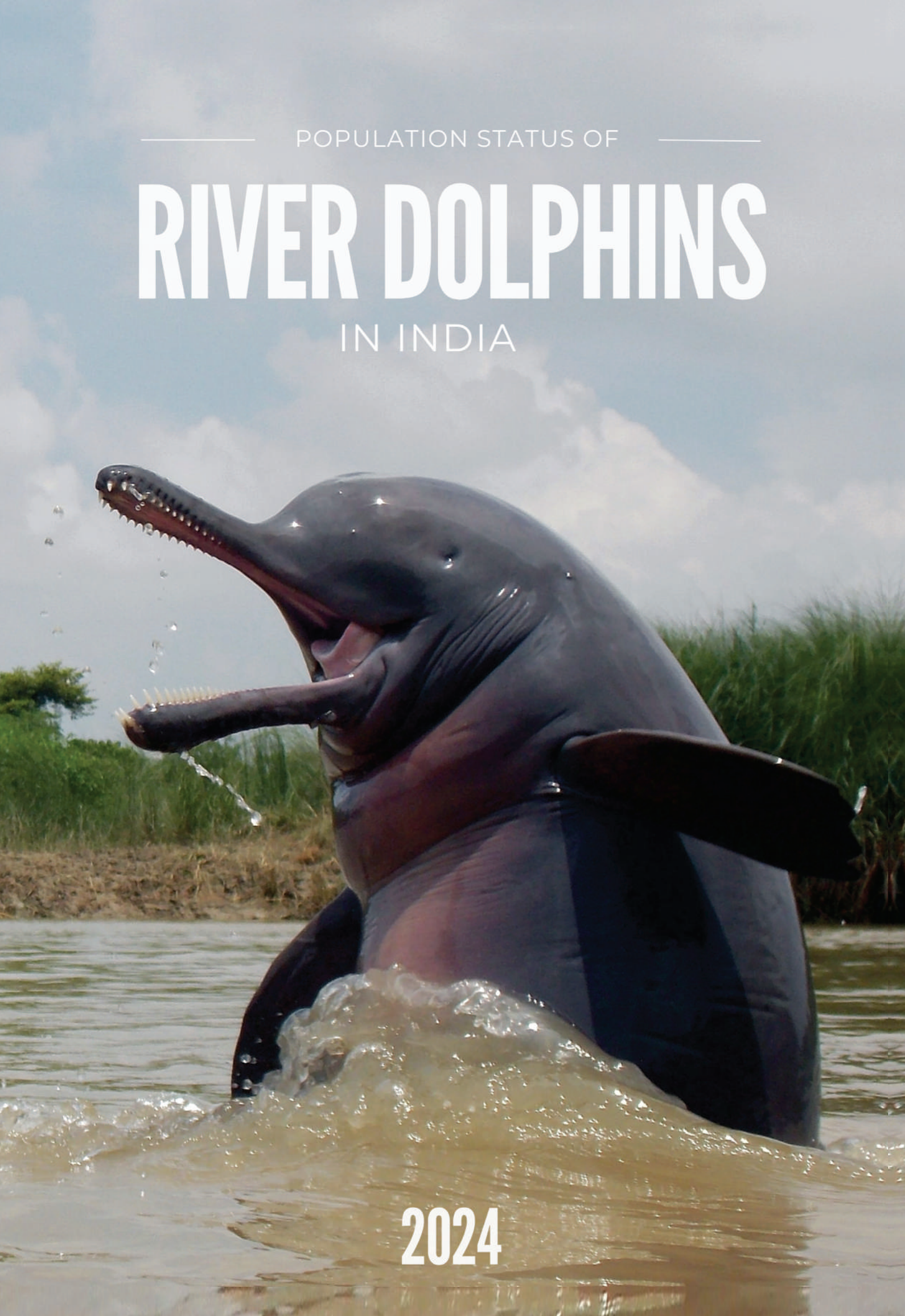
POPULATION STATUS OF

RIVER DOLPHINS

IN INDIA



2024


Project
Dolphin

POPULATION STATUS OF
RIVER DOLPHINS
IN INDIA

2024



CITATION

Qamar Qureshi. Vishnupriya Kolipakam. Abdul Wakid. Soumitra Dasgupta. Satya Prakash Yadav. Virendra R. Tiwari & Bivash Ranjan. Population Status of River Dolphins in India. 2021 - 23 (2024). Ministry of Environment. Forest and Climate Change. New Delhi and Wildlife Institute of India. Dehradun.

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प्रधान मंत्री
Prime Minister

MESSAGE

It is heartening to learn about the publication of the report titled 'Population Status of River Dolphins in India - 2024'.

Living in harmony with nature has always been an integral part of our culture. Carrying forward such a legacy is a commitment and a responsibility that we carry with a sense of commitment and pride.

Rivers and marine ecosystems have not only served as a lifeline for the people and communities, but also nurtured many aquatic species. Our rivers are home to a wide array of aquatic species including dolphins.

Our Government announced Project Dolphin to protect and increase the population of these wonderful creatures. As a government committed to scientific rigour and evidence-based decision making, an important step in this direction was the enumeration of river dolphins in India.

Guided by a spirit of inquiry, the findings of this scientific assessment to ascertain the numerical status of river dolphins and other aquatic species has yielded encouraging results.

We take immense pride in the fact that India is home to 90% of the world's Ganges river dolphins. Further, it is a tribute to the conservation efforts of local communities that three-fourths of the dolphin population lies outside protected areas.

This document is the fruit of painstaking efforts by researchers, fisherfolk, fisheries department, forest department personnel and local communities who surveyed rivers across many different states.

It is now important to use this momentum to involve all stakeholders and accelerate efforts to help increase the populations of our various aquatic species. These efforts will not only help aquatic species, but also support the socio-economic welfare of the marginalised communities that live near rivers.

Hearty congratulations to the Ministry of Environment, Forest and Climate Change, State Forest Departments, the Wildlife Institute of India and other organizations for bringing out this report.

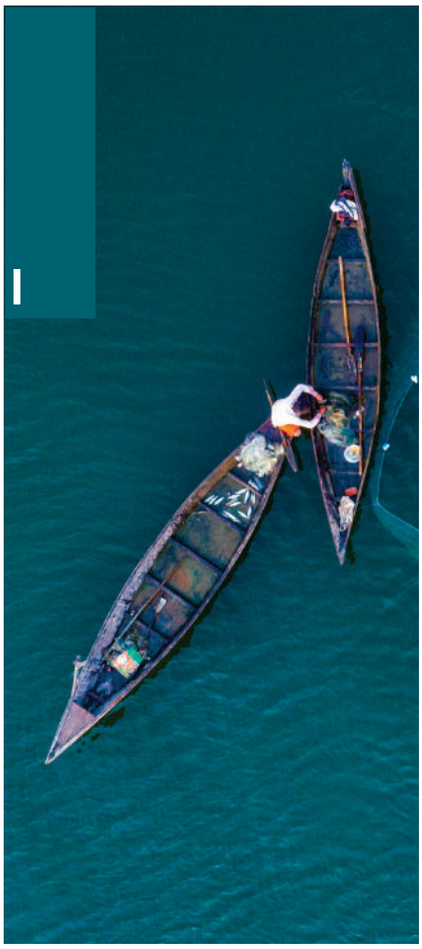
Best wishes for the ongoing efforts in Project Dolphin as well as other future endeavours in this direction.

(Narendra Modi)

New Delhi

श्रावण 29, शक संवत् 1946

20 August, 2024



Executive Summary I



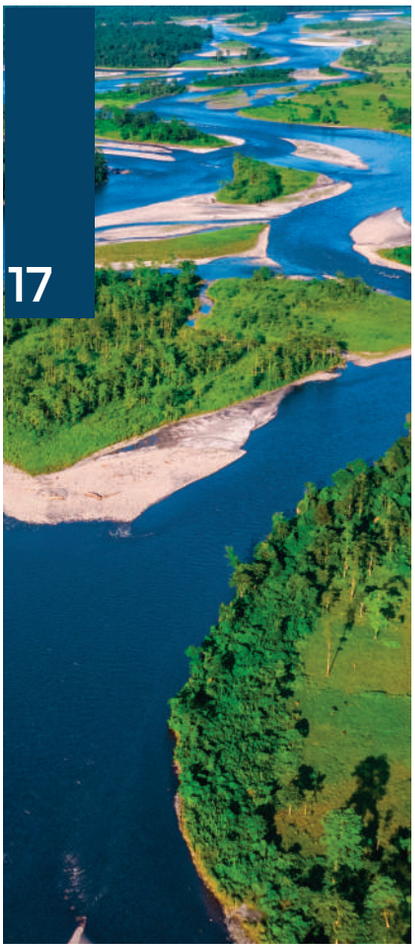
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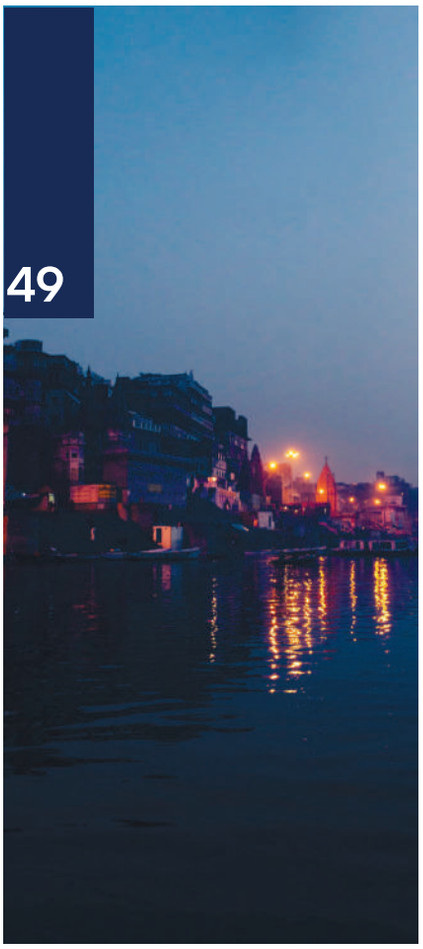
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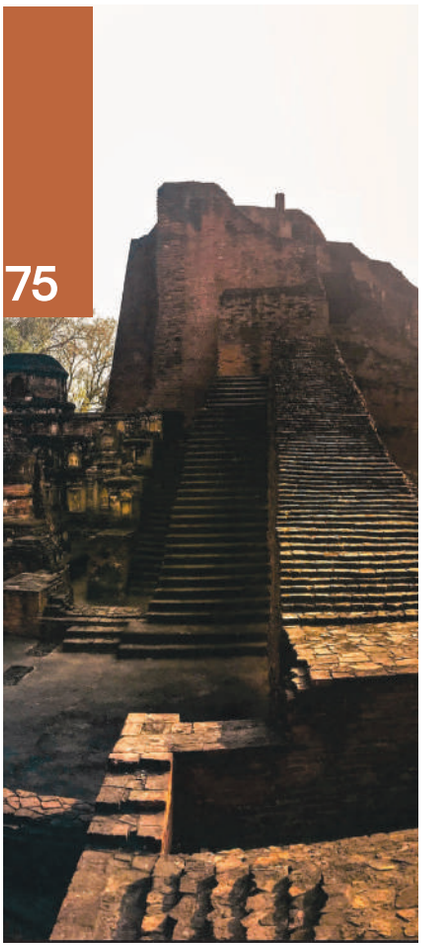


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EFFORT

Number of Rivers Surveyed

28

Secondary Survey For Seasonal Dolphin Presence

30



Man Days

3150

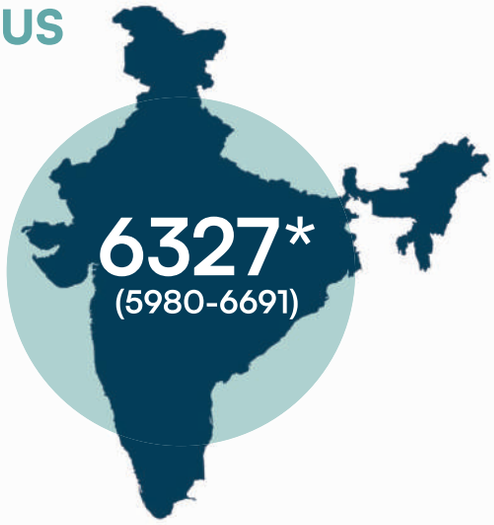
Man Hours

18900

Survey

8507 Kms

POPULATION STATUS





Uttar Pradesh
2397

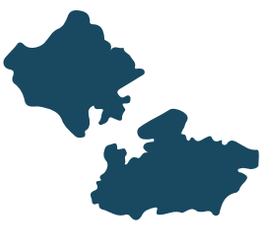


Bihar
2220



Jharkhand
162





Rajasthan &
Madhya Pradesh
95



West Bengal
815



Assam
635



Punjab
3*

**Number includes Indus River Dolphins.*

EXECUTIVE SUMMARY



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EXECUTIVE SUMMARY

The ethos of Indian philosophy “Sarvam Khalvidam Brahma”, emphasizes the interconnectedness of all things in the universe and the need for all-encompassing conservation efforts that prioritize the well-being of all living beings, not just humans. On 15th August 2020 Hon’ble Prime Minister Shri Narendra Modi, announced “Project Dolphin”, for the conservation of Dolphins and other aquatic ecosystems. Project Dolphin aims to bring both river and marine dolphins under its conservation program, which involves a science-based, multi-pronged approach that engages stakeholders such as the forest department, fisheries department, fishermen communities, and other stakeholders to address existing conservation issues. Monitoring dolphin populations and trends is crucial for effective conservation, particularly for species like river dolphins which have a slow growth rate, and inhabit the world’s most threatened habitats. Under Project Dolphin, a range-wide survey of river dolphins covering over 8000 Km, covering eight states across the Ganga and Brahmaputra rivers along with their tributaries, and the Beas river was undertaken from 2021-23. During the survey, a total of 58 rivers were covered , of which, 28 rivers were actively surveyed by boat, and 30 rivers were assessed through road surveys where the seasonal presence of the Ganges River Dolphin had historically been reported.

Method

The estimation of river dolphins has always been a challenging task, given the habitat and short surfacing time of the species. The population status has largely been understood through encounter rates, and in some stretches through line transect. However, the surveyed methods have their limitations for largescale survey and monitoring. Dolphins surface only for 1.26 (±0.23) seconds and dive for 107 (± 46.8) seconds. This creates two issues, (a) not all observers are able to spot surfacing dolphins, termed as “Observer error”, and (b) not all dolphins surface at the time of count i.e. dolphins are not available for counting, termed as “Availability error”. To account for observer error, two independent observer teams are used, and to account for the availability error a hydrophone was dragged under water along with the survey boat which records dolphin presence underwater by recording dolphin clicks, which is used to calibrate the visual observation for unavailability. The data was collected for dolphin abundance, river habitat type, extent of anthropogenic pressure and presence of other associated aquatic fauna. Data on observations of dolphins was analyzed using Lincoln-Peterson’s Chapman’s corrected formula and Huggins method. The enumeration is carried out through collaboration with State Forest Departments and NGO partners. Twenty-two Training workshops were held in eight states, with a total of 455 forest department personnel trained for holistic monitoring of data collection and to prepare a cadre for future dolphin monitoring.

Results

The data generated from the survey is used to obtain fine scale information regarding dolphin presence and status of associated fauna.

FIGURE E.1

Pan India Map of study area with Ganga River and its tributaries; Brahmaputra River and its tributaries; Sundarbans and Beas River

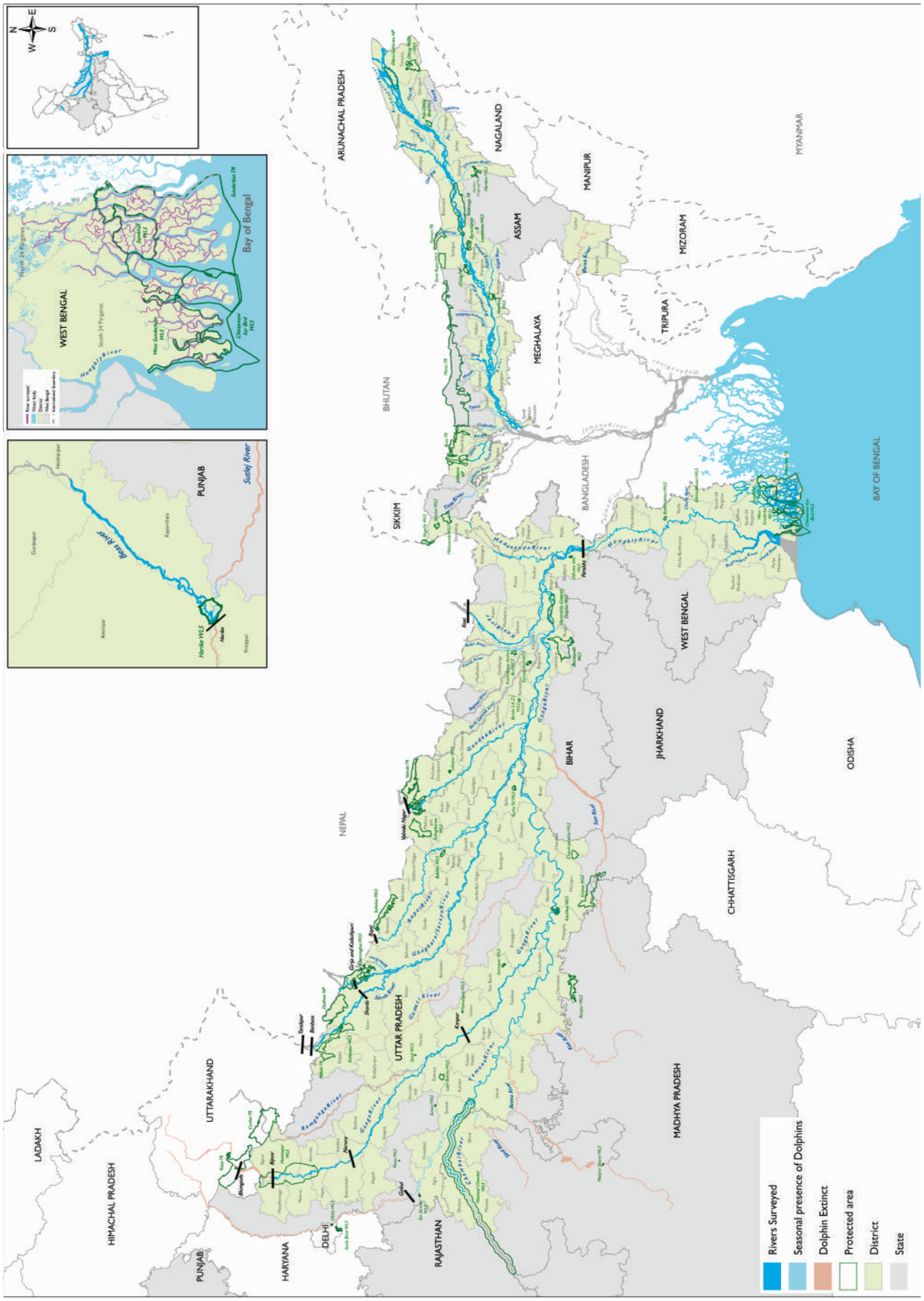


TABLE E.1

River-wise observer and availability corrected population estimation (N_{OA}) and Encounter rate (ER_{OA}) (per Km) of Ganges River Dolphin population In Ganga, Brahmaputra and Its tributaries along with Sundarbans, and Indus River Dolphin population in the Beas River

**Marked km and values are those shared between two states and the dolphin population is equally distributed (half per state) between the states.*

River	State	Stretch	Distance surveyed (in Km)	N_{OA}	E_{OA}
Ganga	Uttar Pradesh	Bijnor Barrage - Narora Barrage	183	114 (103-125)	0.62
		Narora Barrage - Kanpur Barrage	366	50 (44-56)	0.14
		Kanpur Barrage - Vindhyachal	380	718 (681-755)	1.89
		Vindhyachal - Chausa	260	334 (320-348)	1.29
		Chausa - Revalganj	119*	81 (78-85)	0.68
	Bihar	Chausa - Manihari	590*	1297 (1244-1351)	2.20
	Jharkhand	Manihari - Rajmahal	59	162 (152-172)	2.75
	West Bengal	Rajmahal - Farakka Barrage	41	48 (43-53)	1.17
		Farakka Barrage - Diamond Harbour	483	429 (408-450)	0.89
		Diamond Harbour - Ganga Sagar	39	30 (24-36)	0.78
		Farakka Barrage - Nimtita (Indo-Bangladesh border)	21	12 (11-14)	0.62

Chambal	Rajasthan - Madhya Pradesh	Nagar - Pinahat	96	17 (13-22)	0.18
	Madhya Pradesh	Pinahat - Bhind	99	78 (74-83)	0.79
	Uttar Pradesh	Pinahat - Pachnada	146*	203 (192-215)	1.39
Sharda	Uttar Pradesh	Mayapurighat (Lagga bagga) - Sharda - Ghaghara Confluence (Srirampurva)	246	58 (50-66)	0.24
Yamuna		Yamuna Setu (Etawah) - Sangam (Prayagraj)	536	104 (96-112)	0.20
Rapti		Rapti Barrage - Rapti - Ghaghara Confluence	532	152 (143-161)	0.29
Geruwa		Amba - Kailashpuri Dam	17	14 (11-17)	0.83
Kauriala		Kauriala Ghat - Kauriala - Geruwa Confluence	13	7 (5-11)	0.54
Ghaghara		Kailashpuri Dam - Barchuncha	620*	497 (472-521)	0.80
Gandak		Bankasia - Jwalapur	35	65 (56-76)	1.86



Mahananda	Bihar	Kishanganj Bridge - Bhaluka	154*	155 (143-169)	1.00
Kosi		Kosi Barrage (near Indo-Nepal border) - Kosi -Ganga Confluence (Kursela)	242	331 (317-347)	1.37
Ghaghara		Barchuncha - Revalganj	102*	60 (55-66)	0.59
Gandak		Valmikinagar Barrage - Gandak - Ganga Confluence (Patna)	280	377 (359-396)	1.35
Mahananda	West Bengal	Bhaluka - Rajmahal	51*	64 (58-73)	1.25
Rupnarayan		Bandar - Gadiara	79	167 (160-175)	2.11
Mundeswari		Gorurghat - Bakshi	7	12 (11-13)	1.77
Bakshi canal		Shaifon - Bakshi	6	21 (20-22)	3.61
Shilabati		Ghatal - Bandar	6	17 (16-18)	2.94
Dwarakeswar		Singhapur - Bandar	4	0	0
Torsa		Purba Kathalbari - Jhaljhali	55	1	0.02
Kaljani		Bhuchunjmari - Deucharia	21	5	0.28
Churni		Ranaghat - Mangaldeep	10	7	0.71
Haldi		Teropakhyaghat - Haldia	19	0	0
Sundarbans		Sundarban Tiger Reserve and Sundarban Biosphere Reserve	1524	2	0.001
Ganga			**7109**	**5689 (5371-6024)**	**0.80**

River	State	Stretch	Distance surveyed (in Km)	N_{OA}	E_{OA}
Brahmaputra	Assam	Dr. Bhupen Hazarika Setu - Hatsingimari (Near Indo - Bangladesh border)	885	584 (558-610)	0.66
Subansiri		Chauldhuwaghat - Jamagurighat	91	22 (20-24)	0.25
Kulsi		Kukurmara - Nagarbera	61	20 (19-21)	0.33
Beki		Beki River Bridge (Sar-bhog) - Sonabari (Beki - Brahmaputra Confluence)	45	4	0.10
Kopili		Chapormukh (Kolong - Kopili Confluence) - Kajoli Chowki	91	5	0.06
Barak		Sonabari (Assam - Manipur border) - Rajartila (Indo-Bangla-desh Border	124	0	0
Brahmaputra			**1297**	**635 (606-664)**	**0.49**
Ganges River Dolphin (Ganga & Brahmaputra)			**8406**	**6324 (5977-6688)**	**0.75**
River	**State**	**Stretch**	**Distance surveyed (in Km)**	**N_{OA}**	**E_{OA}**
Beas	Punjab	Sri Hargobindpur - Harike	101	3	0.03
Indus River Dolphin			**101**	**3**	**0.03**

In Ganga, a total of 7109 Km was actively surveyed, which includes the mainstream Ganga and its tributaries: Chambal, Yamuna, Rapti, Sharda, Ghaghara, Mahananda, Kosi, Gandak, Geruwa, Rupnarayan (its tributaries-Mundeswari, Shilabati, Bakshi, Dwarakeswar), Torsa, Kaljani, Churni and, Haldi, covering the states of Uttar Pradesh, Bihar, Jharkhand, West Bengal, Madhya Pradesh and, Rajasthan. In Brahmaputra, 1297 Km of the river was surveyed including the tributaries Subansiri, Kulsi, Beki, Kopili and, Barak river in Assam and 101 Km in Beas River was surveyed for the Indus River Dolphin (Table E.1). The dolphin estimate for Ganga is 5689 (5371-6024), while 635 (606-664) dolphins were estimated in Brahmaputra, totaling to a population estimate of 6324 (5977-6688) in the surveyed rivers. While the Indus River Dolphin population was always small, six individuals were reported in 2018 (WWF-India). While 3 individuals were sighted during survey, a recent mortality of one adult female has brought the status of the current population to two individuals.



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TABLE E.2

Ganges and Indus River Dolphin population estimates and sampling effort invested in different states for Ganga, Brahmaputra, some of their tributaries and Beas River.

River Stretch	Effort (Km)	N_{OA}	ER_{OA}
Uttar Pradesh	3453	2397* (2251-2548)	0.69
Bihar	1368	2220* (2118-2329)	1.62
Jharkhand	59	162 (152-172)	2.75
Madhya Pradesh & Rajasthan	195	95* (87-105)	0.49
West Bengal	2366	815* (763-870)	0.34
Assam	1297	635 (606-664)	0.49
Ganges River Dolphins	**8406***	**6324 (5977-6688)**	**0.75**

**Marked km and values are those shared between two states and the dolphin population is equally distributed (half per state) between the states, however encounter rate is calculated as per the total dolphins sighted in the stretch.*

River Stretch	Effort (Km)	N_{OA}	ER_{OA}
Punjab	101	3	0.03
Indus River Dolphins	**101**	**3**	0.03

STATE WISE DOLPHIN DISTRIBUTION AND ABUNDANCE

Uttar Pradesh

A total of 3453 Km was surveyed in Uttar Pradesh covering mainstream Ganga and its tributaries (Chambal, Yamuna, Rapti, Sharda, Geruwa-Kauriala, Ghaghara and part of Gandak River). The total population of Ganges River Dolphins was estimated to be 2397 (2251-2548), with an encounter rate of 0.69/Km (Table E.1 & Table E.2). The highest encounter of dolphins in this stretch was found in the 47 kilometer stretch of Bhind-Pachhnada (2.68/Km) in the Chambal River followed by Kanpur-Vindhyanchal (1.89/Km) within 380 Km. National Chambal Sanctuary, Hastinapur Wildlife Sanctuary and Katerniaghat Wildlife Sanctuary are important conservation sites (Figure E.2).

While the dolphin population between Bijnor to Narora Barrage is small and seems stable, the population between Narora to Kanpur (366 km) is almost non-existent, with an encounter rate of 0.1/Km. In Rapti, the average depth of water is 2.55±1.6 m. The low water depth may be the cause for the very sparse dolphin distribution in this river. The stretches of river where the distribution of dolphins is very sparse or even absent are termed as 'Coldspots'. In the Ganga River, such an area was present in the Farukkhabad-Kannauj which lies between the Narora Barrage and Kanpur Barrage. Similar 'coldspots' were found in the Yamuna River, from Kaushambi-Chitrakoot, in the Sharda River, in Pilibhit, and in Rapti River, from Balrampur-Siddharth Nagar (Figure E.2).

Bihar

The total population of Ganges River Dolphins estimated in Bihar is 2220 (2118-2329), with an encounter rate of 1.62/Km. The average water depth found across the stretch, 5.96±2.9 m, is relatively higher due to several tributaries like Ghaghara, Gandak, Kosi and Son, joining Ganga in Bihar, coupled with ideal river morphology, facilitating the possibility of a higher density of dolphins. The stretch from Chausa - Manihari covering the mainstream Ganga has 1297 (1244-1351) dolphins in 590 Km (Table E.1), resulting in an encounter rate of 2.20/Km, and is amongst the country's most densely populated stretches.

There is a sizable population of Ganges River Dolphins in Bihar's tributaries, numbering 923 (874-978), with an encounter rate of 1.19/Km. In Vikramshila Gangetic Dolphin Sanctuary an encounter rate of 3.10/Km was observed. Bihar has a fairly even distribution of dolphins, with good number of dolphins found largely around the confluences of the tributaries. In mainstream Ganga, the important critical areas are Revalganj-Patna, Begusarai, Katihar-Sahibganj and Vikramshila Gangetic Dolphin Sanctuary (Figure E.2). There are no 'coldspots' in Bihar. The Ganga River flowing through Bihar also supports a relatively healthy status of associated species, with records of the Vulnerable Smooth-Coated Otter and 81 species of birds including the Endangered Greater Adjutant and Black-bellied Tern.

Jharkhand

The 59 Km stretch of Jharkhand from Manihari to Rajmahal has a dolphin encounter rate of 2.75/Km and a population of 162 (152-172). This encounter rate of dolphins is one of the highest dolphin encounter rates in the mainstream Ganga in the country. Other than the Ganges River Dolphin, this stretch also holds a good population of birds with the presence of Vulnerable species like the Lesser Adjutant.

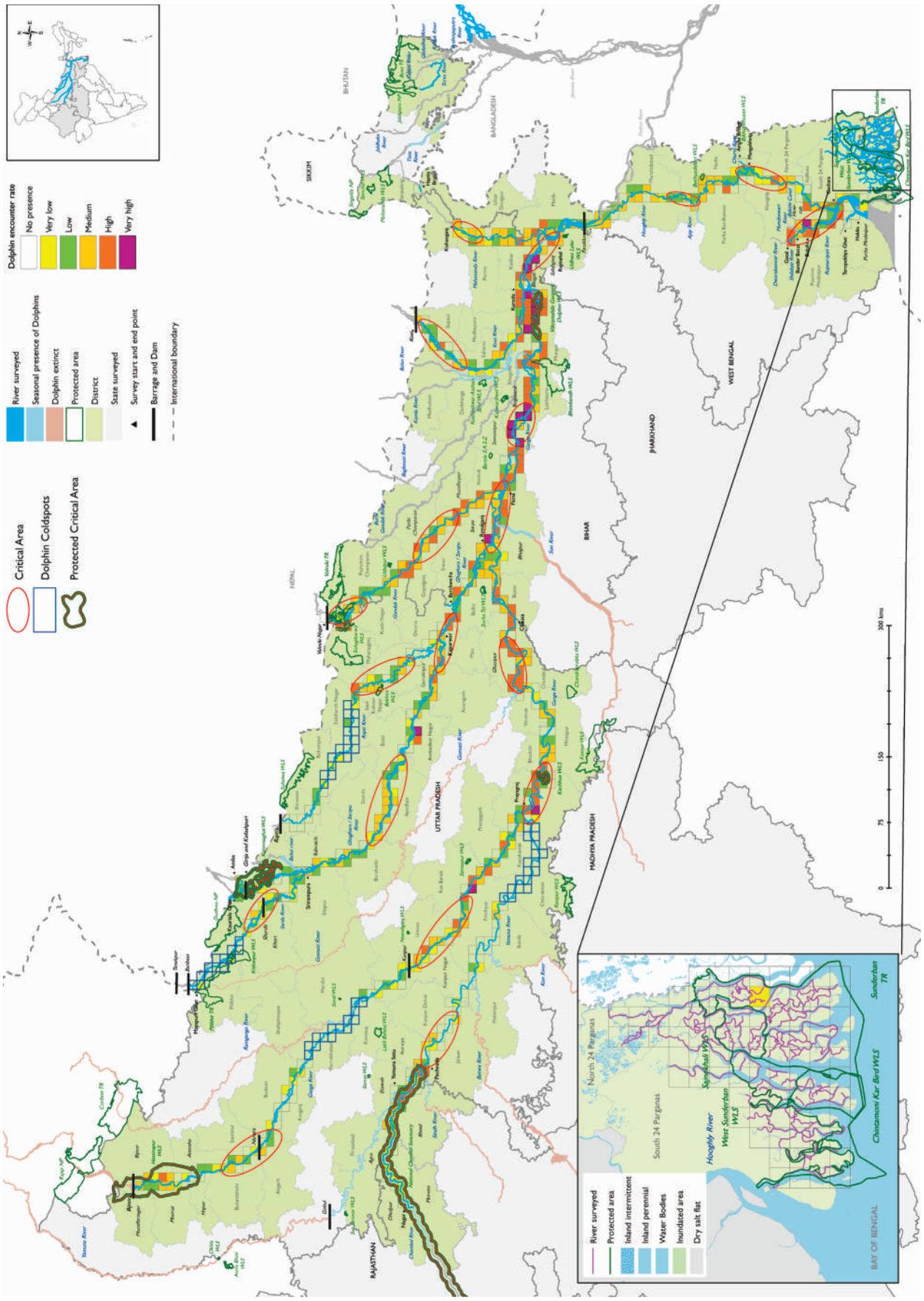
Rajasthan and Madhya Pradesh

The River Chambal marks the boundary between the three states of Madhya Pradesh, Rajasthan and Uttar Pradesh. A total of 195 Km of the Chambal River, including the National Chambal Sanctuary was surveyed from Nagar to Bhind, and a total of 95 (87-105) dolphins were estimated in this stretch, with an encounter rate of 0.49/Km.
The maximum number of Indian skimmers and Gharials, were also seen in this stretch. Chambal

FIGURE E.2

Distribution of Ganges River Dolphin, its encounter rate and critical conservation areas in Ganga mainstream and its tributaries (Uttar Pradesh, Bihar, Jharkhand, Madhya Pradesh, Rajasthan and West Bengal).

**Marked Km are those shared between two states and the dolphin population is equally distributed (half per state) between the states.*



seems to be one of the few places which harbor a viable population of Gharials and a significant breeding population of Indian Skimmers. A total of 53 Indian Skimmers, 91 Muggers and 212 Gharials were encountered during the survey. However, this is likely to be an underestimate as the survey was not designed for these species. Other than these, the Critically Endangered Three-Striped Roofed Turtle (n=4) and a Red-crowned Roofed Turtle, and the Endangered Ganges Soft-shelled Turtle (n=5) were also recorded during the survey.

West Bengal

Across the survey of 2366 Km in Ganga, its tributaries, the Sundarbans in West Bengal, the population of Ganges River Dolphins was estimated to be 815 (763-870), with an overall encounter rate of 0.34/Km. Dolphin encounter rate in Rajmahal-Ganga Sagar stretch was 0.72/Km and in Rupnarayan it was 2.11/Km. The most densely populated river stretch with dolphins was found to be in Bakshi Canal (6 Km) with the encounter rate of 3.61/Km, which is part of the Rupnarayan River System. The Bhagirathi River till Nabadwip is non-tidal and the stretch beyond it is tidal (Hooghly), which influences dolphin movement according to the tide. Ganges River Dolphin abundance is higher in lower reaches where the Rupnarayan meets the Hooghly and other important dolphin sites (Figure E.2).

Assam

The Brahmaputra River, and its tributaries Subansiri, Kulsi, Beki, Kopili and Barak, with a length of 1326 Km were surveyed during the exercise. The estimated population of dolphins in this entire basin was 635 (606-664). Considering that the habitat status in this river is comparatively good, the encounter rate is low, with 0.49/Km. Barak River is identified as the coldspot in the entire state of Assam. The dolphin populations in Subansiri and Kulsi are declining (when compared with previous population estimates from Qureshi *et al.,* 2018; Qureshi *et al.,* 2020). Kaziranga and Orang Tiger Reserves and confluences of tributaries with Brahmaputra are important dolphin areas (Figure E.3).

The average depth of the mainstream Brahmaputra was 5.2 m. However, the overall water depth of the surveyed tributaries was low. The average depth of the tributaries, Subansiri, Kulsi, Kopili and Beki was 3.8 m, 1.7 m, 2.7 m and 1.7 m respectively. Ganges River Dolphins were recorded for the first time in the Kopili River during winters.

The depth, width and nature of the Brahmaputra River creates a diversity of morphological features in the river, which helps support a large variety of aquatic fauna. The River Brahmaputra sustains a significant proportion of wetlands that are crucial for migratory water fowls, as well as resident aquatic birds.

Punjab

The Beas River in Punjab holds the only remnant population of Indus River Dolphins in India. While the Indus River Dolphins in India were thought to have been extirpated in 1960s, a remnant population was discovered in Beas in 2007. According to the previous survey by Punjab Forest Department and WWF-India, six dolphins were reported in 2018. However, the survey in 2022 recorded only three Indus River Dolphins, two adults and one neonate. Unfortunately, Punjab Forest Department reported the death of one adult female dolphin (pregnant with a calf) in March, 2024. Thus, the current population is likely to be only two individuals. The Beas conservation Reserve is an important area (Figure E.4)

Beas River has average depth of 2.2 m and width of 238 m. A total of 86 species of conservation concern were recorded during the survey, of which 78 species were of birds, two species of mammals and six species of herpetofauna.

FIGURE E.3

Distribution of Ganges River Dolphin, its encounter rate and critical conservation areas in Brahmaputra mainstream, and its tributaries, Subansiri, Kulsi, Beki, Kopili and Barak River, Assam.

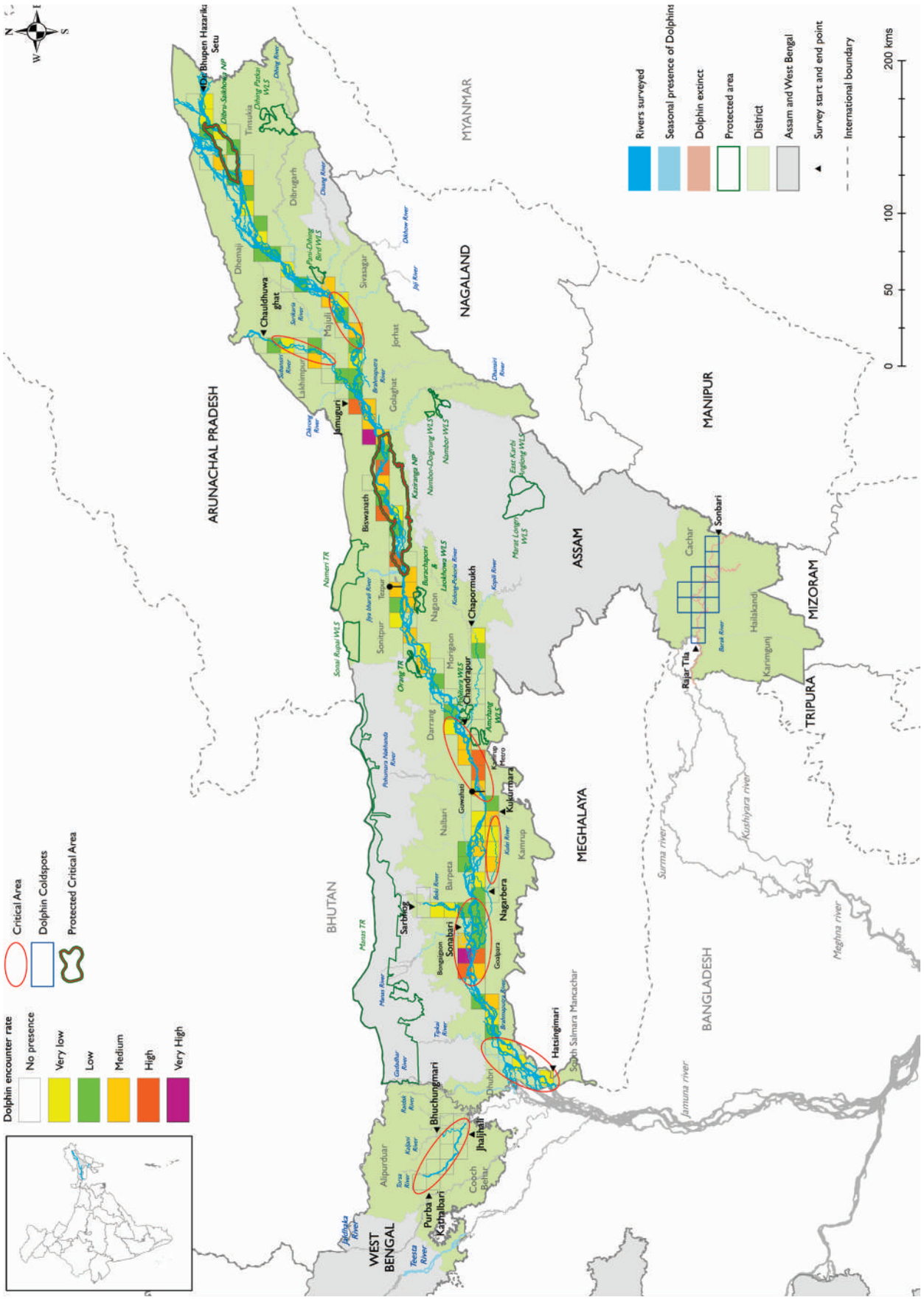
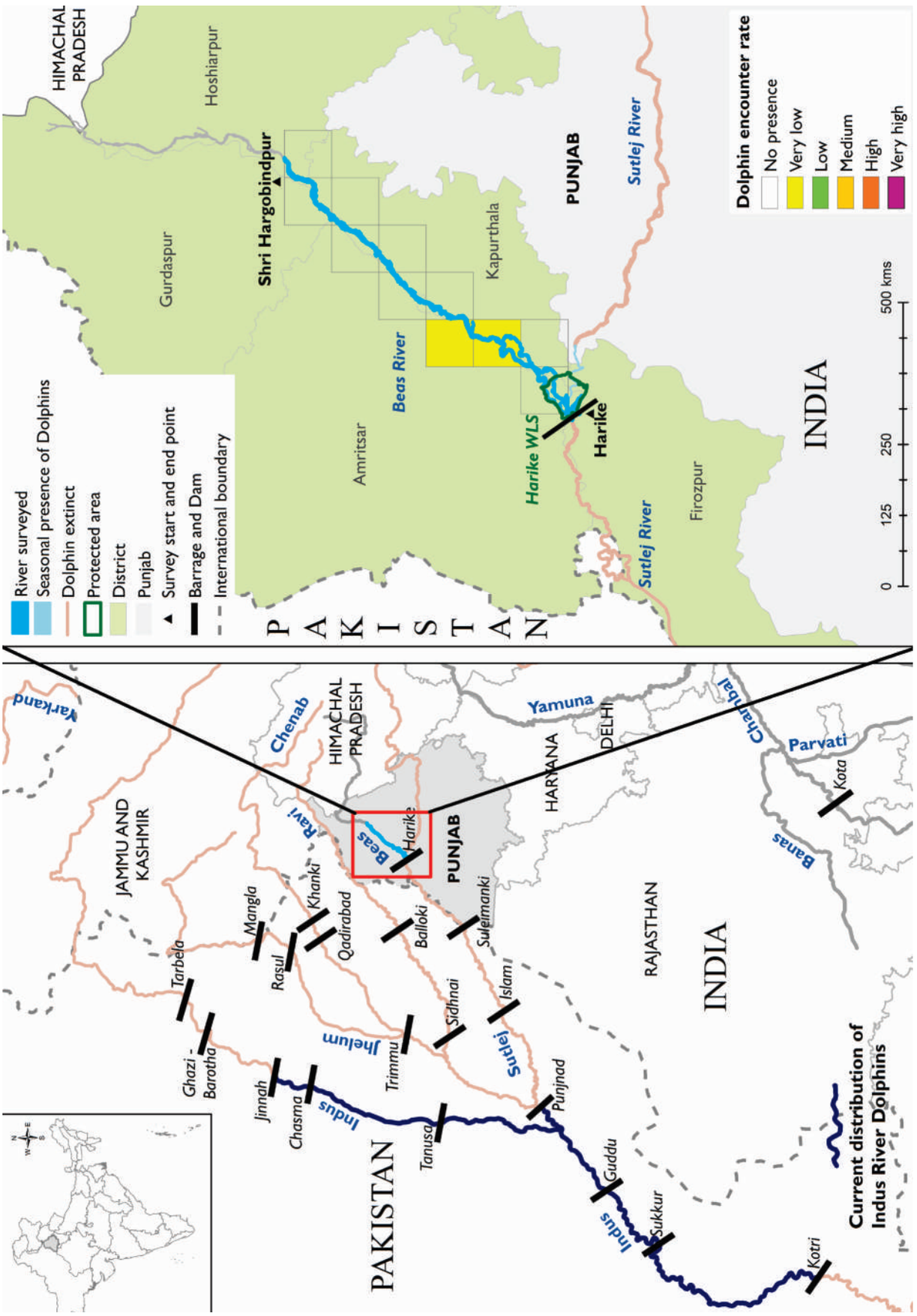


FIGURE E.4

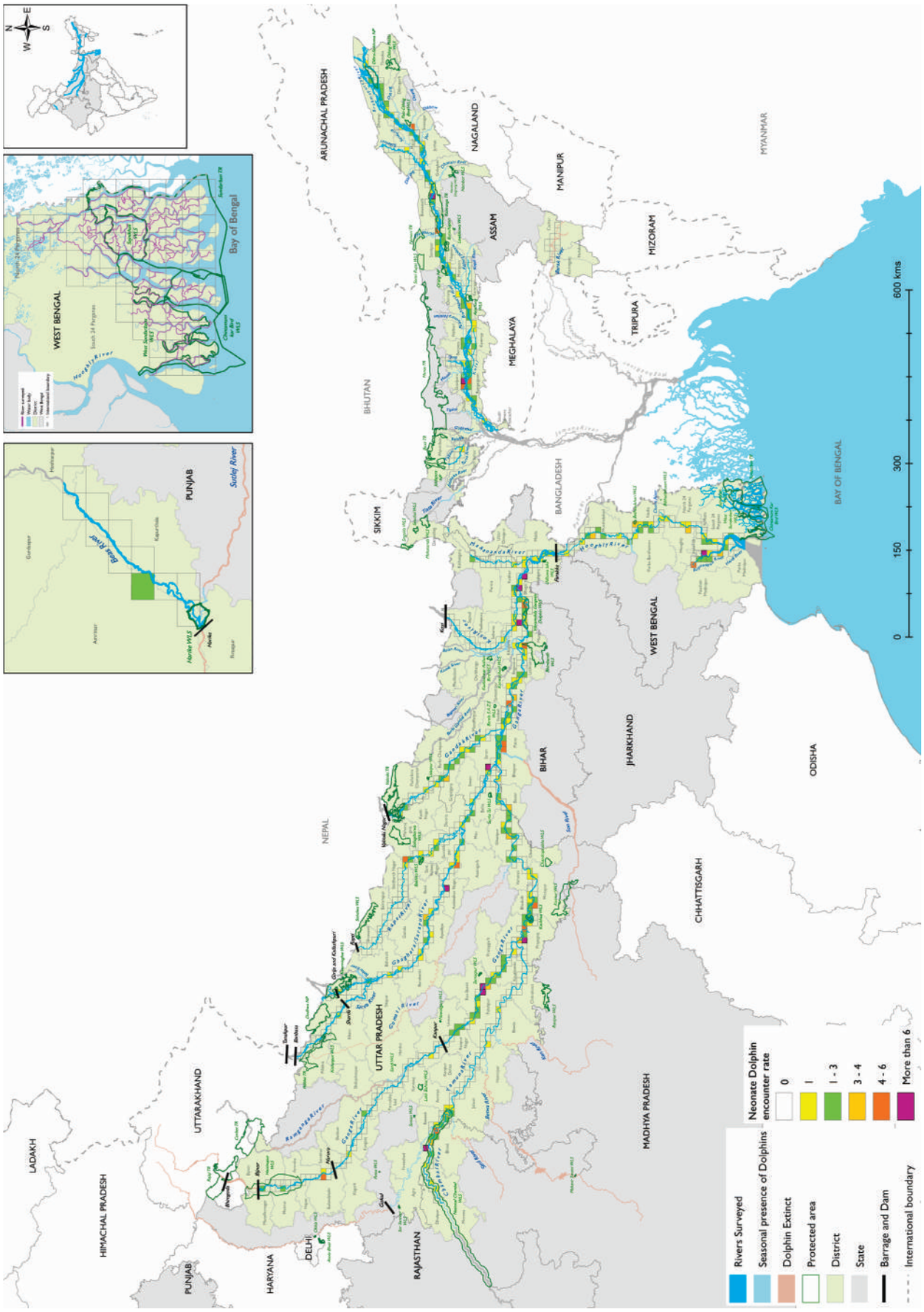
Distribution of Indus River Dolphin, and its encounter rate in Beas River, Punjab.




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FIGURE E.5

Pan India distribution of Ganges and Indus River Dolphin neonates.



Conclusion

Under Project Dolphin, the first-ever comprehensive survey has successfully estimated the population of river dolphins across eight states. This marks one of the world's largest freshwater surveys, covering the entire range of the Ganges river dolphin in the Ganga and Brahmaputra, as well as the Indus river dolphin in the Beas river systems. The population estimate reveals 6,324 (range: 5,977-6,688) Ganges river dolphins and 3 Indus river dolphins. The results suggest that dolphins thrive in areas with sufficient water depth and minimal anthropogenic disturbances.



II. INTRODUCTION



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II. INTRODUCTION

Dolphin acts as an umbrella species, whose conservation results in the well-being of associated habitat and biodiversity. This effort is truly in line with our conservation philosophy of *'Vasudhaiva Kutumbikam'*. On 15th August 2020 Hon'ble Prime Minister, Shri Narendra Modi, announced 'Project Dolphin' for the conservation of Dolphins and other aquatic ecosystems, with a participatory approach of the community.

River dolphins are regarded as sentinels for monitoring the conservation status of rivers. The Project Dolphin envisages bringing river and marine dolphins under its conservation program. This project aims to address existing conservation concerns and to empower the stakeholders to participate in the conservation of dolphins. This includes a multi-pronged approach involving the forest department, fisheries department, fishermen communities, and other stakeholders, through science-based conservation. The river and marine ecosystem is the lifeline for the most marginal people in the country, apart from several threatened and endangered fauna.

A robust scientific monitoring of any population is the single most crucial aspect that is needed for any effective conservation action, and to ensure the long-term survival of a species. As part of Project Dolphin, one of the first activities to ensure appropriate conservation actions was to scientifically estimate the abundance of river dolphins in India. There are two species of river dolphin in India, the Gangetic River Dolphin and the Indus River Dolphin. Both the species are 'Endangered' and listed under Schedule-I of the Wild Life (Protection) Act, 1972, ensuring the highest protection possible in India. While Ganges River Dolphins are found in the Ganga-Brahmaputra River systems in India, their current status is still a guestimate, as there has not been a range-wide synchronous scientific estimation survey carried out to date.

This has been not only due to the species' biology but also partly due to the lack of appropriate techniques to estimate the population of this species, logistic feasibility, lack of technology, and other issues. To address this issue under Project Dolphin, a scientifically robust population estimation method was developed and the first ever rangewide estimation of river dolphins was conducted across 8 states covering Ganga, Brahmaputra, Barak, and Beas rivers and their tributaries historically known to have dolphin populations.

2.1 River Dolphins

2.1.1 Status

Dolphins have been an integral part of our cultural milieu, and according to Indian mythology, the dolphin was mentioned to have descended with Goddess Ganga. During Mauryan emperor Ashoka's time, the protection of dolphins is mentioned in the rock edicts. The Ganges River Dolphin ranges into most of the large tributaries in the Ganga Basin: Chambal, Ramganga, Yamuna, Gomati, Ghaghara, Rapti, Son, Gandak and Kosi, besides the main channel of the Ganga. Anderson confirmed the presence of the species from the Gangetic delta and the Sundarbans, his records also confirm the absence of the species from the northern rocky reaches of Ganga and Yamuna and the complete absence of river dolphins from southern peninsular rivers (Anderson, 1878). In the Brahmaputra valley, the Ganges River Dolphins ranges into the major tributaries such as the Teesta, Gadadhar, Champamat, Manas, Bhareli, Subansiri, Dihang, Dibang, Lohit, Disang, Dikhow and Kulsi Rivers. Dolphins in the main channel of the Ganga were split into four sub-populations, Bijnor Barrage-Narora Barrage, Narora Barrage-Kanpur Barrage, Kanpur Barrage-Farakka Barrage, and Farakka Barrage-Ganga Sagar.



The Indus River Dolphin was found in approximately 3400 Km of the Indus River and its tributaries, from the foothills of the Himalayas to the limits of the tidal zone in Pakistan. However, its distribution has been divided into small fragmented sub-populations, and one such population was reported from Punjab, India in 2007 between Beas City and Harike Barrage. This population is believed to be the only surviving Indus River Dolphin population in India (Behera, 1995). Recent estimates reveal that the Indus River Dolphin now occupies only one-fifth of its former range (Reeves *et al.,* 1991).

River dolphins in general represent a unique evolutionary phenomenon of convergent evolution. River dolphins have evolved from marine Platanistidae ancestors that inhabited the sea, and when the sea penetrated low-lying areas of South Asia during the Miocene, they entered the continent. As sea levels receded, dolphins continued to persist in the river system (Hamilton *et al.,* 2001). Over time, as the connection between the Ganga-Brahmaputra River systems and the Indus River system got disrupted, the populations started diverging from each other, and have evolved into two species, the Ganges and Indus River Dolphins (Braulik *et al.,* 2021). River dolphins are characterized by a long rostrum, almost non-existent dorsal fin, and exhibit side-swimming behaviour (Herald *et al.,* 1969; Sinha *et al.,* 1993). Sexual dimorphism in terms of size is found in the Ganges River Dolphin, where males (2m) are smaller than females (2.5m) (Kasuya & Haque, 1972). In the Indus River Dolphin, both sexes are of the same size (Braulik *et al.,* 2021). They have rudimentary eyes, as an adaptation for turbid waters, and rely largely on acoustic communication for not only movement but also foraging and other life history traits. Prelimiary results also suggest that dolphins behaviourally respond to high ship traffic, where they are known to exhibit changes in amplitude and frequency (Dey *et al.,* 2019; Qureshi *et al.,* 2019).

Hardly anything is known regarding their habitat preference in detail, or their breeding habitat, movement ranges, and prey preference. From recent studies, it is understood that they prefer confluences, meanders, and mid-channel Island (Mary *et al.,* 2013; Qureshi *et al.,* 2019). Apart from river morphology, flow is also deterministic of dolphin presence, as it influences the microhabitat and prey present in the area (Qureshi *et al.,* 2019). Anderson (1878), reported that Platanista species are slow-growing and usually give birth to one individual at a time, rarely to two individuals. Ganges River Dolphins surface for a

very limited time, with an average of 1.26 (SD ± 0.23) seconds above water, and an average of 107.3 (SD ± 46.8) seconds underwater, making it very difficult to observe (Wakid & Braulik, 2009). Given the very low surfacing time, traditional monitoring and abundance estimation methods are difficult to implement. Having a pulse on the abundance and population trends is essential for effective conservation actions for the long-term survival of any species. Especially for dolphins, which inhabit the most threatened habitat in the world, and have a slow growth rate, stemming any population decline in its early stages will be crucial for its survival. The numbers of Ganges River Dolphins were reported to lie somewhere between 4000 and 5000 towards the end of the 20th century (Jones, 1982; Mohan *et al.,* 1997). This was later reported to have dropped to 1800 individuals including the population in the river tributaries by the beginning of the 21st century (Behera *et al.,* 2008), and more recently, various guestimates report the population to be between ~3500 dolphins (Sinha & Prasad, 2014) and ~4500 dolphins (Kelkar *et al.,* 2022). India is home to more than 90% of the Ganges River Dolphins existing in the world.

Since 1980, at least 500 known mortalities have occurred in considerable proportion from bycatch and intentional killing. While it needs to be clarified that all these numbers are not estimated using standardised methodology across the range, the decline is however very much indicative of the status of the population. The Indus River Dolphin in India is currently found in the Beas River (WWF-India, 2018). Substantial population of about 1800 is reported from Indus in Pakistan (Aisha & Khan, 2021). The population within India is precariously low and requires concerted conservation attention. Therefore, it was the need of the hour to undertake a range-wide estimation of river dolphins, to understand their current status and threats.

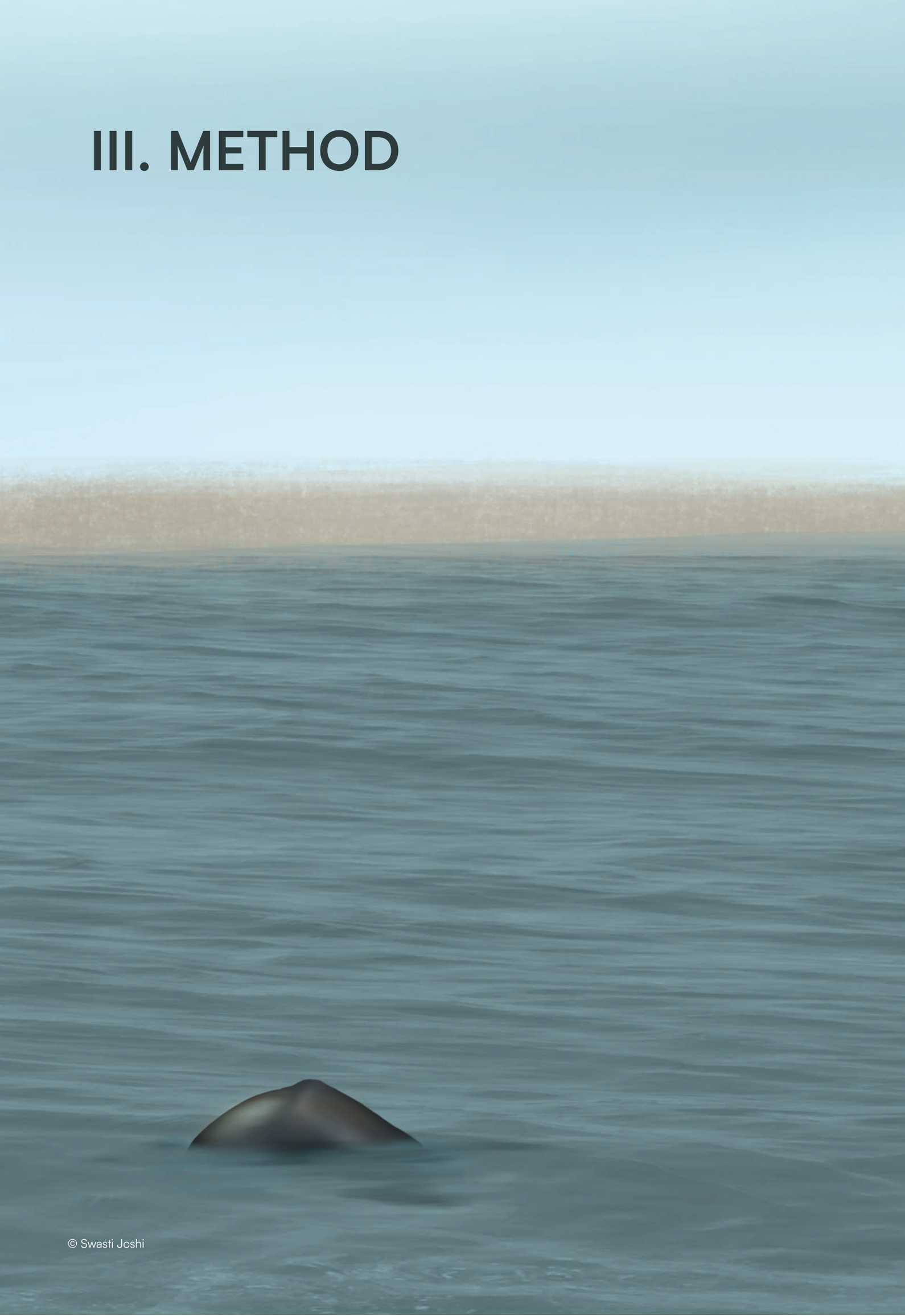
2.2 Objective

A scientifically robust population assessment of river dolphins (Ganges and Indus), across its range in India, will result in the first estimate of river dolphins using a standardised method. Without an actual estimate of the population, it is difficult to understand the status of these species. Population estimation of river dolphins was to be carried out using a method to account for observer error and unavailability errors. The range-wide estimation exercise also helps understand “critical areas”, and “coldspots” (i.e. large stretches without dolphins in the distribution range).

Associated aquatic fauna like herpetofauna, largely limited to turtles, Muggers, and Gharials across Ganga and Brahmaputra and their major tributaries, play a very crucial role in maintaining the energy dynamics of the food chain as well as nutrient cycling in the aquatic environment (Silbajoris, 2019). The extinction of top predators like dolphins, Gharial, and Mugger can lead to cascading impacts on food web structure and disturb ecosystem functioning. These riverine ecosystems are also home to several species of otters, whose population is currently under threat and is vulnerable to extinction. However, there is a huge knowledge gap regarding the status of these species, and it is crucial to gather information to safeguard them. Rivers harbor many vulnerable and endangered species of birds (both migratory and resident). Therefore, monitoring of associated aquatic fauna will provide important directions to conserve these species.


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III. METHOD



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III. METHOD

3.1 Dolphin Abundance Estimation

Population estimation methods for aquatic mammals largely suffer from the aquatic system's complex topography, currents, rippled water surface, reduced visibility, and non-uniform distribution of the species (Dawson *et al.,* 2008; Richman *et al.,* 2014). These render population estimation methods commonly adopted for terrestrial mammals unsuitable for aquatic mammals (Dawson *et al.,* 2008). For cetaceans, that surface for a short duration and rely largely on echolocation for their movement, both visual and acoustic surveys have been commonly employed (Richman *et al.,* 2014). With visual surveys, though the number of animals missed can be modeled, the number unavailable for detection despite being present is unknown. Acoustic surveys have a small range of detection compared to visual detection. Therefore, estimation methods for both river and marine dolphins involve visual as well as acoustic surveys or a combination of both (Richman *et al.,* 2014). The double observer-based mark-recapture method corrects for observer bias and has been used for river dolphins and marine mammal surveys (Qureshi *et al.,* 2018; Smith *et al.*, 2001). There is substantial bias due to observer error and it is an absolute must to use Double observer-based surveys involving either double platform or Boat in tandem method (Braulik *et al.,* 2012), depending upon the navigability of the river. While the visual-acoustic combination method is the most robust, it can only work in areas with good water depth, where medium-sized boats can navigate, and the technical know-how of analyzing acoustic data is developed. However, the correction factor developed for unavailability (by subject-experts) can be used to correct the visual survey and it is not necessary to do acoustics with all surveys. In the absence of an acoustic survey, the counts will be negatively biased but have persistent errors and thus will not have an effect on the temporal trend of dolphin presence.

3.1.1 Visual Survey

Depending on the type of vessel operating, based on the width of the river, and the available water depth, the survey method was chosen (Qureshi *et al.,* 2021):

1) **Double observer method** (Richman *et al.,* 2014; Smith & Reeves, 2000) (for deep and wide channels).
2) **Boat in tandem method** (Braulik *et al.,* 2012) (for rivers with a width less than 600m and, or a river depth less than 3m).
3) **Single boat method** (for river width less than 300m or river depth less than 2m).

Pre-preparation:

During the survey, before the start of each day, participants undertook calibration of angle and distance estimation. Two observer teams performed ocular distance calibration before starting the survey. This was done to improve the distances guesstimated by each observer and also to calibrate the data. For distance estimation, random objects on the river surface were marked and the distance to the objects was measured by the observer, which was later compared with the actual distance taken by the rangefinder. The accuracy for each observer was estimated by correlating the guesstimated and actual distances. The result was used to correct the distance to the animal guesstimated by each observer from the boat position during the actual survey.

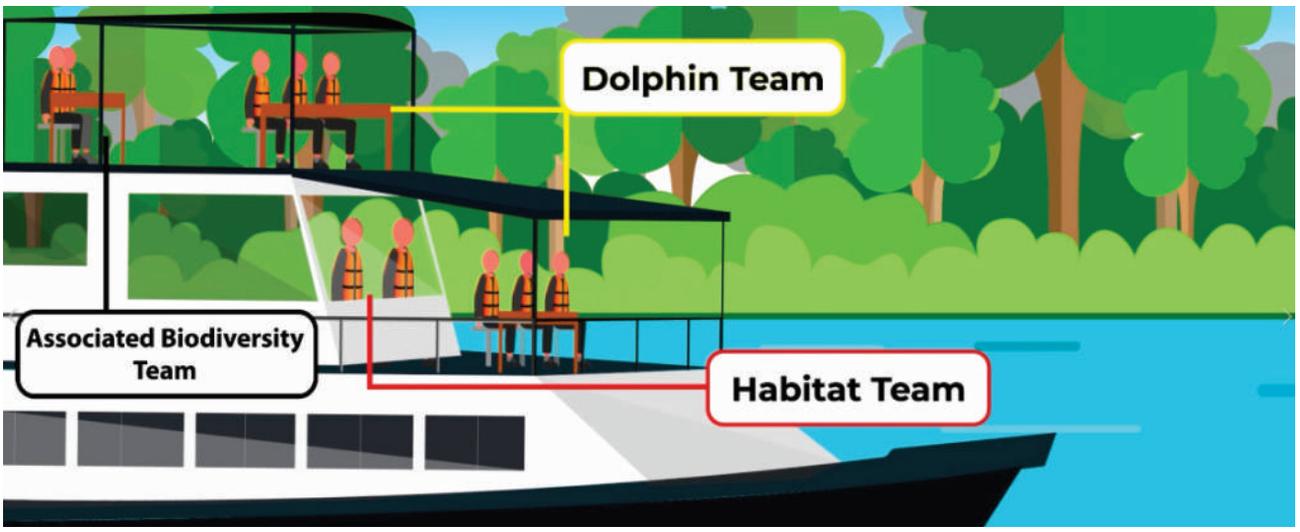
3.1.2 Independent Double Observer Method

Boat-based Double observer method employs two independent observation teams, placed on two decks of a boat, that record dolphin encounters simultaneously (Figure 3.1). Each observer team consists of two

observers - a left and a right observer, the left observer conducts observation from 0° to 89° and a right observer conducts observations between 90° to 180° (observations beyond these angles are written with remarks) and a data recorder who visually scan for dolphin surfacing within their vicinity while the boat travels at a speed of 10 Km/h. The boat speed maintained is to ensure efficient detection of the dolphins and avoid multiple counts of the same individual. As soon as a dolphin is sighted by the observer, the observer provides the data recorder with the following information: number of dolphins, age structure ('Neonate', 'Non-neonate', and 'Unknown'), radial angle, the radial distance of the dolphin, and if it is a resurfacing of the same individual recorded before. The recorder along with the aforementioned information records the GPS location, time of dolphin surfacing, odometer reading, boat bearing, the river channel type, average boat speed, and visibility conditions.

FIGURE 3.1

Double observer survey method.

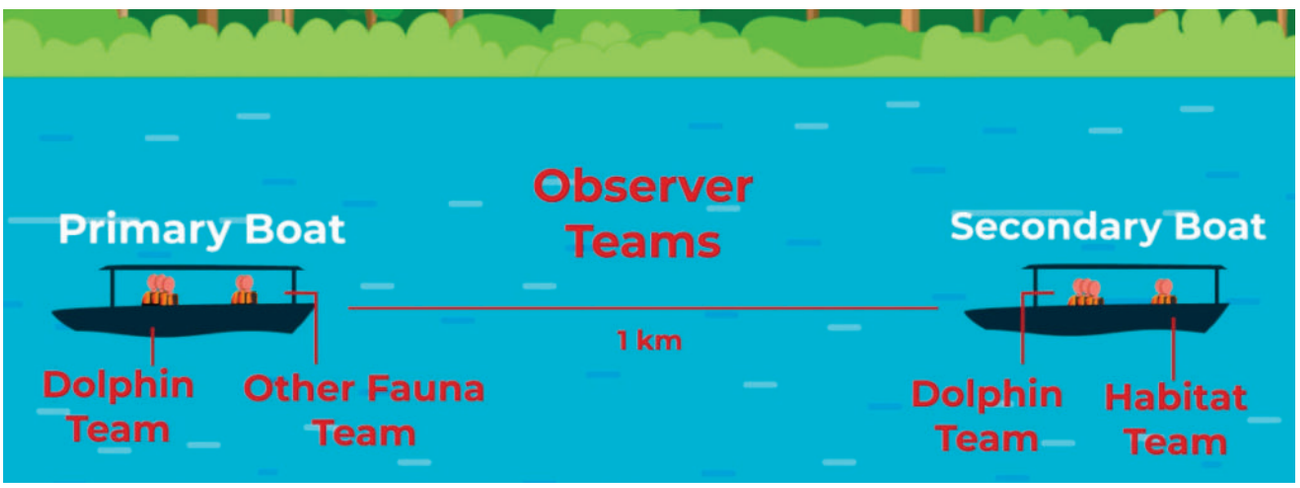


3.1.3 Boat in Tandem Method

The Boat in tandem method was employed when the river channel width was less than 600 m and/or the river depth was less than three meters (Figure 3.2). For this method, two motorized boats were used. Each boat has two independent observer teams with two observers - a left and a right observer, the left observer conducts observation from 0° to 89° and a right observer conducts observations between 90° to 180° (observations beyond these angles are written with remarks) and a third team member, the data recorder, visually scans for dolphins surfacing within the vicinity. The approximate distance between the two boats was kept either at one Km or at a time difference of 8-10 minutes to ensure no cue was provided by the leading boat. The recorder takes down the same parameters as those mentioned in the Double-observer method.

FIGURE 3.2

Boat in tandem method.

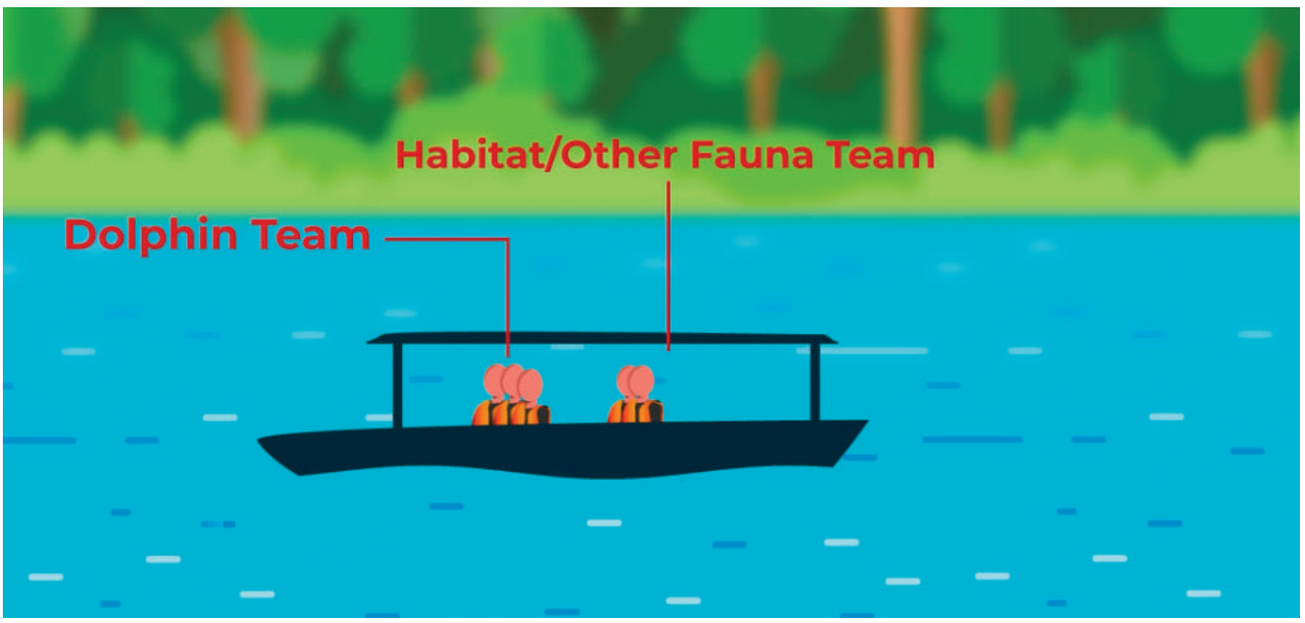


3.1.4 Single Boat Method

The Single boat dolphin observer method is used in those rivers which are small, and shallow and the dolphin population is sparsely distributed (Figure 3.3). If possible, a small motorized boat should be used for the survey. The methodology is similar to that of Boat in tandem, except that there is only one boat instead of two. The boat speed was maintained at 10 Km/h same as the double observer/tandem boat method. All the other recordings were taken in accordance with the methods elaborated previously.

FIGURE 3.3

Single boat method.



3.1.5 Underwater Acoustic Survey

Along with visual observation, either of the two types of acoustic data recorders (A-Tag/FPOD) were towed to account for unavailability bias. Each A-tag consists of two hydrophones, therefore, a pair was used to triangulate the dolphin location. In the case of FPOD which consists of a single hydrophone, acts as a third observer. These hydrophones are passive recorders of underwater soundscapes, that are within their effective detection range of the device (A-tags=125m and FPOD=~500m). This also includes the sound produced by the river dolphins.

The first A-tag was towed at 70m from the boat and the second at 90m. Floats were placed every 2m from the A-tags to avoid dragging (Figure 3.4). After completion of each survey stretch, the data from the A-tag was retrieved using Logger tools software to visualise and analyse using the Igor Pro software (Wave Metrics, version 7.0). The acoustic data obtained from these recorders include the time of recording, pulse interval of the sound recorded, and its sound pressure level. The FPOD was kept at 50-100m depending on the width of the river. After completion of the survey, the data from FPOD was retrieved and analysed using FPOD.exe software.

The sounds emitted by a phonating dolphin can be visualised as trains and are non-random on the in-built sound visualization plot. Moreover, the river dolphin clicks are biosonar sounds that have a pulse interval of 10 to 100ms, with predominance at around 50ms. The clicks also have a sound pressure level of up to 450 Pa, that is unmasked by the surrounding noise which is commonly under 200 Pa. These parameters make acoustic detections of these river dolphins accurate, with minimum false positives.

3.1.6 Matching Visual Recordings (Observer 1/Boat 1 and Observer 2/Boat 2)

After completion of a survey stretch, the dolphins seen by the independent teams were matched to determine the individuals captured (recorded by one team) and recaptured (recorded by the other team). It is a very crucial step for the abundance estimation, as incorrect matching can lead to bias in

estimation. To match the visual observations taken during the independent Double observer method, the GPS locations, angle of detection (±10 degree), sighting distance (±50m), and dolphin age structure (calf/non-calf, determined based on the nearest sighting distance and experienced observer) were considered. In the Boat in tandem method, sightings recorded by both teams that are within 1000 m of a location were considered to be matched. The distance of 1000m was based on matching GPS location of all sightings using R software. This was carried out based on the consideration that the river dolphin does not move large distances in such a short span of time (Braulik *et al.,* 2015).

3.1.7 Matching Visual and Acoustic Recordings

The acoustic data was considered as the third observer in the capture-recapture model. Since the A-tags and FPODs were towed ~100m behind the visual observers, the basic assumption is that visual recordings were made ahead of acoustic recordings. The time window for matching visual and acoustic detection was worked out to be ~2 minutes considering the species dive time and time interval between vocalization (Akamatsu *et al.,* 2008).

3.1.8 Analysis

To determine the number of captured-recaptured individuals, the population was estimated using the modified Lincoln-Peterson formula (Chapman's corrected-Equation 3.1) and Huggins method (Equation 3.2) using Mark software (Version 9.0) (White & Burnham, 1999) (Equation 3.3 & 3.4).

3.1.8.1 Chapman's Corrected Lincoln-Peterson's Estimate

In this method, the accuracy of estimation is governed by two assumptions,

(i) All dolphins that surface in the observers' visibility range are captured by both teams. Increase in the number of individuals not recaptured leads to an overestimation of the dolphin population. Improper records of dolphin surfacing, i.e., perception bias, could arise from many factors - observer fatigue, weather conditions affecting visibility, distance of dolphin surfacing, low surfacing time, high dive time interval, etc.

(ii) All dolphins that are present in the survey stretch surfaces at least once during the survey.

Unavailability bias is addressed by using acoustic data.

EQUATION 3.1

Chapman's corrected Lincoln-Peterson formula.

$$\hat{\mathbf{N}} = \left(\frac{(n_p + 1)X(n_s + 1)}{m_{ps} + 1}\right) - 1$$

Where,

$\hat{\mathbf{N}} = Population\ size\ estimate$

$n_p = number\ of\ animals\ sighted\ by\ primary\ observer\ team$

$n_s = number\ of\ animals\ sighted\ by\ secondary\ observver\ team$

$m_{ps} = number\ of\ amimals\ sighted\ by\ both\ teams\ (matches\ or\ recaptures)$

The probability of detection is estimated as $\frac{m_{ps}}{n_p}$ **and** $\frac{m_{ps}}{n_s}$

The associated variance (Seber, 1970), $V = \frac{(n_p+1)X(n_s+1)X(n_p-m_{ps})X(n_s-m_{ps})}{(m_{ps}+1)^2X(m_{ps}+2)}$

3.1.8.2 Huggins' Estimate

The capture-recapture analyses assume homogeneity of capture (sighting) probabilities. This assumption may have been violated by extraneous variations such as individual dolphin diving behaviour, and the combined effects of covariates such as sighting conditions and habitat types.

EQUATION 3.2

We also conducted the analysis where captured probabilities were modeled as a function of sighting covariates according to Huggins(1989).

$$logit\,(p_{ik}) = \ln\left(\frac{p_{ik}}{1-p_{ik}}\right) = \beta + \sum_j \beta_j x_{jk}$$

Where logit = type of link function, i = primary or secondary observer team (Seber, 1982), k = dolphin sighting, ß0= intercept, ßj= the slope parameter for the covariate value xj. A type of Horvitz-Thompson estimator (Horvitz & Thompson, 1952) was used to estimate the abundance N and the associated variance using program MARK 9.0.

EQUATION 3.3

Abundance estimate with Horvitz-Thompson estimator (1952) using MARK 9.0.

$$\hat{N} = \sum_k \frac{1}{1-(1-\hat{p}_{pk})(1-\hat{p}_{sk})}$$

EQUATION 3.4

Variance of the abundance estimate with Horvitz-Thompson estimator (1952) using MARK 9.0.

$$var\hat{N} = \sum_k \frac{1}{1-(1-\hat{p}_{pk})(1-\hat{p}_{sk})}(1-\hat{p}_i)$$

Radial distance to the dolphin, channel types, visibility conditions, and distance between two boats (in case of the Boat in tandem method) were included as covariates. The effect of the covariates was scaled on the basis of Akaike's Information Criterion (AIC) (Akaike, 1973) and the best-fit model was selected based on the minimum AIC value.

3.1.8.3 Addressing Unavailability Bias with Acoustic Data

Given the diving behaviour of the animals, it was expected that a portion of the population would be missed by visual observers during active surveys (Wakid & Braulik, 2009). In this survey method, the observers counted the dolphins as they surfaced while the boat moved along the river stretch. To address the unseen part of the population, a pair of underwater acoustic tags or A-tags (two hydrophones per A-tag, making a total of four hydrophones) were used. The boat speed was maintained at 8-10Km/hr, which was greater than the average speed of the animal (~6.36 Km/hr) so that the phonating animal would always pass the survey boat from bow to rear end (Akamatsu *et al.*, 2002). The radial distances to the animal were estimated by triangulating the time differences corresponding to two independent bearing angles (α and ß, Figure 3.4 & Equation 3.5) to the phonating animal (Li *et al.*, 2009).

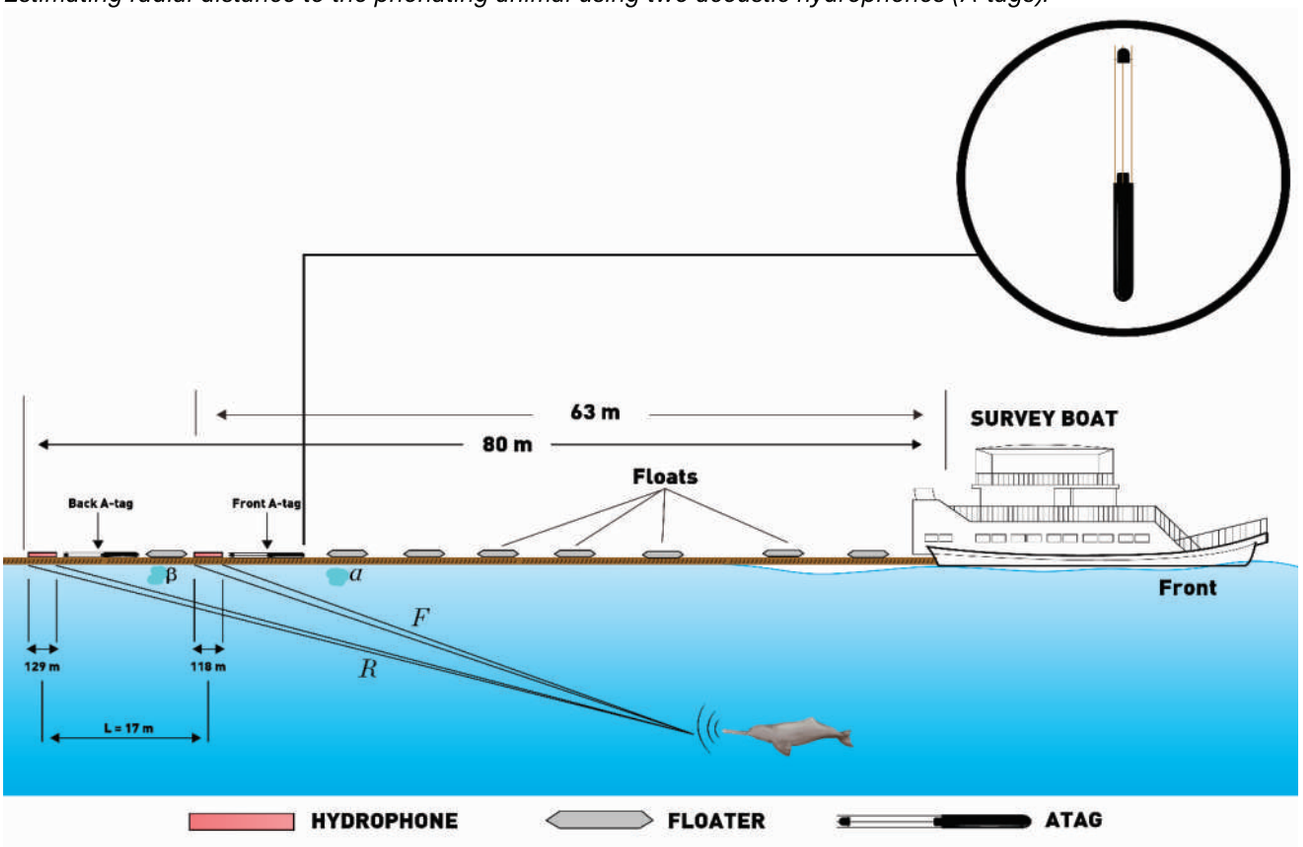
EQUATION 3.5

Radial distance to the animal from the front (F) and rear (R) A-tag (Li et al., 2009)

$$F = \frac{L \times sin\,\beta}{\sin\alpha - \beta} \qquad R = \frac{L \times sin\,\alpha}{\sin\alpha - \beta}$$

FIGURE 3.4

Estimating radial distance to the phonating animal using two acoustic hydrophones (A-tags).



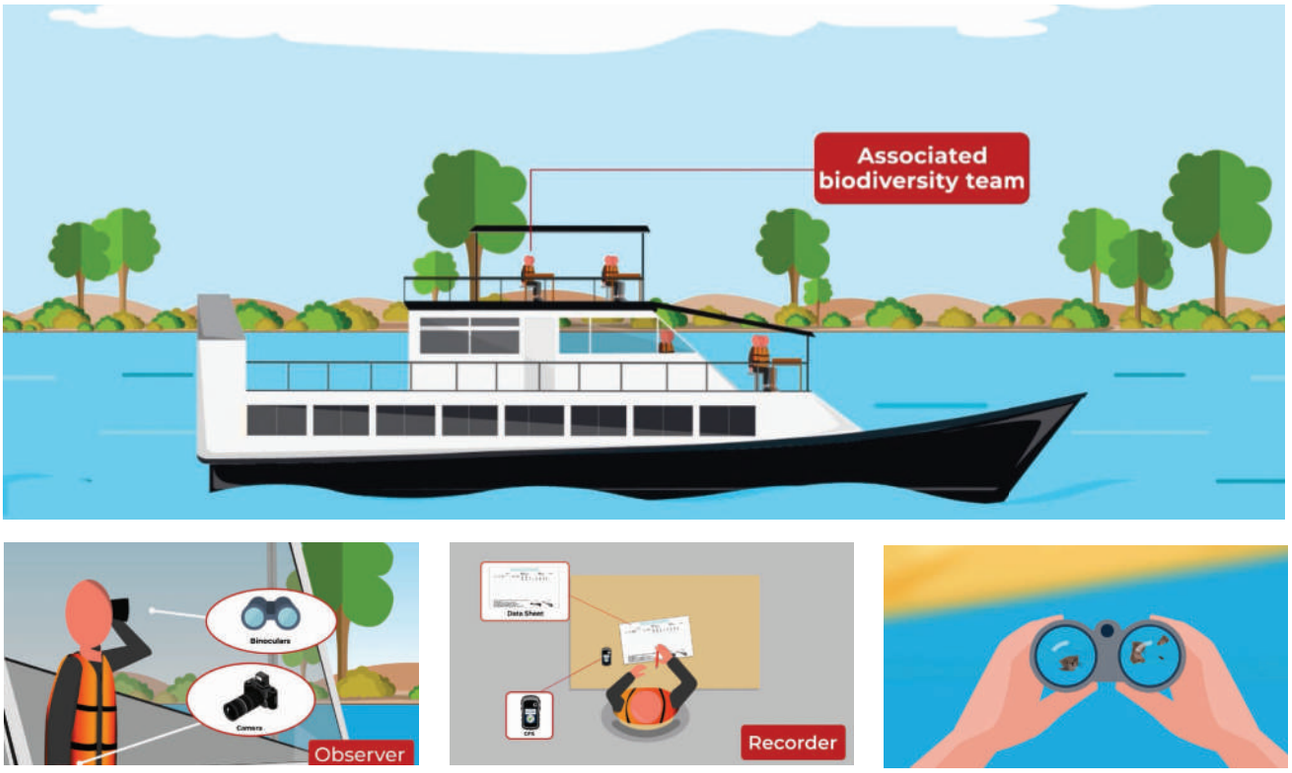
To estimate the correction factor, the visual and A-tags were matched using the time window method (Akamatsu *et al.*, 2008). The detection of A-tags reduces after 125 m, and therefore the data from Brahmaputra, Chambal, and Ganga was curtailed to 125 m radial distance and was then used to calculate the proportion of dolphins present but unavailable for counting. Overall, in the current survey, we estimated that 15% of the dolphin population was unavailable for counting. The correction factor of 0.85±0.017 was used to correct for unavailability bias (N_{OA}), the magnitude of correction in Richman *et al.*, (2014) also reported a similar unavailability proportion (30% to 13%) ranging from 0.7 - 0.87 in Bangladesh. The variance of N_{OA} was estimated using the Delta method (Seber, 1982).

3.2 Associated Fauna

During the survey, in the Double observer and Boat in tandem method, a team of one observer and one recorder was engaged for each river stretch to record associated fauna (Figure 3.5). In the Boat in tandem survey, the observer and recorder were stationed in the first boat to avoid flushing of animals due to the noise produced. The observations were made using a Nikon Monarch 10x42 binocular, and the corresponding images were collected for further identification. Each photograph was assigned a specific image ID using a Nikon Coolpix camera. GPS location of the observation was taken for different species observed during the survey with the help of Garmin etrex 30xGPS device. The observer continuously scanned the river and banks, and provided the recorder with the species name, count, age, sex class, and any specific activities (nesting, foraging, courtship, etc.). Unidentifiable species observed during the field survey were subsequently identified using the image IDs collected during the survey. Geographic coordinates of each observation were taken and ArcGIS (version 10.8) was used to create maps of associated species with conservation importance such as Indian Skimmer, Gharial, Mugger, Otters, Turtles, and Greater Adjutant.

FIGURE 3.5

Monitoring associated fauna.



3.3 River Bank Characteristics

The team documents the river channel type, bank habitat, and other morphological characteristics such as depth and width for the entire 2 km stretch. The following are the classifications of the river channel types:

a) Wide Channel (WC) (>600 m total bank distance)
b) Narrow Channel (NC) (<600 m total bank distance)
c) Meander (M)
d) Confluence (CF)
e) Braiding Confluence (BRCF)
f) Braided Channel (BRC)
g) Mid Channel Island (MCI)
h) Stagnant Pool (SP) (Qureshi *et al.*, 2021).
i) Water depth

3.4 Weather/Visibility Condition

The weather and visibility conditions, including wind, glare, and rain/fog, are observed for each reach and then recorded.

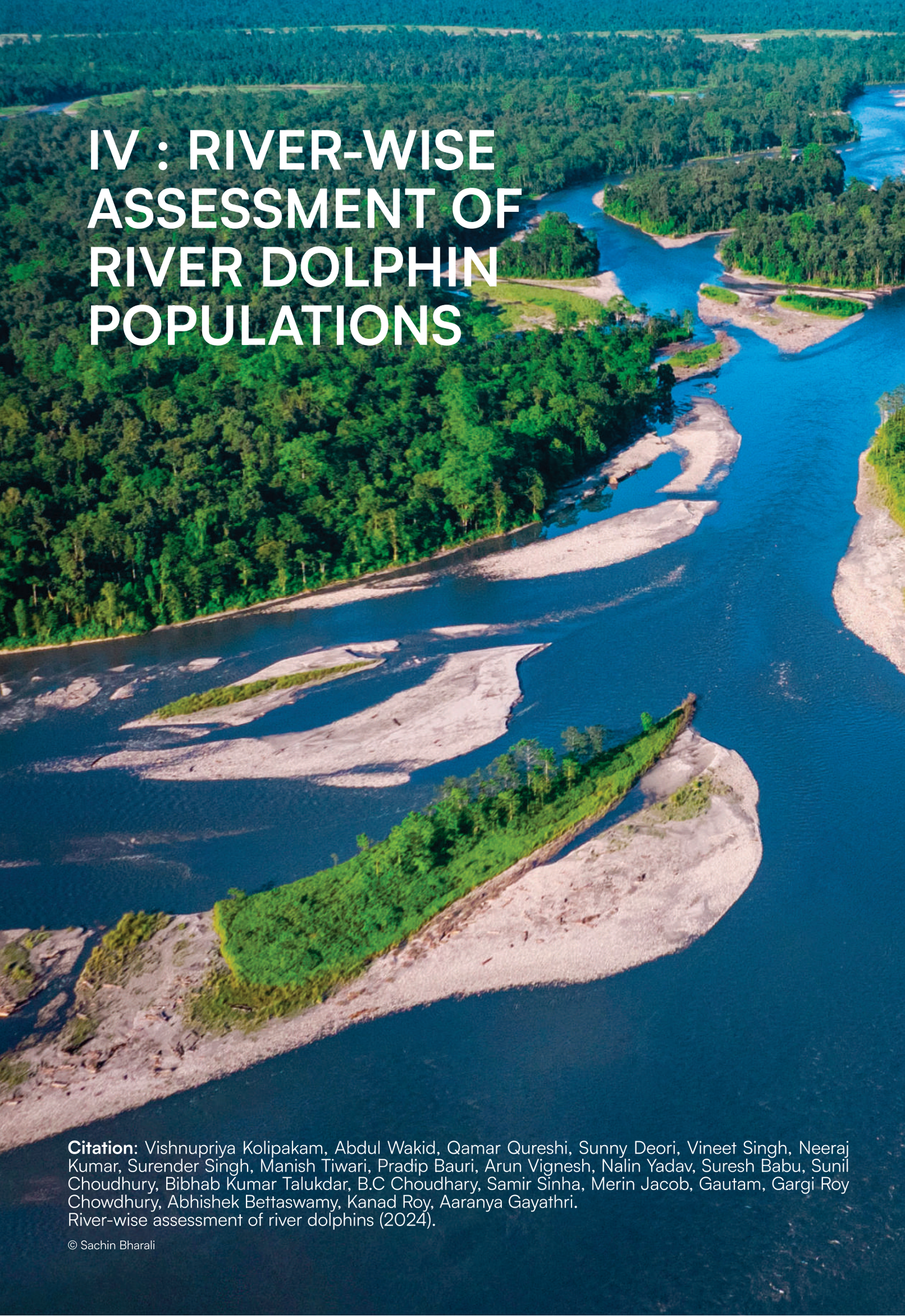
3.5 Analysis

Geographic coordinates were taken at the starting of each reach. Water depth was recorded using a Garmin chart plotter at four consecutive points at an interval of 500m in 2 Km reach. At the end of the survey, each day, the total trip odometer (Km), average speed, and data collation for all reaches are computed. The maps were created using ArcGIS (version 10).

The dolphin encounter map classification was based on average dolphin encounter per 10 Km grid with 0 (no presence), 1-2 (very low), 3-5 (low), 6-12 (medium), 13-28 (high), more than 28 (very high). The areas with no or very low dolphin presence for long stretches were considered *coldspots*. Areas with high to moderate, and occasionally low, dolphin presence, distributed approximately 200 km apart and encompassing important dolphin habitats like confluences, are crucial for conserving source populations across the range and ensuring the species' long-term persistence; these are termed "Critical Areas."



IV : RIVER-WISE ASSESSMENT OF RIVER DOLPHIN POPULATIONS



Citation: Vishnupriya Kolipakam, Abdul Wakid, Qamar Qureshi, Sunny Deori, Vineet Singh, Neeraj Kumar, Surender Singh, Manish Tiwari, Pradip Bauri, Arun Vignesh, Nalin Yadav, Suresh Babu, Sunil Choudhury, Bibhab Kumar Talukdar, B.C Choudhary, Samir Sinha, Merin Jacob, Gautam, Gargi Roy Chowdhury, Abhishek Bettaswamy, Kanad Roy, Aaranya Gayathri.
River-wise assessment of river dolphins (2024).

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The Northern Plains have been considered as the birthplace of Indian civilization. The banks of rivers Ganga and Indus, have borne witness to a tapestry of historical events, including the rise and fall of empires, the flourishing of art, culture, and spirituality, and the establishment of human settlements spanning millennia. Diverse cultures intersected here, creating a distinct blend unique to the world. The rivers of the Northern Plains and Assam, prominently the Ganga, and Brahmaputra, and their intricate network of tributaries have been pivotal in shaping the region's scientific, historical, and cultural landscape. They have served as the lifeblood, influencing biodiversity, ecology, and human civilization throughout the annals of time.

The cultural and religious resonance of these rivers is profound. The Ganga River, in particular, is revered as sacred by Hindus and believed to possess purifying properties. Its banks are adorned with countless temples and ghats, each witnessing the spiritual devotion of pilgrims who journey from across India and around the world to bathe in its holy waters. For Hindus, immersing themselves in the Ganga represents the cleansing of the soul and an opportunity for spiritual purification. Grand Hindu festivals, including the Kumbh Mela, draw millions of devotees to the banks of the Ganges. The Ardh Kumbh and Maha Kumbh Melas are monumental events in the Hindu calendar, bringing together a sea of devotees in celebration.

The Brahmaputra basin is a cultural cauldron where Tibetan, Indian, and Southeast Asian influences have converged, giving rise to a rich and diverse cultural heritage. This confluence of cultures has not only enriched the traditions but also contributed to the distinctive character of the region. These rivers have been a source of inspiration for poets, writers, and artists throughout history. Their landscapes and the communities that inhabit their banks have served as subjects for timeless works of literature, art, music, and cultural expressions. The ancient Indian epics of the Mahabharata and the Ramayana are set in the mystical backdrop of these rivers, immortalizing them in the collective memory of the nation. The rivers of this region have played a pivotal role in the flow of goods, ideas, and culture. They facilitated ancient trade routes connecting diverse regions, leading to the growth of great empires and urban centers that flourished along their banks.

The river banks, marshlands, and wetlands along these rivers have emerged as invaluable ecological niches. They have provided essential breeding, nesting, and foraging grounds for an array of species, both migratory and resident, contributing to the region's unparalleled ecological richness. The seasonal flooding of these rivers is a dual-edged phenomenon, delivering fertile silt for agriculture while also presenting the risk of catastrophic floods. Human civilizations have innovatively adapted to these cycles, developing unique strategies for flood management. The rivers of the Northern Plains and Assam represent far more than just bodies of water; they are the custodians of scientific significance, ecological diversity, and cultural heritage. To understand and preserve these rivers is to cherish the heritage, traditions, and history of a region that has long thrived at the confluence of human civilization and the natural world.

A survey spanning a distance of 8507 kilometers was conducted between November 2021 and March 2023. The purpose of this survey was to estimate the population of dolphins in the Ganga, Brahmaputra, and Beas rivers. The study encompassed the Ganga River and its tributaries such as Chambal, Yamuna, Rapti, Sharda, Ghaghara, Mahananda, Kosi, Gandak, Geruwa, Rupnarayan (as well as its sub-tributaries Mundeswari, Shilabati, Bakshi, and Dwarakeswar), Torsa, Kaljani, Churni, and Haldi. The survey covered the Brahmaputra River along with its tributaries; Subansiri, Kulsi, Beki, Kopili, and the Barak River. The Beas River was surveyed for the Indus River Dolphin (Figure E.1).

4.1 Ganga

Ganga takes its name at Devprayag, where one of the headstream rivers Bhagirathi originating from Gomukh joins Alakananda. This 2525 Km long river flows through the Gangetic plains of India, covering 11 states, and is the largest basin of India covering 26% of India's land area (~1,086,000 Km). Ganga forms two distributaries in its lower reach while entering the Murshidabad district of West Bengal. One distributary with the name Padma enters Bangladesh and the other, Bhaghirathi-Hooghly, courses into the Bay of Bengal. Brahmaputra (Jamuna in Bangladesh), joins Ganga (Padma), and subsequently confluences with Meghana, before entering Bay of Bengal (Singh, 2022). Until the 16th

century, the Bhagirathi-Hooghly River used to be the principal distributary of the river Ganga (Bagchi, 1944; Hirst, 1916; Oldham, 1870; Reaks, 1919; Singh, 2022). But because of high siltation, sedimentation, and flow of a greater portion of Ganga's water into the Padma, the channel started to decline drastically. In response to this, the Government of India constructed the Farakka Barrage in the year 1975 and joined the Ganga with Bhagirathi-Hooghly to facilitate the river system with a larger amount of water. The prominent feature of the river is the oxbow lakes which are the possible result of previously active channels (Roy *et al.,* 2021). The water level of Hooghly fluctuates every day, and the water level reaches a maximum twice a day due to tidal variations.

Upper Ganga (from Gomukh to Haridwar), middle Ganga (from Haridwar to Varanasi), and lower Ganga (from Varanasi to Ganga Sagar) are the three divisions of the river Ganga (NMCG, 2010). The mainstream of Ganga receives more flow of water, nutrient-rich silt and sediment loads through its tributary. Gomati, Ghaghara, Gandak, and Kosi, which are of Himalayan origin, join the Ganga in the north. Betwa, Chambal, and Ken, rivers having their source in the "Central Indian Craton," feed the Ganga basin in the south (Sinha *et al.,* 2010). Gomati, Ghaghara, Betwa, Chambal, and Ken flow through Uttar Pradesh before joining the mid-Ganga basin and carrying a significant amount of water with northern tributaries to the state of Bihar, which makes up the majority of the mid-Ganga basin. In Bihar, the rivers Son, Gandak, Ghaghara, and Kosi merge with the mainstream Ganga. Tributaries of Ganga and Brahmaputra holds a good population of Ganges River Dolphins. During high water season, the Ganges River Dolphins migrate from the mainstream rivers towards the tributaries (Kasuya & Haque, 1972). Tributaries are particularly important, as they form lifelines for dolphins during flood season. The connection between tributaries and mainstream also ensures when the flow of water during the lean period is less in tributaries, dolphins can navigate to the mainstem.



Historically, the distribution range of Ganges River Dolphins was seen right from the foothills of the Himalayas downstream of Haridwar (present day Uttarakhand), to the delta region of Sundarbans (present-day West Bengal). This range has drastically declined and dolphins have gone locally extinct from the stretch between Bhimgoda Barrage (Haridwar) to Bijnor Barrage (Sinha *et al.,* 2000). The different stretches of Ganga have been sampled and the encounter rate varied from 0.01 to 1.7/Km depending upon the quality of the stretch (Sinha, 1997; Sinha, 1999; Sinha *et al*., 2000; Sharma, 2010; Sinha *et al*., 2010; Bashir *et al.,* 2010; Behera *et al.,* 2013; Behera *et al*., 2014). Downstream of the Bijnor Barrage to Narora Barrage, 22 dolphins were sighted in approx. 166 Km stretch of the river during the year 1993-95 (Behera, 1995) and during 2010 the number increased to 56 (Sinha & Kannan, 2014). Another survey was conducted in the same stretch covering 175 Km of the river, by Bashir and his team in the year 2010, which reported dolphin sightings with an encounter rate of 0.34/Km. The survey downstream from the Narora Barrage to the Kanpur Barrage, a segment of 358 Km was studied by Sinha in 1997, which reported the absence of dolphins in the stretch (Sinha, 1999). The same stretch was surveyed by Bashir *et al.,* (2010) for 300 Km and documented very few dolphin sightings with an encounter rate of only 0.01/ Km. In 2012, another survey was conducted by (Bashir *et al*., 2012) from Kanpur to Prayagraj, covering a 252 Km stretch of the Ganga River. They sighted 98 dolphins in the region (Sinha & Kannan, 2014). From Prayagraj to Buxar, a stretch of approx. 425 Km was surveyed by Sinha in the year 1997 and recorded 204 dolphins (Sinha, 1999). Moreover, 65 Km of the stretch encompassing Vikramshila Gangetic Dolphin Sanctuary, from Sultanganj to Kahalgaon was surveyed in the year 2007-2008, reported 179 dolphins in the region (Kelkar *et al.,* 2010). Again, from Buxar to Manihari Ghat in a 500 Km River stretch 808 dolphins were recorded with an encounter rate of 1.62/ Km in the year 2006 (Sinha *et al.,* 2010a). Sinha (1999) reported 115 dolphin sightings from Manihari Ghat to Farakka in approx. 70 Km stretch in the year 1998. In the Farakka Feeder Canal (38.2 Km), the occurrence of 21 dolphins with an encounter rate of 0.55/Km is recorded by Sinha *et al.,* (2000) during the year 1996. In a study conducted in the Bhagirathi River in the year 1995, from Jangipur to Triveni Ghat, 119 dolphins were found to be present in a stretch of 320 Km (Sinha, 1997). From Triveni Ghat to Sagar Island in Hooghly River, a 190 Km river segment was surveyed in the year 2008 and 97 dolphins were sighted with an encounter rate of 0.51/ Km (Sharma, 2010). Sinha *et al.,* (2010a, b) reported 1355 Ganges River Dolphins estimated between different stretches sampled between 2003 to 2006. The model-based estimate of the Ganges River Dolphin was 1981 (SE 139) for the Ganga mainstream from Bijnor Barrage to Ganga Sagar (Das *et al.,* 2022).

Based on the recent distribution of Ganges River Dolphin in the Ganga mainstream, the current survey was started from Bijnor Barrage in Uttar Pradesh and culminated at Ganga Sagar of West Bengal (apart from Sundarbans), covering a total distance of 2422 Km, in 65 days, with a survey effort of 259 hrs. 15 min (Table 1.1). The dolphin population in mainstream Ganga was estimated to be 3275 (3107-3445) individuals with an encounter rate of 1.3/Km.

4.2 Chambal

Chambal is a perennial river, originating from the Vindhyan Range in Janapav, Ambedkar Nagar (MHOW) Madhya Pradesh, flows in the north-eastern direction and merges with Yamuna near Bhareh of Etawah district of Uttar Pradesh. Till the confluence of Yamuna, this river has a course of 965 Km (CWC-NRSC, 2014), and traverses Madhya Pradesh, Rajasthan, and Uttar Pradesh. The Chambal River flows through a broad valley that is characterised by steep cliffs, known as ravines, and used to be badlands of the region. These ravines are a distinctive feature of the Chambal River basin, created by centuries of erosion. The ravines can reach heights of up to 30 meters and extend several kilometers along the river's course. They provide shelter and nesting sites for various species, including raptors. The riverbanks of the Chambal in the upper reaches are rocky and sandy, while the lower reaches are mostly composed of sandy and alluvial deposits. The sandbanks and islands formed along the river provide habitats for several species of turtles, crocodiles, and birds. These sandy areas are crucial for the nesting and breeding of wildlife, particularly herpetofauna and some bird species. The Chambal River has a meandering channel, characterized by numerous bends and curves. The river's flow is relatively steady, with moderate water levels throughout the year which is declining due to water drawl projects. The flow is influenced by seasonal variations in rainfall, with the river experiencing higher water levels during the monsoon season.

The National Chambal Sanctuary is situated in three states Rajasthan, Madhya Pradesh, and Uttar Pradesh, from 24°55' to 26°50' N and 75°34' to 79°18' E, stretches 600 Km length and covers an area of 5400 Km^2 from Jawahar Sagar to the point where the Chambal River meets the Yamuna River. The river was declared a sanctuary in 1978 and covers an area of 5400 Km^2. It is one of the few river sanctuaries in the country (Hussain *et al.,* 2011; Rahmani *et al.,* 2016).

The diverse river habitats include deep pools, shallow rapids, and riffles, supporting a wide range of aquatic species. The Chambal River features several islands and wetlands along its course. These islands are formed as a result of sediment deposition, often created by the shifting currents and meandering patterns of the river. Wetlands associated with the Chambal River, such as lakes, marshes, and swamps, serve as vital habitats for numerous bird species, amphibians, and reptiles. They also play a crucial role in regulating water flow, filtering pollutants, and supporting the overall ecological balance of the river ecosystem.

Over the past three decades, there has been a gradual increase in the number of dolphins observed within the National Chambal Sanctuary. However, their distribution has shifted downstream. Notably, the section spanning 116 kilometers from Ushedghat to Chakarnagar now accounts for approximately 80- 81% of the entire dolphin population in the Chambal region (Sharma & Singh, 2014). One of the earliest surveys to estimate the Ganges River Dolphin population in the Chambal River was conducted by Singh and Sharma (1985), which reported 45 dolphins with an encounter rate of 0.14/Km, in the National Chambal Sanctuary. Rao *et al.,* (1989) reported the dolphin number to be 59 in a stretch from Batesura to Pachhnada (320 Km) in 1988 and 43 in a stretch from Batesura to Chakarnagar in 1989. From the year 1990 to 2002, the population has shown an increasing trend, and thereafter a fluctuating trend, with an encounter rate of 0.25 in 2012 (Sharma *et al.,* 2013; Sharma & Singh, 2014). Singh and Rao (2012) recorded a total of about 91 and 66 dolphins in 2007 and 86 and 55 dolphins in 2008 in dry and wet seasons respectively. The mean encounter rates of dolphins were 0.21/Km±0.013 individuals/Km in the dry season and 0.15/Km±0.37 individuals/Km in the wet seasons of each year. In 2014-15 in 356 Km of Chambal Sanctuary, 90-120 dolphins were recorded (Behera *et al.,* 2014; WWF-UPFD 2015; Singh *et al.,* 2014) while Sharma and Singh (2014) reported counts of 59 and 66 dolphins in 2013 and 2014 respectively. These observations were exclusively concentrated within a 222 Km segment from Sarsaini to Chakarnagar. This shift in dolphin density is evident when considering the change in encounter rates. Specifically, the encounter rate rose from 0.14 between 1983 and 1985 to 0.27 in 2013, and further to 0.30 in 2014 (Sharma & Singh, 2014). The model-based population estimate of the Ganges River Dolphin was 114 (SE 8) (Das *et al.,* 2022).

The National Chambal Gharial Sanctuary harbours a substantial resident population of the Ganges River Dolphin. During the Rangewide estimation of river dolphins, a total of 242 km of river stretch from Nagar to Pachhnada (spanning Rajasthan, Madhya Pradesh, and Uttar Pradesh) was surveyed in seven days. The survey estimated 298 individuals (278- 320) and recorded an encounter rate of 1.2/ Km.



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4.3 Yamuna

The Yamuna is the second-largest tributary of the Ganga River and the longest in India, with a total length of 1,376 Km and a drainage system of 366,223 Km^2 (CWC-NRSC, 2014). It originates from the Yamunotri Glacier in Uttarakhand and passes through several states including Himachal Pradesh, Haryana, Delhi, Uttarakhand, and Uttar Pradesh, before joining the Ganga River at Triveni Sangam in Prayagraj. The river has a meandering course and its width varies from several meters to several kilometers, depending on the location and season. The riverbed is mostly composed of sand, gravel, and boulders, with occasional stretches of rocky outcrops. The river has several tributaries, including Tons, Chambal, Sindh, Betwa, and Ken, which contribute to its flow and provide water for irrigation and other uses.

The Yamuna River, is home to a variety of wildlife. The river and its surrounding ecosystem support a diverse range of plant and animal species, including several endangered and threatened species. The most notable species found in the Yamuna River are the Gharial and Ganges River Dolphin. The river also supports populations of the endangered Smooth-coated Otter and the Ganges Soft-shelled Turtle. The Yamuna River is also an important habitat for several species of migratory birds, particularly during the winter months. The river and its floodplains provide feeding and nesting grounds for several species of waterbirds, including ducks, geese, and storks. Some of the common species found in the river include the Bar-headed Goose, Common Pochard, and Eurasian Coot (Sivakumar *et al.,* 2012).

In the Yamuna River, the Ganges River Dolphin was reported by Anderson in 1878, and in the 1990s, only occasional sightings were reported by fishermen and other river users. In recent years, several surveys have been conducted to estimate the population of Ganges River Dolphins in the Yamuna River. Eighteen dolphins were recorded in 1995 from Kausambi to Prayagraj, where a maximum of 11 dolphins were recorded near Prayagraj, confluence with the river Ganga (Sinha, 1997). A survey conducted by the World Wildlife Fund (WWF) in 2006 and 2012 estimated 104 and 50-60 Ganges River Dolphins respectively in the Yamuna River, while a survey conducted by the Uttar Pradesh Forest Department in 2018 reported a decline in the population to just 22 individuals. An unpublished study by WWF India revealed the dolphin number to be 48 in the year 2009, from Chilla to Saraswatighat near Prayagraj Sangam (183 Km) (Behera *et al.,* 2013).

A total of 536 Km of Yamuna River was covered in Uttar Pradesh, starting from Yamuna Setu at Etawah and ending at the Sangam Ghat at Prayagraj, Uttar Pradesh. The survey was completed in 13 days. The Ganges River Dolphin were largely observed around Chambal and Yamuna Confluence with a total of 104 (96-112) individuals with an encounter rate of 0.2/Km.

4.4 Sharda

The Sharda River is named after the Hindu Goddess Saraswati. As it flows through the hills, the name of the river changes to Kali River at Gunji. After passing through Brahmadev Mandi near Tanakpur, it enters the Terai plains where it is called the Sharda River (Walton, 1911). It originates from Kalapani in the Himalayas at an elevation of 3,600 meters in the Pithoragarh district of Uttarakhand, India (Midha & Mathur, 2014). The Sharda River has a total length of 350 Km, with around 170 Km of the river flowing through India and the remaining flowing through Nepal. It flows along the western border of Nepal with India and has a basin area of 14,871 Km^2. The river joins the Ghaghara River 30 Km east of Bahraich, which is a tributary of the Ganga.

The morphology of the Sharda River is characterized by steep slopes and narrow channels in the upper course, wider valleys and gentler slopes in the middle course, and broad floodplains and a large delta in the lower course. The river is subject to periodic flooding and erosion, and its sediment load is relatively high (Midha & Mathur, 2014). The Sharda River is an important natural resource that provides water for irrigation, hydroelectric power generation, and transportation and supports the livelihoods of millions of people in India and Nepal.

The Sharda River is home to a diverse array of fish species, including mahseer, catfish, and trout. These fish are an important source of food and income for local communities and also support recreational

fishing activities. The Sharda River is an important wintering and breeding ground for waterfowls. The Sharda River supports a diverse assemblage of freshwater turtle species, including the Indian Flap-shelled Turtle, Ganges Soft-shelled Turtle, and roofed turtle. The Sharda River is one of the few remaining habitats of the Gharial. The river is home to several wetland-dependent mammal species, including the endangered Ganges River Dolphin, Smooth-coated Otter, Barasingha, and Fishing Cat (Paul *et al.,* 2020). These mammals rely on the river for food and habitat, and their presence indicates the overall health of the river ecosystem. Several important Protected Areas of Nepal and India are on its bank, Shukla Phanta National Park (Nepal) and Pilibhit as well as Dudhwa Tiger Reserve of India. The wildlife values of the Sharda River highlight its importance as a biodiversity hotspot and an ecological resource of global significance. The conservation of the river and its habitats is crucial for maintaining the ecological integrity of the region and ensuring the survival of these species for future generations.

The survey done in 1994 found no dolphins in Sharda till Palia (Sinha anmd Sharma, 2003b). Although an exact dolphin count is lacking, there have been reports of dolphin presence within this stretch (Kumar, 2021). Local fishermen and farmers also confirm dolphin sightings in both the summer and monsoon, with higher frequencies during the latter due to high water levels (Kumar, 2021).

In the river Sharda, a total of 246 Km was surveyed and was completed in 5 days. The population of Ganges River Dolphins was 58 (50-66) with an encounter rate of 0.2/Km.

4.5 Rapti River

The Rapti River originates in the Himalayas and flows through Nepal and India. It courses through the Terai region before joining the Ghaghara River in India. The river is an important source of water for irrigation, hydropower generation, and domestic use, and also supports a rich diversity of aquatic and terrestrial species (Midha & Mathur, 2014).

The Rapti River is approximately 420 Km long, with a drainage basin of about 24,920 Km^2 (CWC-NRSC, 2014). The river originates from the Mahabharat Range in Nepal and flows through the Chitwan Valley, forming a wide floodplain characterized by meandering channels, oxbow lakes, sandbars, and wetlands. The river is fed by several tributaries, including the Daraundi, Madi, and Deukhuri rivers, which join the Rapti in its middle and lower reaches. Several tributaries from Banke National Park (Nepal) and Suhelwa Wildlife Sanctuary (India) drain in Rapti. The river is subject to seasonal flooding, with rainfall and snowmelt from the Himalayas contributing to high flows during the monsoon season. The morphology of the Rapti and its floodplain, have a complex network of channels, sandbars, and oxbow lakes that characterize the river and have documented the changes in the river morphology over time due to floods and human activities.

The Rapti River supports a rich diversity of aquatic and terrestrial species, including several endangered and threatened species such as the Gharial, Mugger, Indian Skimmer, and Sarus Crane. The river is also an important habitat for fish, turtles, otters, and other aquatic fauna. The river and its floodplain are recognized as an important Ramsar site, indicating its global importance as a wetland ecosystem.

The population of Ganges River Dolphins in the Rapti River was estimated using the direct count method from October 5^{th}-7^{th}, 2012. During this time, a total of eight Ganges River Dolphins were sighted over a distance of approximately 30 km, resulting in an encounter rate of 0.26 dolphins per Km (Behera *et al.*, 2014). A survey conducted for the population estimation of the Ganges River Dolphin by the Uttar Pradesh Forest Department and World Wildlife Fund, India in 2015 recorded 40 individuals (WWF-UPFD, 2015). The 20 Km survey of Rapti in Balrampur district along Suhelwa Wildlife Sanctuary, reported 3-4 Ganges River Dolphins (Maurya *et al.,* 2014).

The current status survey started from Rapti Barrage and ended in the Rapti-Ghaghara Confluence in Uttar Pradesh covering a distance of 532 Km and was completed in 12 days. In this survey, 152 (143-161) Ganges River Dolphins were counted with an encounter rate of 0.3/Km.

4.6 Geruwa - Kauriala (Karnali)

The Karnali River is a transboundary river that flows through Nepal and India and is one of the major tributaries of the Ghaghara River. In Nepal, Karnali travels 507 Km, making it Nepal's longest river. The Karnali River bifurcates into two main branches: the western branch, known as Kauriala or Karnali, and the eastern branch, called Geruwa. This river exemplifies a braided river, with its braiding process being instrumental in shaping its branches, including the Geruwa and Kauriala Rivers. The river flows through a region with steep slopes and high rainfall, which causes significant erosion of the riverbed and the surrounding hills, resulting in a large sediment load carried by the river. As the river flows downstream, the sediment load creates sandbars, islands, and multiple channels. The channels merge and split, forming complex patterns of braids, bars, and islands.

The Geruwa River is formed by the confluence of the Karnali and the Triveni Rivers, while the Kauriala River is formed by the confluence of the Karnali and the Daha Rivers. Mohana River which marks the boundary of India and Nepal and flows on the northern boundary of Dudhwa National Park confluence with Kauriala. In 2009, a change in the hydrology occurred; the dominant discharge branch of the Karnali River, bifurcating at Chisapani, shifted from the eastern branch (Geruwa River) to the western branch (Kauriala River), which modified the ecology for aquatic fauna as well as dynamics of terrestrial ecosystem in Bardia National Park, Nepal and Katerniaghat Wildlife Sanctuary (Dudhwa Tiger Reserve), India.

The river system supports a rich biodiversity, including several species of fish, turtles, and other aquatic life. The Geruwa and Kauriala rivers are also important sources of water for irrigation and other human activities in the region. In addition, the construction of dams and other infrastructure on the river can further alter its flow and impact the river's ecological and socio-economic functions (Singh & Behera, 2018).

The most notable wildlife species found in these rivers are the Gharial, Mugger, Ganges River Dolphin, and otters (Singh & Behera, 2018). Conservation efforts are underway to protect and restore their populations. The Gharial population is doing well in this river system. These rivers are also home to a diverse array of fish species, including Mahseer, catfish, and carp. These rivers have two important wildlife reserves Karnali-Bardia in Nepal and Katerniaghat in India which support a diversity of bhabhar and terai fauna of this region.


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Smith (1993) recorded just seven individuals from the Karnali River (Nepal) in 1990. Later, in the early 1990s, a comprehensive survey of the Ganges River Dolphin population in the Geruwa River (India and Nepal) was conducted from February 19th to 25th, 1993. This survey estimated 20, 24, and 29 individuals upstream and 13, 15, and 16 downstream (Smith *et al.*, 1994).

In India, Basu and Sharma (2000) carried out surveys across the Katerniaghat Wildlife Sanctuary and estimated the Ganges River Dolphin population to be 25 individuals. Following this, a WWF-India study from February 7th to 10th, 2001, surveyed the area between the Indo-Nepal border and the Katerniaghat pontoon bridge. They estimated the dolphin population to range from 23 to 44 individuals, with a best estimate of 30 and an encounter rate of 1.67/km (WWF-India, unpublished report, 2001). Another significant survey by WWF-India was conducted from December 11th to 12th, 2006. It estimated the dolphin population to be between 31 and 54 individuals along the same river length, with a best estimate of 39 and an encounter rate of 1.95/km (WWF-India, unpublished report, 2006). Later, from December 9th to 10th, 2009, a WWF study in the Geruwa River reported a low-best-high estimate of 40-49-62 individuals, with an encounter rate of 2.22/km (WWF-India, unpublished, 2009).

Further research was conducted by Behera *et al.* from October 5th to 7th, 2012, in the Geruwa River using direct count methods. They estimated the dolphin population to be between 29 and 44 individuals, with a best count of 39 (Behera *et al.*, 2014). Singh and Behera (2018) also conducted surveys in 2013, from February 8th to 9th, along the Geruwa and Kauriala Rivers within the Indo-Nepal border to the Girijapuri Barrage segment of the Katerniaghat Wildlife Sanctuary. Their survey estimated a dolphin population of 27 to 41 individuals, with a best estimate of 35 and an encounter rate of 1.94/km.

Lastly, seasonal reports from the Mohana River between June and October indicated the presence of Ganges River Dolphins. The highest recorded count was 43 individuals in 2016 (Labh, 2023). The dolphin numbers in this river vary over time as they migrate between the Kauriala and Geruwa rivers.

In the current study, a total of 30 Km was surveyed in the Geruwa River along with Kauriala. The survey was completed in one day, recording 21 (14-28) Ganges River Dolphins with an encounter rate of 0.7/km. Overall, the Geruwa and Kauriala rivers play a vital role in supporting the diverse and rich wildlife communities of the region, and efforts to protect and conserve these rivers are critical for ensuring the survival of these important species.

4.7 Ghaghara-Sarayu

Karnali is called Mapcha Khambab River in Tibet which becomes Karnali in Nepal and Ghaghara in India (Baral, 2020). The Karnali River originates from Mount Kailash, splits into the Geruwa and Kauriala branches, and reunites at the Girija Barrage in India. The Government of Uttar Pradesh proposed to rename the Ghaghara River to the Sarayu River. The cabinet has approved renaming the stretch of Ghaghara between Chandpur, Katauli in Gonda (Uttar Pradesh) to Rewalganj in Bihar. This transboundary Himalayan river travels 1,100 Km from its source in the Tibetan Plateau in China, through the mountains of Nepal, to the confluence in the Indo-Gangetic Plain in India. Ghaghara River, also known as Sarayu in parts of Uttar Pradesh, is a transboundary river that flows through India and Nepal. The river basin covers an area of approximately 127,950 Km^2 (Mohan, 2018).

The Ghaghara River has a complex morphology due to its diverse geological settings. The river basin is composed of different types of rocks, including limestone, sandstone, and shale. It is a perennial river that is fed by snowmelt and monsoon rains. The river has a high flow rate during the monsoon season and experiences frequent floods, causing extensive erosion and sediment transport. The morphology of the Ghaghara River is characterized by its varying width, depth, slope, and meander patterns. The river's width varies from a few meters to several hundred meters, depending on the river's flow and the surrounding topography. The depth of the river also varies, with the deepest points often found in the areas where the river flows through narrow gorges or canyons. The slope of the river is relatively steep in the upper reaches, where the river flows through the Himalayas, and becomes gentler in the lower reaches. The Ghaghara River is also characterized by its meandering pattern, which is caused by the

river's natural tendency to erode its banks on the outer side of bends and deposit sediment on the inner side of bends. The meanders of the river are particularly pronounced in the lower reaches, where the river flows through a broad alluvial plain (Mohan, 2018). The meander patterns of the river have been shaped by both natural and human factors, including geological processes, land-use changes, and river engineering.

The Ghaghara River is an important habitat for a variety of wildlife species, including several endangered and threatened species such as the Gharial, Ganges River Dolphin, and Smooth-coated Otter. The river is also home to several species of fish, including the Golden Mahseer (Kumar *et al*., 2020). The forests and wetlands surrounding the Ghaghara River are also important habitats for a variety of bird species, including several migratory species that travel to the region during the winter months.

A study by Basu in 2001 recorded 246 dolphins in a 505 Km stretch of the river with an encounter rate of 0.49/Km from Kailashpuri Barrage to Dohrighat (Basu, 2001; Singh *et al*., 2021). Basu and Singh (2009), surveyed the river from Mallapur to Barabanki Bahraich Road Bridge and recorded 115 dolphins in a 90 Km segment. A survey conducted by WWF India & UPFD in 2012 counted 231 dolphins from Kailashpuri Bridge to Bali in a 505 Km river stretch. WWF India, TSA India and UPFD carried out a survey in 2015 from Kailashpuri Bridge to Balia in a 519 Km river stretch and recorded 317 dolphins. In 2021, Singh *et al*. carried out a survey from Chalari Ghat to Ayodhya Ghat (107 Km) and recorded 127 dolphins with an encounter rate of 0.90/Km (Singh *et al*., 2021). A more recent investigation conducted by Das *et al*. in 2022, covering approximately 615 Km, estimated around 509 (SE 36) individual dolphins.

Our recent assessment of the Ghaghara River, covering a total of 626 kilometers were surveyed over a period of 14 days, leading to the estimation of 557 (527-587) dolphins and an encounter rate of 0.9/Km.



4.8 Gandak

The Gandak River is a vital tributary of the Ganga, flowing through Nepal and India. The Gandak River originates from the Nhubine Himal Glacier in Mustang, Nepal, and flows through the Terai region before joining the Ganga River in India (Singh, 2018). The river has a total length of 425 Km, of which 80 Km flows through Nepal (Singh, 2018), and the rest flows through India. The basin contains significant mountains (over 8,000 m) namely Dhaulagiri, Manaslu, and Annapurna-I. Kali Gandaki traverses through the Mahabharat range and is joined by a major tributary, Trishuli at Devghat, and then joined by East Rapti River. The river crosses the Shiwalik and is known as Narayani (Gaindakot). The entry point of the river at the Indo—Nepal border is called Triveni which has a confluence with rivers Pachnad and Sonha from Nepal. The Gandak enters India at Maharajganj District of Uttar Pradesh, it passes through Kushinagar District before entering Bihar. The Gandak flows southeast 300 Km across Bihar state through West Champaran, Gopalganj, Saran, and Muzaffarpur districts. It joins the Ganga near Patna just downstream of Hajipur at Sonpur (also known as Harihar Kshetra). The river basin covers an area of approximately 46,000 Km^2, supporting diverse ecosystems such as forests, wetlands, grasslands, and agricultural lands (Singh, 2018).

The Gandak River is an important habitat for a variety of wildlife species in Nepal and India. The river and its surrounding areas provide critical feeding, breeding, and nesting sites for many species, including several endangered and threatened species such as the Gharial, Ganges River Dolphin, and Smooth-coated Otter. The forests and wetlands surrounding the Gandak River are also important habitats for a variety of bird species, including several migratory species that travel to the region during the winter months. Two important protected areas are on the banks of this river system, Chitwan National Park in Nepal and Valmiki Tiger Reserve in India (Maurya & Borah, 2013; Singh, 2018).

In 2008, Sharma (2013) began a comprehensive survey of the Ganges River Dolphin population along a 290 km stretch of the Gandak River, from Balwaghat in Bagaha to Patna, which continued until 2010. Over this period, Sharma reported a dolphin population of 259 (256-275) individuals. In the same year, Choudhary (2010) and Choudhury *et al.* (2012) undertook a pioneering multi-species survey over a 332 km stretch of the Gandak River. They estimated the dolphin population between Valmikinagar Barrage and Patna to be 257 (250-267) individuals. In a study by Smith *et al.* (2012), they noted the occurrence of 47 to 48 Ganges River Dolphins within a 66 km stretch of the Gandak River. This provided additional data for understanding the distribution of the species in this river system.

In 2016 and 2017, the Wildlife Trust of India (WTI) conducted four separate surveys to assess the status of gharials in the Gandak River. During these surveys, they also documented sightings of Ganges River Dolphins. In December 2016, WTI reported spotting 9 to 10 dolphins in a 50 km stretch downstream of the Valmikinagar Barrage. In February 2017, they observed 104 dolphins along a 322 km stretch from Valmikinagar Barrage to Sonpur. Subsequently, in March 2017, WTI reported 13 dolphins in a 102 km section of the river. In another survey conducted between March and April 2017, they documented 81 dolphins in a 321 km stretch. In 2018, WTI (2020) reported the presence of 150 Ganges River Dolphins in the Gandak River. The same year, Kelkar *et al.* (2022) estimated a dolphin population of 175 (155-200), over a 320 km stretch of the Gandak River. In 2020 and 2021, Das *et al.* (2022) conducted a detailed survey of a 295 km stretch of the Gandak River. They observed 152 dolphins and, using modeling techniques, estimated the population to be 231 ± 16, with a range of 199 to 263 dolphins.

In a notable recent development, the presence of Ganges River Dolphins in the Narayani River in Nepal, which had not been reported for a long time, was confirmed. A sighting in November 2022 documented the dolphins between Amaltari Ghat and Triveni in Nepal (Paudel, 2015). Overall, these surveys highlight the varying population estimates and underscore the importance of ongoing monitoring and conservation efforts to protect the Ganges River Dolphin in the Gandak River and its tributaries.

Our Recent survey of river Gandak was completed in eight days, covering 315 Km, leading to the estimation of 442 (415-472) dolphins and an encounter rate of 1.4/Km.


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4.9 Kosi

The Kosi River is a transboundary river that flows through China, Nepal, and India. It is also known as Saptakosi for its seven upper tributaries. It is 720 Km long and drains an area of about 74,500 Km^2 in Tibet, Nepal, and Bihar in India (Rai *et al.*, 2018). The river originates in the high Himalayas and flows through the Kosi floodplain, which is a large alluvial plain created by the river over thousands of years. The Kosi floodplain is known for its unique morphology, with a complex network of channels, levees, and sandbars, which create a dynamic and ever-changing landscape. The river also forms several ox-bow lakes, which provide important habitat for aquatic and terrestrial species. The river has shifted its course for more than 133 Km from east to west in the past 200 years (Chakraborty *et al.*, 2010), and it has seven main tributaries, including the Tamur River, Arun River and Sun Kosi (Agarwal & Bhoj, 1992). The SaptaKosi crosses into northern Bihar where it branches into distributaries before joining the Ganga near Kursela in Katihar district. The shifting of the river's course was found to be random and oscillating in nature (Agarwal & Bhoj, 1992).

The Kosi River is home to a rich diversity of aquatic and terrestrial species, including several endangered and threatened species such as the Gharial and Ganges River Dolphin. Several wildlife reserves are on the banks of the river namely Kosi Wildlife Reserve, Kosi-Tappu National Park in Nepal, and Valmiki Tiger Reserve in India. According to (Khatri *et al.*, 2010), the Kosi River and its associated wetlands provide critical breeding, feeding, and nesting grounds for several migratory bird species. The Kosi-Tappu Wildlife Reserve in Nepal is a significant habitat for several species of mammals, birds, reptiles, and fish.

Sinha (2000) mentioned the occurrence of 22-32 dolphins in 1994 in a 60 Km stretch of Kosi River downstream of the Kosi Barrage (Smith *et al.*, 2012). Sinha and Sharma (2003a) conducted surveys in the Son and Kosi Rivers in 2001 and reported 87 dolphins in a 270 Km stretch of Kosi River from Kosi Barrage to Kursela. WTI (2017) conducted a survey in 2017 in Kosi River in an 80 Km stretch between Dumari Ghat to Kursela and recorded 73 dolphins. Choudhary *et al.*, (2019a) and Choudhary *et al.*, (2019b) surveyed Kosi in 2019 from the Indo-Nepal border to Hati Ghat, and Hati Ghat to Fungo in Bihar respectively. They have reported 82 dolphins in the 86 Km stretch between the Indo-Nepal border to Hati Ghat, and 79 Dolphins in the 72 Km stretch between Hati Ghat to Fungo. Kelkar *et al.* (2022) mentioned the occurrence of 325(300-350) dolphins in the 245 Km stretch of Kosi River between Kosi Barrage to Kursela. The model-based estimate of the Ganges River Dolphin was 272±19 (235-309) for a 235 Km stretch of Kosi River (Das *et al.,* 2022).

Our Recent survey of the Kosi River was completed in six days, covering 242 Km, leading to the estimation of 331 (317-347) dolphins and an encounter rate of 1.4/Km.

4.10 Mahananda

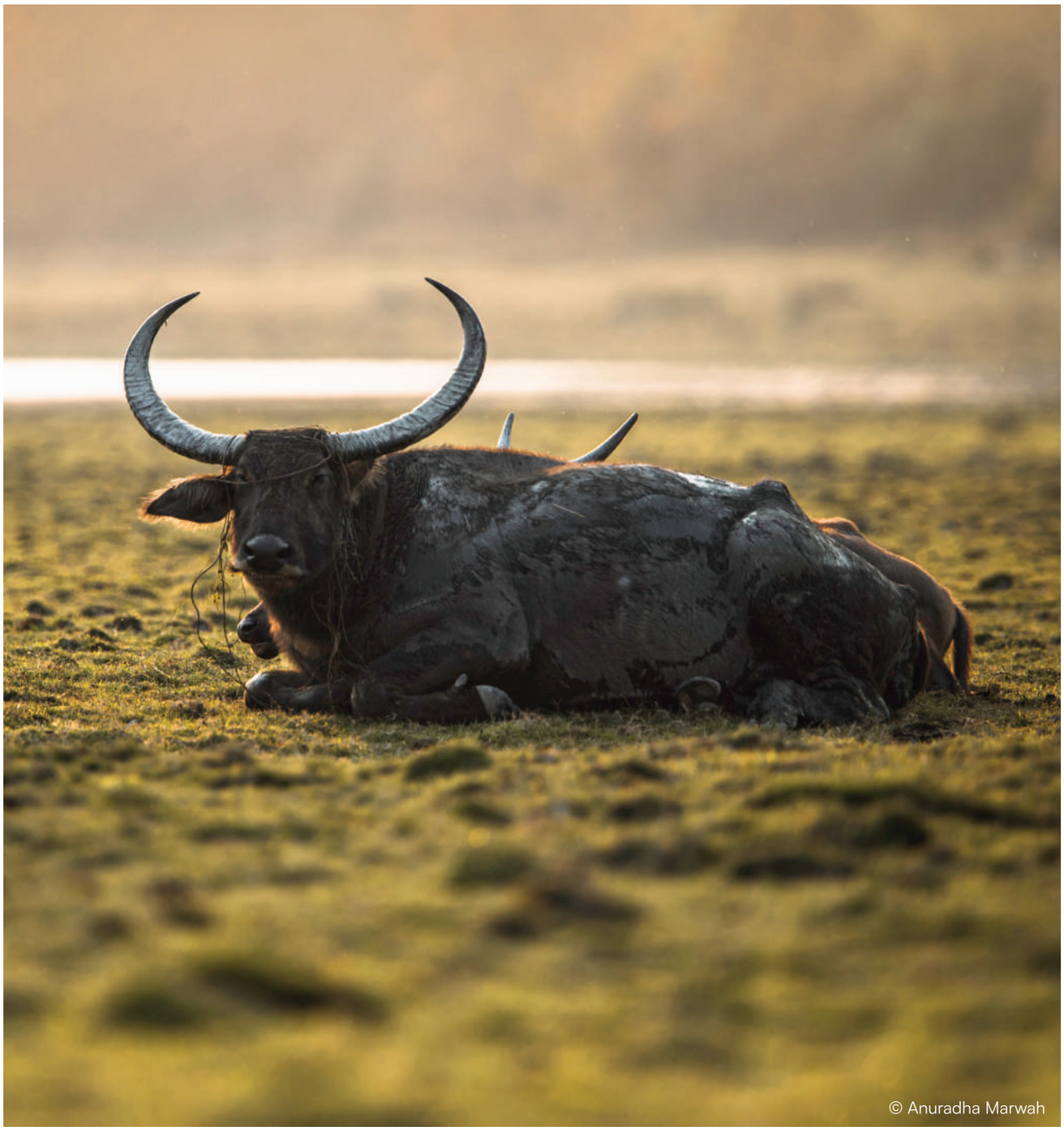
Mahananda River is a transboundary river that flows through India and Bangladesh. It originates in the Himalayas near Kurseong in Darjeeling district, West Bengal, at an elevation of 2,100 m. It flows through the Mahananda Wildlife Sanctuary and descends to the plains near Siliguri, touching Jalpaiguri district. The river then enters Bangladesh near Tentulia in the Panchagarh district, flows for 3 Km, and returns to India.

After flowing through Uttar Dinajpur district in West Bengal and Kishanganj, Purnia, and Katihar districts in Bihar, it enters Malda district in West Bengal. The river divides the Malda district into two regions : the eastern region, consisting mainly of old alluvial and relatively infertile soil, commonly known as Barind, and the western region is further subdivided by the river Kalindri into two areas. The northern area is known as Tal, which is low-lying and vulnerable to inundation during the rainy season. The southern area consists of very fertile land and is thickly populated, commonly known as Diara. Finally, the Mahananda River joins the Ganga River at Rajmahal in Jharkhand. The Mahananda mainstream in India flows through meandering and braided channels with highly dynamic channel course variations brought on by flooding and associated sediment erosion-deposition processes (Momin *et al.*, 2020). The river has a total drainage area of 20,600 Km^2 where the total stretch covered by the river is 360 Km of which 342 Km is in India and the rest flows through Bangladesh (Rangarajan *et al.*, 2019). The Mahananda flows

through steep gorges and valleys before entering the alluvial plains of West Bengal. The river has a total length of about 360 Km, of which 273 Km is in India. The river has a drainage basin of about 11,000 Km^2. The Mahananda River basin supports a rich diversity of flora and fauna and is associated with significant ecological, social, and cultural importance in the region.

Sen *et al.*, (2016) have reported an incident of two dolphins rescued from a shallow water pool in the Donk River, a tributary of the Mahananda River, near Baldihati village in the Kishanganj district of Bihar. The two dolphins were later released in the Mahananda River. Choudhary and Dey (2019) surveyed a 45 Km stretch of Mahananda River between Sonapur Ghat and Behrakola Ghat in 2019 and reported 14 dolphins. During the same period, they also conducted surveys in the Parman, Bakra, Kankai, and Mechi tributaries of Mahananda, and no dolphins were recorded. Kelkar and Dey (2021), surveyed a 250 km stretch of the Mahananda River and observed 190 dolphins, estimating a total of 232 dolphins.

Our recent assessment of the Mahananda River, covering a total of 187 Km was surveyed over a period of 8 days, leading to the estimation of 219 (201-242) dolphins with an encounter rate of 1.2/Km.






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4.11 Rupnarayan River system

The Rupnarayan River forms a network of sub-tributaries including the Damodar, Dwarakeswar, Kangsabati, Shilabati, and Mundeswari Rivers (Das *et al*., 2021). It is considered the most important tributary of the Hooghly River. The Rupnarayan River originates in Dhaleswari, in the Chota Nagpur Plateau, located in the foothills northeast of the town of Purulia. River Shilabati and Dwarakeswar join at Bandar, and the combined flow is known as Rupnarayan, which meets river Mundeswari and Bakshi Canal (a small canal connecting Damodar River) at Bakshi and finally drains into river Hooghly at Geonkhali covering a distance of 78 Km. This river serves as the main drainage for the Trans-Damodar region (Maity & Maity, 2017). A point observation study at 12 stations conducted from 2012-2014 (Chowdhury *et al*., 2016) confirmed the continued occurrence of Ganges River Dolphin in the Rupnarayan River System where, 4±1 dolphins in Gadiara (confluence of Rupnarayan and Bhagirathi-Hooghly), 4±1 dolphins in Kolaghat (East Medinipur) and 5±1 dolphins in Bakshihat (Bakshi Canal- confluence of Rupnarayan, Damodar and Mundeswari) were recorded. On 30th May 2007, a female dolphin entered the river Shilabati from the Rupnarayan during high tide and got stuck in the mud, resulting in death. The model-based estimate of the Ganges River Dolphin was 99±21 for the 80 Km stretch of the Rupnarayan River (Das *et al*., 2022). Except for a few sporadic studies, no comprehensive research or surveys have been conducted focusing mainly on the Ganges River Dolphin population in the tributaries of Bhagirathi-Hooghly specifically the Rupnarayan River network including all the sub-tributaries like Shilabati, Dwarakeswar, Mundeswari and Bakshi Canal. So, to fill in the deficiency of data methodical comprehensive research is required for this river network.

The status survey included the main channel of the Rupnarayan River covering a total length of 79 Km from Bandar (confluence of Shilabati and Dwarakeswar) to Gadiara (confluence of Rupnarayan and Bhagirathi-Hooghly River), 6 Km of Shilabati River (Ghatal to Bandar), 4 Km of Dwarakeswar River (Singhapur to Bandar), 6 Km of Bakshi Canal (Shaifon to Bakshi), and 7 Km of Mundeswari River (Gorur Ghat to Bakshi). Our recent survey of the Rupnarayan River System was completed in three days, covering 102 Km, leading to the estimation of 217 (207-228) with an encounter rate of 2.1/Km.

4.11.1 Rupnarayan

The Rupnarayan River originates as the Dhaleswari in the foothills of the Chhota Nagpur plateau, passes through the town of Bankura where it is known as the Dwarakeswar River, and is joined by the Shilabati River near Ghatal. It finally joins the Hooghly River near Gadiara. It flows for about 260 Km before emptying into the Bay of Bengal. The river passes through the districts of West Medinipur and East Medinipur in West Bengal. The Rupnarayan River is important in West Bengal, as it provides water for irrigation and serves as a source of livelihood for the people living in the surrounding areas. The river is also important for transportation, with several towns and villages located along its banks.

River Rupnarayan approximately has a drainage basin of about 5,870 Km^2 (Chakraborty, 2021). The river flows through a region with different geological formations, including alluvium, laterite, and hard rock formations (Chakraborty, 2021). It has a meandering channel with several sharp bends, and the channel width varies from 10 to 200m (Chakraborty, 2021). The Rupnarayan is a monsoon-fed river with a high discharge during the monsoon season (June to September) and low discharge during the dry season (October to May) (Biswas *et al*., 2015). The river has a mean annual discharge of about 64.4 cubic meters per second (Biswas *et al*., 2015).

The Rupnarayan River has a diverse fish fauna with more than 50 species, including several economically important ones (Bera & Mishra, 2021). The river supports the breeding and spawning of many fish species, which is essential for maintaining their populations (Bera & Mishra, 2021). It is also important for its avian diversity. The river and its surrounding areas provide habitat for more than 150 bird species, and several mammal species, including the Indian Smooth-coated Otter, Fishing Cat, Indian Pangolin (Mishra *et al*., 2015), and Ganges River Dolphin. The river supports several species of turtles and snakes, including the Indian Rock Python, and King Cobra (Mishra *et al*., 2015).


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In previous surveys, the population of Ganges River Dolphins in the Rupnarayan River was estimated to be around 35-40 individuals (Sinha *et al.*, 2013). The recent model-based estimate was 82 (SE 6) Ganges River Dolphins (Das *et al.*, 2022).

Our recent assessment of the Rupnarayan River, covering a total of 79 Km was surveyed over 2 days, leading to the estimation of 167 (160-175) dolphins with an encounter rate of 2.1/Km.

4.11.2 Shilabati

The river Shilabati originates from the Chak Gopalpur village of Hura block in the Purulia district of West Bengal. The river extends to a length of 350 Km, with a catchment area of 4086 Km^2. It joins with the river Dwarakeswar near Ghatal and flows as the Rupnarayan River in Purulia, Bankura, and Medinipur. Rivers Joypanda, Purandar, Champakhali, and Sasra originate from the left side of Shilabati, and rivers Donai, Kubai, Buriganga, Tamal, and Parang originate from the right side (Roy *et al.*, 2021). Shilabati River is the main cause of flood in the Banka, Khirpai, and Ghatal areas. One of the main causes of flooding in the river is high sinuosity and very low gradient in the lower reaches (Das *et al.*, 2020). It is reported that dolphin entanglements mostly occur in rivers like the Kangsabati, Damodar, and Malta.

Our recent assessment of the Shilabati River, covering a total of 6 Km, resulted in an estimation of 17 (15-18) dolphins with an encounter rate of 2.9/Km.

4.11.3 Mundeswari

Mundeswari River originates as a canal from Ramchandrapur, a village in Madabdihi of the Bardhaman district. It flows past Kaiti Chakbhura through East Medinipur, Hooghly, and Howrah districts and ultimately flows into the Rupnarayan River at Bakshi (Mallick, 2013). It also causes floods in Hooghly, East Medinipur, and Howrah districts during the monsoons.

Our recent assessment of the Mundeswari River, covering a total of 7 Km was surveyed over 1 day, leading to the estimation of 12 (11-13) dolphins with an encounter rate of 1.8/Km.

4.11.4 Bakshi Canal

Bakshi Canal bifurcates from the Damodar River in Rashpur and flows through the district of Howrah for about 12 Km before draining into the Rupnarayan River in Bakshi. This canal is referenced in The Bengal Embankment Act of 1873, where a 9.6 km continuous line of embankment was constructed on the left bank of the Bakshi Khal. Except for the study of Chowdhury and Mitra, 2016, no survey for dolphins has been conducted previously.

Our recent assessment of the Bakshi Canal, covering a total of 6 Km was surveyed over 1 day, leading to the estimation of 21 (20-22) dolphins with an encounter rate of 3.6/Km.

4.11.5 Dwarakeswar

One of the longest rivers in the Damodar basin is Dwarakeswar, which is around 214 Km long (Majumder & Dutta, 2014). This river originates in the steep Tilaboni region of the Purulia district and runs from the north to the south, practically splitting the Chhatna Block in half (Nag & Lahiri, 2012). It began with a geographical expansion of the Chota Nagpur plateau in the Purulia District and concluded in the alluvial tract of West Medinipur in West Bengal (Malik & Pal, 2020). It travels through the Purulia, Medinipur, Bankura, Bardhaman, and Hooghly districts along the way before meeting Silai-Rupnarayan at Ghatal (Majumder & Dutta, 2014). Earlier, the Ganges River Dolphin was sighted at the confluence of the Shilai and Dwarkeswar Rivers at a depth of 3.5-4 m (Mitra *et al.*, 2015).

No Ganges River Dolphin was sighted during the current status survey.

4.12 Torsa

The river Torsa in West Bengal is a transboundary river between Bangladesh, India, China, and Bhutan. It originates from the Chumbi Valley in Tibet at an elevation of 7065 m and has a total length of 358 km. It is a snow-fed perennial river and is the second largest river of Dooars region, West Bengal (Sarkar & Pal, 2017). It has a tributary known as Buri Torsa in the district and meets with Jaldhaka. Ghargharia River meets with Torsa in the Tufanganj subdivision. Near Deocharai and Balarampur, Torsa meets with the river Kaljani and then flows to Bangladesh and merges with Brahmaputra (Koushlesh *et al.*, 2017). The Torsa catchments also receive heavy monsoon rainfalls which fierce on river flow causing very rapid rise in water level within a short period (Sharma, 2011).

Our recent assessment of the Torsa, covering a total of 55 Km was surveyed over a period of 2 days, leading to the estimation of one dolphin with an encounter rate of 0.02/Km.

4.13 Churni

The Churni is a distributary of Mathabhanga that flows through the Nadia district, West Bengal, and meets the Bhagirathi-Hooghly at Shibpur. The general landscape is mostly vast and characterized by alluvial terrain. The river bed is dumped with sediment and is full of small, often submerged river islands. Mathabhanga-Churni flows in the lower reach of the Bhagirathi-Hooghly; therefore, it is replenished regularly by the tidal flow (Dutta, 2018). It covers about a stretch of 54 Km. River Churni is one of the primary sources of fresh water in the district and also a major source of livelihood for the fishermen's communities.

Our Recent assessment of the Churni River, covering a total of 10 over 1 day, leading to the estimation of 7 dolphins with an encounter rate of 0.7/Km.

4.14 Kaljani

The Kaljani River, a tributary of the Torsa River, is formed by the combined waters of the Alaikuri and Dima at the Western Dooars of Alipurduar subdivision. Both the rivers originate in Bhutan hills (Majumdar, 1977). The Kaljani River meets with Torsa and Ghargharia near Deocharai. It has a good depth and is about 1 Km wide. The peak discharge of the river at Maruganj is 87,364 cusec. Major tributaries of Kaljani are Dima, Nonai, etc. The major portion of the river flows through West Bengal.

This assessment of the Kaljani River, covering a total of 21 km over 1 day, leading to the estimation of 5 dolphins with an encounter rate of 0.3/Km.

4.15 Haldi

Haldi River is a tributary of Hooghly River flowing through East Medinipur district of West Bengal. The Kangsabati River joins the Keleghai River in Purba Medinipur district to form the Haldi River. It is 24 Km in length. It is the last major river to flow into the Hooghly before the latter flows into the sea. The Haldi joins the Hooghly at the industrial town of Haldia (Maity *et al.*, 2020).

This assessment of the Haldi River, covering a total of 19 Km was surveyed over 1 day, leading to the estimation of zero dolphin.

4.16 Brahmaputra

The Brahmaputra River is a transboundary river that flows through Tibet, Northeastern India, and Bangladesh. It is known by various names, such as the Brahmaputra in Assam, Yarlung Tsangpo in Tibet, Siang/Dihang in Arunachal, and Jamuna in Bangladesh. It ranks as the 9th largest river in the world by discharge and the 15th longest. It is amongst the largest silt-carrying rivers along with the Amazon and Ganga. The river originates in the Manasarovar Lake region near Mount Kailash in Tibet, known as the Yarlung Tsangpo. It flows through southern Tibet, breaking through the Himalayas in impressive gorges,



including the Yarlung Tsangpo Canyon, and enters Arunachal Pradesh in India. The Dihang River of Arunachal Pradesh meandering from its mountainous origins, changes course towards the southeast and flows into a lower-lying basin upon entering the northeastern state of Assam. In close proximity to the town of Sadiya, the river takes another turn, this time heading southwest. Here, it merges with two mountain streams, the Lohit and the Dibang. From there, it flows through Assam as the Brahmaputra and continues south into Bangladesh as the Jamuna, where it merges with the Ganga (Padma in Bangladesh) in the vast Ganges Delta. Padma and Jamuna, after their confluence (with each other) and with Meghana, ultimately empty into the Bay of Bengal. The Brahmaputra is approximately 3,969 Km long and plays a vital role in irrigation and transportation in the region. The river is prone to severe flooding during the spring when the Himalayan snow melts and during monsoon in Assam and Bangladesh, with an average discharge of about 19,800 cubic meters per second and floods reaching approximately 100,000 cubic meters per second. There are five dams and hydropower stations in Tsangpo, China. At present, there are no dams on the Brahmaputra in India or Bangladesh (Prabhu, 2023; Saikia, 2019).
The Brahmaputra is known as one of the largest braiding rivers in the world where 83% of the river is braided in Assam. The braiding of a river fluctuates with changes in water discharge, leading to irregular movement of the bedload. Excessive discharge often results in increased erosion. The Brahmaputra is the third-longest and fourth-largest river in the world in respect of annual discharge with an average discharge of approximately 20,000 cubic meters per second (Immerzeel, 2008). The river has an average annual sediment load of about 735 million metric tonnes and a specific flood discharge of 0.149 m3/s/Km^2 (Datta & Singh, 2004). Aggradation and degradation are the prominent features of the river Brahmaputra. The aggradation process increases the elevation of the river bed because of an increase in sediment load more than the river can transport.

The first status survey of Ganges River Dolphin in Brahmaputra River was conducted in 1993 by Mohan *et al.* (1997), which estimated a total population of the species at 400 in the entire river (Mohan *et al.*, 1997; Bordoloi & Saharia, 2021). Another survey was carried out during April 1995 and March 1998 in the upper stretches of Brahmaputra, from Sadiya to Dhansirimukh, which was divided into four distinct sectors (Biswas & Baruah, 2000). The 1995-96 and 1997-98 surveys encountered a drop in numbers to 28 and 24, respectively. The trend in neonates and juveniles together was 36.84% of the total population in 1992-93, 27.43% in 1995-96 and 33.33% in 1997-98 (Biswas & Baruah, 2000). A survey was conducted in Brahmaputra between mid-February to the onset of April in 2005, along with Subansiri and Kulsi. The study area was divided into seven distinguished segments with a length ranging between 117 Km to 134 Km. A total of 197 dolphins (27 calves, 32 sub-adults and 138 adults) were recorded from 82 locations of the Brahmaputra River. The highest encounter rate was calculated in the segments Pancharatna to Indo-Bangladesh border (0.39/Km), and Dhansirimukh to Gabhorumukh (0.32/Km) (Wakid, 2009). The lowest encounter rate was witnessed in the stretch from Balijan to Dikhowmukh with merely 0.13/Km. In case of the calves and subadults, the highest encounter was found in Dhansirimukh to Koliabhumura (0.06/Km), whereas that of adults was found in Jugighopa to Dhubri (Indo-Bangladesh border) (0.31/Km) (Wakid, 2005; Wakid, 2009).

In 2008, a dolphin expedition was carried out from Assam-Arunachal border till India-Bangladesh border. A total of 212 individuals were counted with an encounter rate of 0.24/Km. Highest abundance of dolphins was recorded in the stretch from Tezpur to Guwahati with 19.8% of total dolphin population of Brahmaputra River. A notable increase in the total count of Ganges River Dolphin in the Brahmaputra River system was observed from 250 in 2005 to 264 in 2008 (Wakid & Braulik, 2009).

This assessment of the Brahmaputra River, where a total of 885 Km was surveyed over a period of 15 days, leading to the estimation of 584 (558-610) dolphins with an encounter rate of 0.7/Km (Table 3.1).

4.17 Subansiri

The Subansiri River is a trans-Himalayan river, known as Chayul Chu in Tibet, and it acts as a significant tributary of the Brahmaputra River. The name "Subansiri" is derived from the Sanskrit word "*svarna,*" signifying 'gold.' Originally, the name was used only after the confluence of the Chayul Chu and Tsari Chu rivers at Gelensiniak. Its course spans Tibet's Lhuntse County and, the Indian states of Arunachal Pradesh and Assam. Stretching about 518 Km with a drainage basin covering 32,640 Km^2, it contributes

a substantial 7.92% to the Brahmaputra's total flow. It enters India near Taksing and winds through Miri Hills, eventually joining the Brahmaputra River at Jamugurighat in Assam (Prabhu, 2023). The Subansiri River is significant in the region and has lent its name to two districts in Arunachal Pradesh: Upper Subansiri and Lower Subansiri. It exhibits a variable discharge, with a maximum of 18,799 cubic meters per second and a minimum of 131 cubic meters per second. The 1950 Assam earthquake caused a blockage in the flow of Subansiri at Gerukamukh. After three days the blockade broke causing a massive flash flood (Prabhu, 2023).

The first-ever survey on the Ganges River Dolphin in the mainstream Brahmaputra River system and its tributaries, Kulsi and Subansiri, was conducted by Mohan *et al.* (1997) in 1992-93. Most of the sightings were made in the river meanderings (42%). The study recorded altogether 25 dolphins in the Subansiri River in 1993, with an encounter rate of 1.13/Km from Dikrangmukh to Subansirimukh (22 Km). There was a gradual increase in their numbers from 21 to 29, from 2006 to 2009 (Baruah *et al.*, 2012). In the 2005 survey, Wakid recorded a best estimate of 26 (SD± 1.68, group size 1-6) dolphins in a 108 Km stretch of the river (Wakid, 2009), whereas, in the 2008 survey, the team recorded a best estimate of 23 dolphins in 94 Km stretch with an encounter rate of 0.24/Km (Wakid & Braulik, 2009). Another extensive study was conducted in 2007, which estimated 23 dolphins in Subansiri (Bordoloi & Saharia, 2021). The Wildlife Institute of India, using the double platform mark-recapture method estimated 48±6 in the Suban- siri River in January 2018. 93 Km of the river was surveyed from Katai Sapori to Brahmaputra Confluence with an encounter rate of 0.52/Km (Qureshi *et al.*, 2018).

This assessment of the Subansiri River, covering a total of 91 Km survey over 2 days, lead to the estimation of 22 (20-24) dolphins with an encounter rate of 0.2/Km.

4.18 Kulsi

The Kulsi River, a tributary of the Brahmaputra River, begins its journey in the West Khasi Hills of Meghalaya. In its upper course, this river is known as the Khir River. After traversing a distance of 12 Km in Meghalaya, it enters the Kamrup district of Assam, where it is called Kulsi. The confluence between the Kulsi and the Brahmaputra River occurs at Nagarbera in the Kamrup district of Assam (Prabhu, 2023). The river is about 76 Km in length from Kulsi village to the Brahmaputra Confluence.

The earliest survey of river dolphins was conducted by Mohan *et al.*, (1998), where they recorded 24 and 12 dolphins in 1992 and 1995 respectively. Wakid (2005) reported the presence of 27 dolphins in the river. Subsequently, surveys conducted in 2012 and 2020 recorded 17 and 29 dolphins respectively (Qureshi *et al.*, 2021a). The population is seen to fluctuate and is found to be stranded in deep pools at various locations during summer.

This assessment of the Kulsi River, covering 61 Km survey over 2 days, resulted in a population estimate of 20 (19-21) dolphins with an encounter rate of 0.3/Km.

4.19 Beki

The Beki River, alternatively known as the Kurissu River, originates from the Himalayan glacier in Bhutan. It journeys southwards for 83 Km and eventually confluence with the Brahmaputra River in Assam. River Beki is one of the major north-bank tributaries of Brahmaputra that flows from north to south through the Barpeta district (Kalita *et al.*, 2015).

Despite the known presence of dolphins in the Beki River, there is currently no scientific data available regarding their population and status. A distribution study conducted in 2005 in the Brahmaputra and its adjacent tributaries did not record dolphin presence in the Beki River (Wakid, 2005).

This assessment of the Beki River (Bridge to Sonabari, Beki-Brahmaputra Confluence), where total of 45 Km was surveyed over a period of 1 day, lead to the estimation of 4 dolphins with an encounter rate of 0.1/Km.

4.20 Kopili

The Kopili River originates in the Meghalaya plateau (Borail range), courses through Central Assam, as well as the hilly regions of Assam, ultimately merging with the Brahmaputra. In Assam, it serves as a drainage basin for the districts of Karbi Anglong, Dima Hasao, Kamrup, and Nagaon. With a total length of 290 Km and an expansive catchment area spanning 16,420 Km^2, the Kopili River stands out for its numerous striking waterfalls (Mahanta, 2012). The Kopili River boasts a diverse aquatic ecosystem, hosting up to 54 different fish species.

This assessment survey of the Kopili River, covering total of 91 Km over 2 days, lead to the estimation of 5 dolphins with an encounter rate of 0.1/Km.

4.21 Barak

The Barak River originates at Liyai Kullen Village in Manipur, where a majority of the population belongs to the Poumai Naga tribe. The river bears the name Vourei in its upper reaches. As it meanders from its source, it is joined by various tributaries, including the Vehrei from Phuba Village, as well as the Gumti, Howrah, Kagni, Senai Buri, Hari Mangal, Kakrai, Kurulia, Balujhuri, Shonaichhari, and Durduria streams. The river's course takes it westward through Manipur, forming the border with Nagaland, and then it flows southwest into Assam. Eventually, the river crosses the Indian border and enters Bangladesh at Bhanga Bazar. The Barak River embarks on a 900 Km journey, traversing the Indian states of Manipur, Nagaland, Mizoram, and Assam. Upon entering Bangladesh, it splits into the Surma River and the Kushiyara River, only to merge again and give rise to the Meghna River. This convergence ultimately forms the Ganges Delta alongside the Ganga and Brahmaputra Rivers, culminating in its outflow into the Bay of Bengal.

Of its total length, 524 Km are situated within India, 31 Km mark the Indo-Bangladesh border, while the remaining stretch flows through Bangladesh. The upper navigable section, spanning 121 Km between Lakhipur and Bhanga, has been declared National Waterway 6 (NW-6) since 2016. The river basin covers 52,000 Km^2, with the majority, 41,723 Km^2, within India, constituting approximately 1.38% of the country's total land area.

Notably, resident dolphin populations currently thrive in the deep pools of the Kushiyara River along the Indo-Bangladesh border (Mazumder *et al.*, 2014; Nath & Dhar, 2015). In the survey conducted in 2016 by the Double Observer method covering a 90 Km length of the river stretch from the Assam-Manipur border to Karimganj (Indo-Bangladesh border), no dolphins were found in the river (Choudhury *et al.*, 2019).

During our recent assessment of the Barak River covering a total of 124 Km over three days, no dolphins were sighted, indicating its local extinction.

4.22 Beas

The Beas River originates from the Pir-Panjal range near Rohtang Pass, emerging at an elevation of 4,361 m above sea level from two sources Beas Kund (4060 m asl) on the south and a cavern, and Beas Rishi (4350 m asl). River Beas is one of the major rivers of the Indus River system. This river originated from the southern slope of Rohtang Pass within the North-Western Himalayas. The river courses in a south-easterly direction, occupying a wide U-shaped valley upstream of the location known as Bandrol. The river has a total catchment area of 12,560 Km^2 with a total length of 460 Km covering the states of Himachal Pradesh and Punjab. In Punjab, this river enters Talwara and covers 185 Km by flowing through Amritsar, Kapurthala, and finally confluence with Sutlej River at Harike Pattan, Tarn Taran.

The name 'Beas' as we know it today appeared in the imperial gazetteer of India in 1908, which documented the river's tributaries at that time. The primary tributaries were the Chakki and Bein. The Chakki gathered waters from the Chamba hills and met the Beas near Mirthal, while the Bein, formerly known as Black (Siydh) Bein, originated in the Shiwaliks and joined the Beas a few miles above its confluence with the Sutlej (Frowde, 1908).

Furthermore, the river boasts remarkable biodiversity and is home to two prominent Ramsar sites: the Pong Dam Reservoir and the Harike Wetland. The Pong Dam Reservoir, situated behind the Pong Dam, was built in 1975 and earned recognition as 'Wetlands of International Importance' under the Ramsar Convention in 2002 due to its remarkable diversity. It also serves as a temporary haven for winter migratory birds (Malik & Rai, 2019). The river eventually meets the Sutlej River at Harike, where another wetland known as Harike Wetland came into existence. This wetland received its Ramsar designation in 1990 (Mabwoga & Thukral, 2014).

The Beas River plays a vital role as it provides essential habitats for over 500 species of birds, serving as a seasonal haven for both summer and winter migratory waterfowl (Kumar & Kler, 2021). Furthermore, the river sustains various types of freshwater turtles, including the Indian Flap-shelled Turtle, Ganges Soft-shelled Turtle, Narrow-headed Softshell Turtle, Crowned River Turtle, Spotted Pond Turtle, and Brown Roofed Turtle. The Harike and Beas Conservation Reserve, in conjunction, offer a nurturing environment for over 90 fish species (RIS, 2020). Recognizing its ecological significance, the river Beas was accorded the status of a conservation reserve in 2017 by the Government of Punjab (Action Plan for Clean River Beas, 2019). In 2019, it was also designated as a Ramsar site (RIS, 2020), underscoring its international importance for wetland conservation. To further safeguard this precious ecosystem, the Government of Punjab has developed an action plan, managed by the Directorate of Environment and Climate Change within the Department of Science, Technology, and Environment (Yumnam *et al*., 2021).

The only surviving population of Indus River Dolphins in India is found in the Beas River in Punjab, while the majority of the species is found in the mainstream of the Indus, which flows through Pakistan. While they were once found throughout the Beas and Sutlej rivers in the plains of Punjab (Anderson, 1878), their population drastically declined and was thought to be extinct in India. However, a remnant population of Indus dolphins was discovered by the Punjab Forest Department and the World-Wide Fund for Nature (WWF-India) in 2007 (Behera *et al*., 2008). Informal interviews with locals revealed that the dol- phins, locally called Bhulan ("Bul'ha" meaning lips in Punjabi possibly depicting its long rostrum), have been present in the Beas River for at least the past few decades (Behera *et al*., 2008).

Our Recent assessment of the Beas River, covering 101 Km survey over 3 days, lead to the estimation of 3 dolphins with an encounter rate of 0.03/Km.


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TABLE 4.1

Survey details in mainstream Ganga, Brahmaputra, Barak, Beas and their tributaries.

River	Stretch	Distance (in Km)	Survey method	Survey months	Duration (days)	Effort (in hours)
Ganga	Mainstream Ganga	2422	Boat in tandem (Bijnor -Vindhyachal) and Double observer (Vindhyachal - Ganga Sagar)	December, 2021 - March, 2023	65	259 hrs. 15 min
	Chambal	242	Boat in tandem	10th- 16th January, 2022	7	30 hrs.
	Sharda	246	Boat in tandem	17th -22nd November, 2022	5	25 hrs. 56 min
	Yamuna	536	Boat in tandem	15th November-1st December, 2022	13	48 hrs. 14 min
	Rapti	532	Boat in tandem	3rd -15th December, 2022	12	52 hrs. 45 min
	Geruwa	17	Boat in tandem	25th November, 2022	1*	1 hrs. 48 min
	Kauriala	13	Boat in tandem	25th November, 2022	1*	1 hrs. 13 min
	Ghaghara	626	Boat in tandem and Double observer	16th-28th November, 2022	14	67 hrs. 49 min
	Mahananda	187	Boat in tandem	26th December, -2022-5th January ,2023	8	26 Hrs. 9 min
	Kosi	242	Double observer	13th - 18th December, 2022	6	29 hrs. 52 min
	Gandak	315	Boat in tandem	15th -23rd January, 2023	8	40 hrs.
	Rupnarayan	79	Double observer	6th April and 21st September, 2022	2	7 hrs. 2 min
	Mundeswari	7	Double observer	22nd September, 2022	1*	45 min
	Bakshi canal	6	Double observer	22nd September, 2022	1*	46 min

	Shilabati	6	Double observer	21st September, 2022	1*	38 min
	Dwarakeswar	4	Double observer	21st September, 2022	1*	33 min
	Torsa	55	Double observer	11thand 21st September, 2022	2	5 hrs. 15 min
	Kaljani	21	Double observer	13th September, 2022	1	2 hrs. 56 min
	Churni	10	Double observer	18th September, 2022	1	1 hr. 24 min
	Haldi	19	Double observer	23rd September, 2022	1	1 hr. 44 min
	Sundarbans	1524	Double observer	02nd -26th February and 10th-25th February, 2023	34	115 hrs. 20 min
Overall Ganga		**7109**	**Boat in tandem & Double Observer**	**November 2022-March 2023**	**182**	**719 hrs. 24 min**
Brahmaputra	**Mainstream Brahmaputra**	885	Double observer	1st -17th March, 2022	15	89 hrs.
	Subansiri	91	Double observer	27th-28th March, 2022	2	7 hrs.
	Kulsi	61	Boat in tandem	3rd-4th April, 2022	2	9 hrs.
	Beki	45	Double observer	20th March, 2023	1	4 hrs. 22 min
	Kopili	91	Double observer	17th -18th March, 2023	2	9 hrs. 3 min
Barak	**Barak**	124	Double observer	19th-21st march, 2023	3	15 hrs. 28 min
Overall Brahmaputra & Barak		**1297**	**Boat in tandem & Double Observer**	**1st -21st March, 2022-23**	**25**	**133 hrs. 50 min**
Beas		101	Boat in tandem	28th - 30th November, 2021	3	12 hrs.
Overall Effort in Rivers		**8507**	**Boat in tandem & Double observer**	**November, 2021 - March, 2023**	**210**	**865 hrs. 14 min**

TABLE 4.2

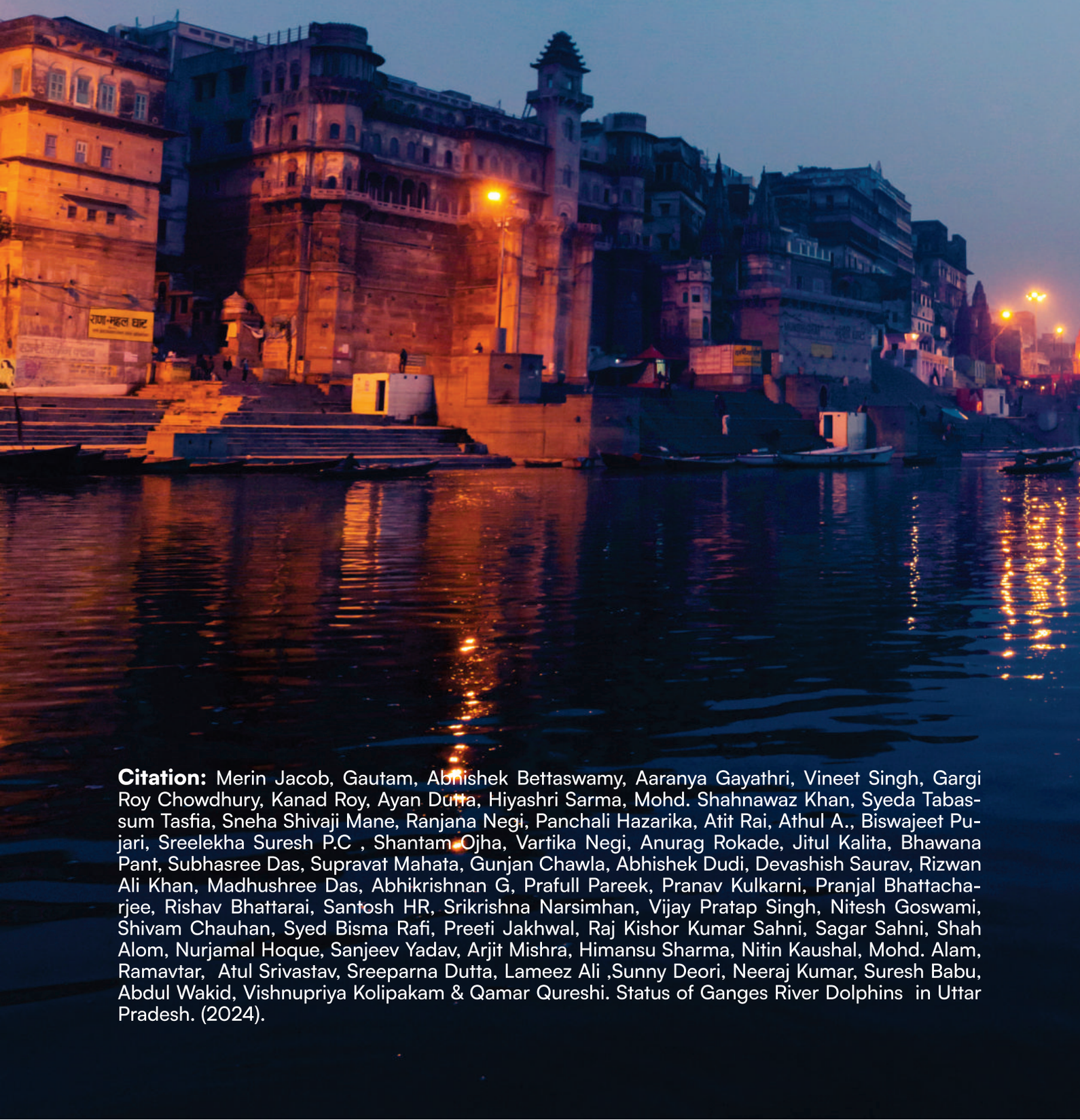
Population estimates of mainstream Ganga, Brahmaputra, Beas and their tributaries.
N_{OA} is the observer and availability corrected population estimate and ER_{OA} is the observer and availability corrected encounter rate (per Km).

River	N_{OA}	ER_{OA}
Ganga	3275 (3107-3445)	1.3
Chambal	298 (278-320)	1.2
Sharda	58 (50-66)	0.2
Yamuna	104 (96-112)	0.2
Rapti	152 (143-161)	0.3
Geruwa	14 (11-17)	0.8
Kauriala	7 (5-11)	0.6
Ghaghara	557 (527-587)	0.9
Gandak	442 (415-472)	1.4
Mahananda	219 (201-242)	1.2
Kosi	331 (317-347)	1.4
Rupnarayan	167 (160-175)	2.1
Mundeswari	12 (11-13)	1.8
Bakshi canal	21 (20-22)	3.6
Shilabati	17 (15-18)	2.9
Dwarakeswar	0	0
Torsa	1	0.02
Kaljani	5	0.3
Churni	7	0.7

Haldi	0	0
Sundarbans	2	0.001
Brahmaputra	584 (558-610)	0.7
Subansiri	22 (20-24)	0.3
Kulsi	20 (19-21)	0.3
Beki	4	0.1
Kopili	5	0.1
Barak	0	0
Beas	3	0.03



V. UTTAR PRADESH



Citation: Merin Jacob, Gautam, Abhishek Bettaswamy, Aaranya Gayathri, Vineet Singh, Gargi Roy Chowdhury, Kanad Roy, Ayan Dutta, Hiyashri Sarma, Mohd. Shahnawaz Khan, Syeda Tabassum Tasfia, Sneha Shivaji Mane, Ranjana Negi, Panchali Hazarika, Atit Rai, Athul A., Biswajeet Pujari, Sreelekha Suresh P.C , Shantam Ojha, Vartika Negi, Anurag Rokade, Jitul Kalita, Bhawana Pant, Subhasree Das, Supravat Mahata, Gunjan Chawla, Abhishek Dudi, Devashish Saurav, Rizwan Ali Khan, Madhushree Das, Abhikrishnan G, Prafull Pareek, Pranav Kulkarni, Pranjal Bhattacharjee, Rishav Bhattarai, Santosh HR, Srikrishna Narsimhan, Vijay Pratap Singh, Nitesh Goswami, Shivam Chauhan, Syed Bisma Rafi, Preeti Jakhwal, Raj Kishor Kumar Sahni, Sagar Sahni, Shah Alom, Nurjamal Hoque, Sanjeev Yadav, Arjit Mishra, Himansu Sharma, Nitin Kaushal, Mohd. Alam, Ramavtar, Atul Srivastav, Sreeparna Dutta, Lameez Ali ,Sunny Deori, Neeraj Kumar, Suresh Babu, Abdul Wakid, Vishnupriya Kolipakam & Qamar Qureshi. Status of Ganges River Dolphins in Uttar Pradesh. (2024).



UTTAR PRADESH

NUMBER OF RIVERS SURVEYED

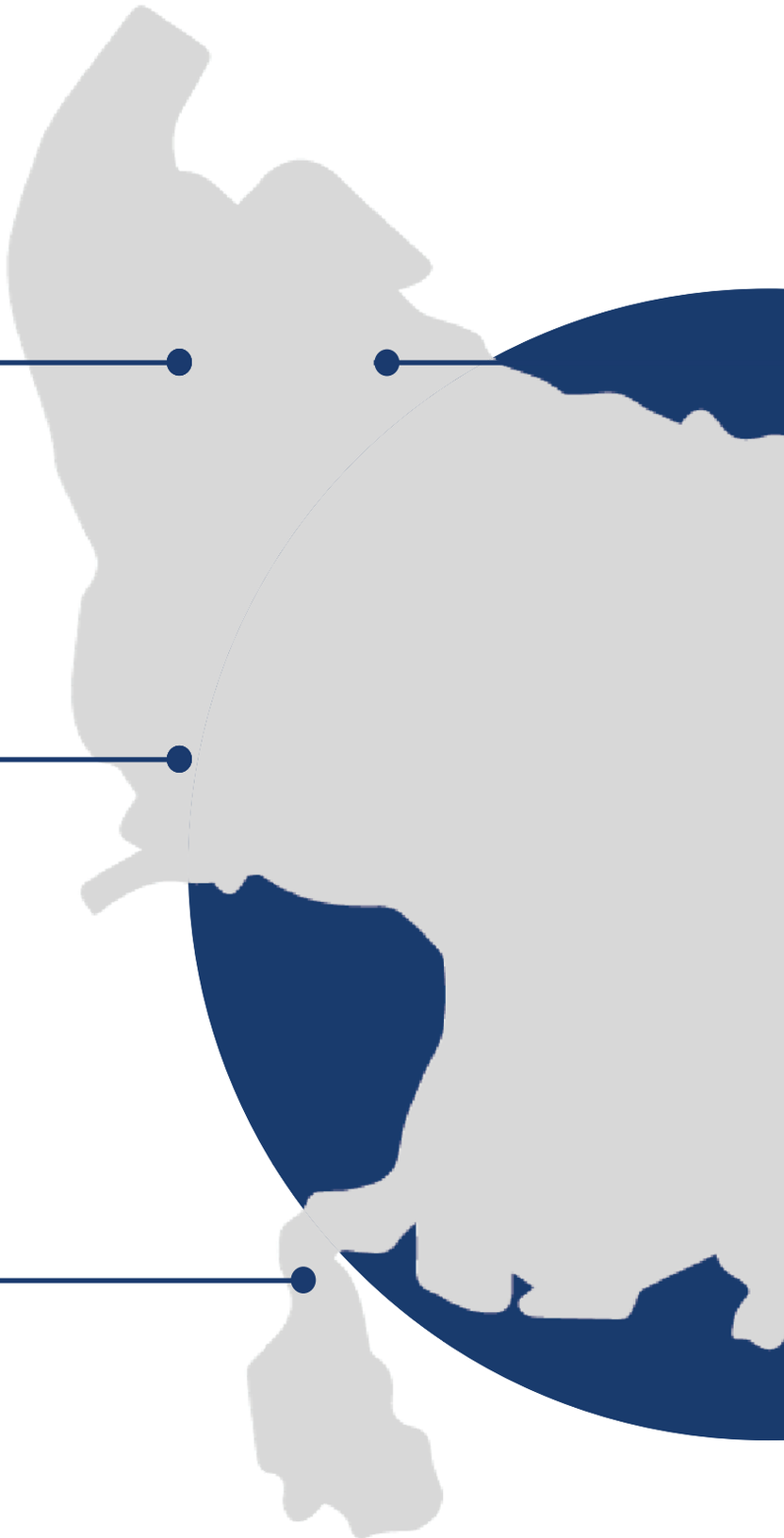
8

NUMBER OF KILOMETERS SURVEYED

3453

NUMBER OF SURVEY DAYS

86



LEAST COUNT

1898



POPULATION ESTIMATE

2397 (2251-2548)

5.1 Background

The landscape along the Ganges River in Uttar Pradesh was home to to lush green jungles and swamps and supported a diverse range of wildlife including rhinos, tigers, buffaloes, and barasingha. However, it has undergone drastic changes, as much of these forests have been lost, impacting the protected areas and relict populations. The advent of the industrial age has altered water flow regimes, and river morphology, and changed water quality, all of which is affecting the aquatic ecosystem in a significant manner.

5.2 Study Area

The entire stretch of River Ganga is divided into three portions (i) the upper stretch ranges from its origin-Gomukh to Haridwar (294 Km), (ii) the middle stretch ranges from Haridwar to Varanasi (1082 Km), (iii) the lower stretch starts from Varanasi and ends in the Bay of Bengal in West Bengal (1134 Km) (NMCG, 2010).

In the state of Uttar Pradesh, based on previous information on the presence of dolphins, it was established that the mainstream of Ganga where dolphins are distributed extends from Bijnor Barrage to Chausa and its tributaries in Uttar Pradesh-Yamuna, Chambal, Sharda, Ghaghara, Rapti and Geruwa - Kauriala. This total length of 3453 Km (including the shared distance between Ghaghara, Chambal River between Uttar Pradesh and part of Gandak River which flows through Uttar Pradesh) was surveyed in 86 days (Figure 5.1). In the mainstream, the total length of 1308 Km was surveyed in 36 days, and 2145 Km of tributaries in 50 days (Table 5.1). Babai River was not surveyed due to navigability issues, Babai River and the link canals report limited seasonal presence of dolphins.

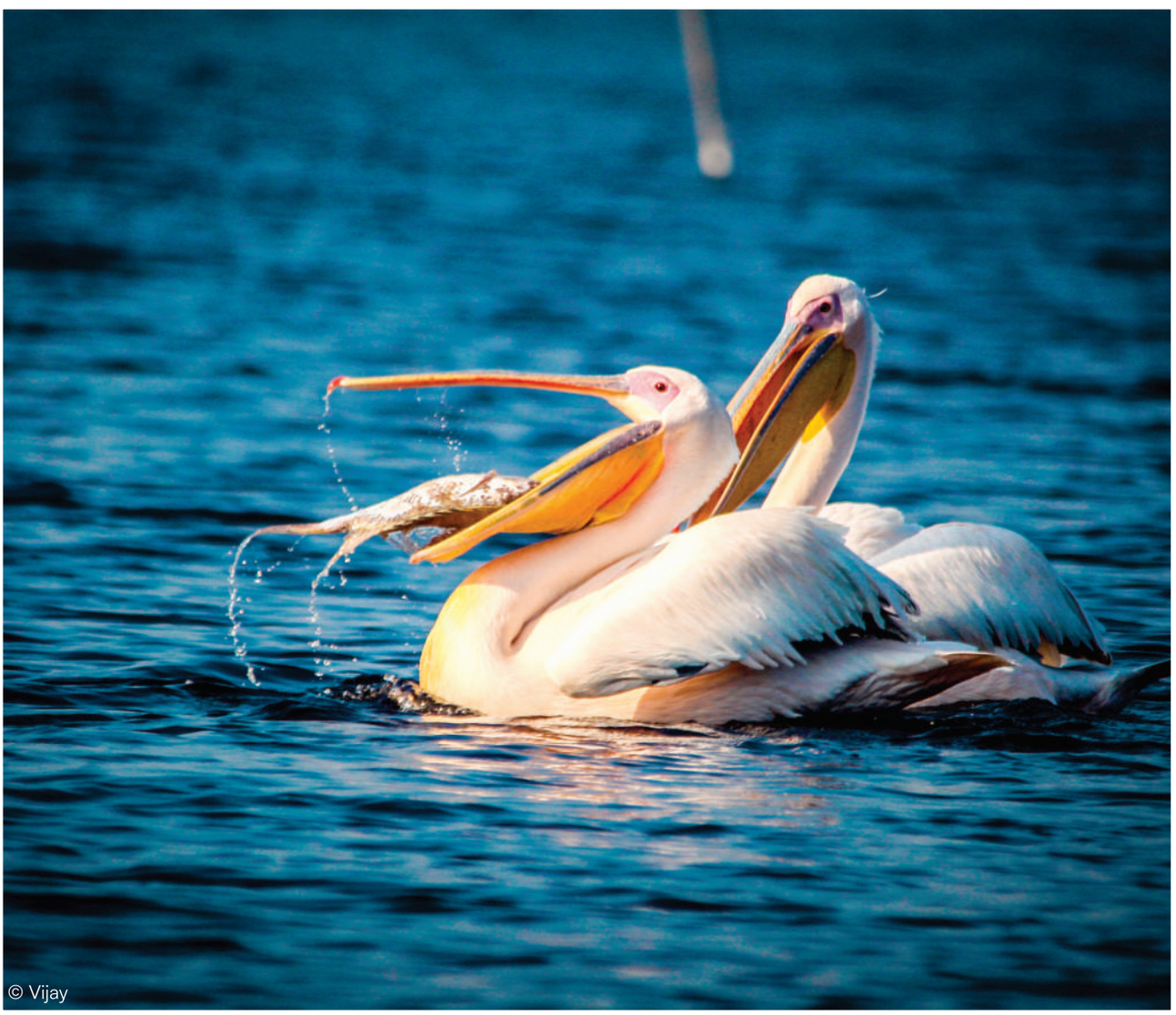


FIGURE 5.1

Ganga River from Bijnor to Revalganj in mainstream Ganga and its tributaries Chambal, Yamuna, Ghaghara, Sharda, Rapti, Geruwa- Kauriala, and part of Gandak River in Uttar Pradesh.

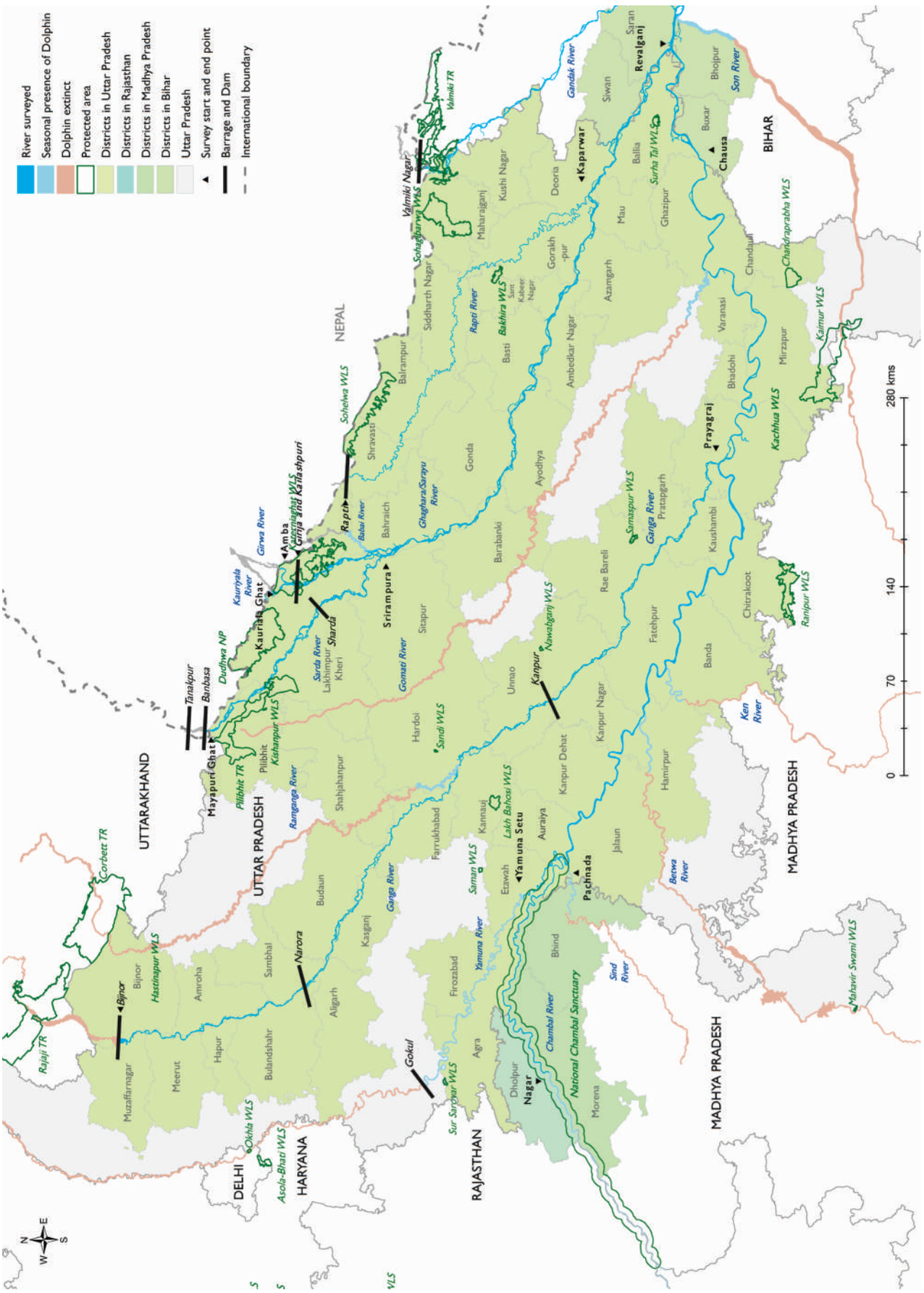


TABLE 5.1

Effort and method used for the Ganges River Dolphin survey from Bijnor to Revalganj in mainstream Ganga and its tributaries Chambal, Yamuna, Ghaghara, Sharda, Rapti, Geruwa - Kauriala, and part of Gandak River in Uttar Pradesh.

**Marked Day, Hrs and Km are those shared between different states*

***96 Km of the Ghaghara River is shared between Uttar Pradesh and Bihar, *99 Km of Chambal is shared between Uttar Pradesh and Madhya Pradesh, *1 day of survey is shared between Geruwa - Kauriala**

State	River	Stretch	Method	Distance surveyed (in Km)	Survey dates	Survey days	Total effort (in hrs.)
Uttar Pradesh	Ganga	Bijnor Barrage - Narora Barrage	Boat in tandem	183	4th-8th December, 2021	5	22 hrs. 8 min
		Narora Barrage - Kanpur Barrage	Boat in tandem	366	11th- 20th December, 2021	9	43 hrs. 24 min
		Kanpur - Vindhyachal	Boat in tandem	380	5th-20th December, 2021	13	43 hrs. 16min
		Vindhyachal - Chausa	Double observer	260	1st – 8th March, 2022	7	24 hrs.
		Chausa - Revalganj	Double observer	119*	9th -10th March ,2022	2*	11 hrs.
	Chambal	Pinahat - Bhind	Boat in tandem	99*	13th -15th Jan, 2022	3*	11 hrs*.
		Bhind - Pachnada	Boat in tandem	47	15th – 16th Jan,2022	2	8 hrs.
	Sharda	Mayapurighat (Lagabhaga)- Sharda- Ghaghara Confluence (Srirampurva)	Boat in tandem	246	17th -22nd November ,2022	5	25 hrs. 56 min
	Yamuna	Yamuna Setu (Etawah)-Sangam (Prayagraj)	Boat in tandem	536	15th November-1st December,2022	13	48 hrs. 14 min
	Rapti	Rapti Barrage - Rapti - Ghaghara Confluence	Boat in tandem	532	3rd -15th December, 2022	12	52 hrs. 45 min
	Geruwa	Amba - Kailashpuri Dam	Boat in tandem	17	25th November, 2022	1*	1 hrs. 48 min
	Kauriala	Kauriala Ghat - Kauriala - Geruwa Confluence	Boat in tandem	13	25th November, 2022	1*	1 hrs. 13 min
	Ghaghara	Kailashpuri Dam-Barchuncha	Boat in tandem and Double observer	620*	16th - 27th November,2022	12	50 hrs. 30 min.
	Gandak	Bankasia - Jwalapur	Boat in tandem	35	15th January, 2023	1	5 hrs.
				3453	December,2021 - January, 2022	86	348 hrs. 14 min


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FIGURE 5.2

Encounter rate of Ganges River Dolphin from Bijnor to Revalganj in mainstream Ganga and its tributaries Chambal, Yamuna, Ghaghara, Geruwa - Kauriala, Sharda, Rapti and part of Gandak River in Uttar Pradesh.

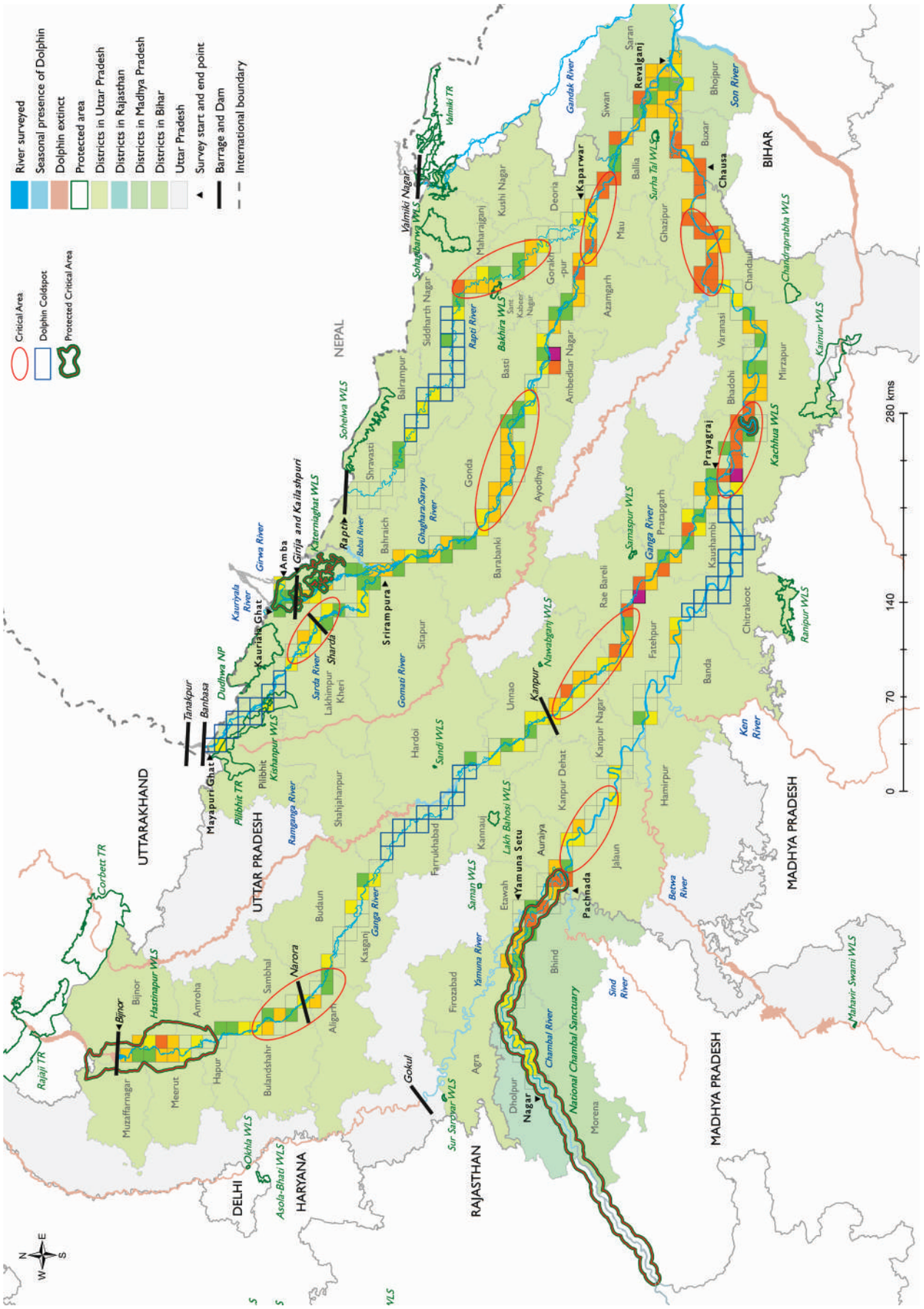


TABLE 5.2

Ganges River Dolphin population estimate in Ganga from Bijnor to Revalganj and its tributaries Chambal, Yamuna, Ghaghara, Geruwa - Kauriala, Sharda, Rapti and part of Gandak River in Uttar Pradesh.

N_O is the observer corrected population estimate, and ER_O is the observer corrected encounter rate (per Km). N_{OA} is the observer and availability corrected population estimate and ER_{OA} is the observer and availability corrected encounter rate (per Km).

**Dolphin population of Chambal River is equally divided between Uttar Pradesh and Madhya Pradesh, in Ghaghara river, 96 Km of dolphin population is equally shared between Bihar and Uttar Pradesh.*

River	River Stretch	N_{OA}	ER_{OA}
Ganga	Bijnor Barrage - Narora Barrage	114 (103-125)	0.6
	Narora Barrage - Kanpur Barrage	50 (44-56)	0.1
	Kanpur Barrage - Vindhyachal	718 (681-755)	1.9
	Vindhyachal - Chausa	334 (320-348)	1.3
	Chausa - Revalganj	81 (78-85)	0.7
Chambal	Pinahat - Bhind	78 (74-83)	0.8
	Bhind - Pachnada	125 (118-132)	2.7
Sharda	Mayapurighat (Lagabhaga) - Sharda - Ghaghara Confluence (Srirampurva)	58 (50-66)	0.2
Yamuna	Yamuna Setu (Etawah) - Sangam (Prayagraj)	104 (96-112)	0.2
Rapti	Rapti Barrage - Rapti - Ghaghara Confluence	152 (143-161)	0.3
Geruwa	Amba - Kailashpuri Dam	14 (11-17)	0.8
Kauriala	Kauriala Ghat - Kauriala - Geruwa Confluence	7 (5-11)	0.5
Ghaghara	Kailashpuri Dam - Barchuncha	497 (472-521)	0.8
Gandak	Bankasia - Jwalapur	65 (56-76)	1.9
		2397 (2251-2548)	**0.7**

5.3 Population Estimation

Nine independent surveys were carried out to estimate the dolphin population in Uttar Pradesh between December 2021-2022 (Table 5.1). In the mainstream Ganga, Boat in tandem surveys were carried out simultaneously in two stretches, Bijnor Barrage to Kanpur Barrage and Kanpur Barrage to Vindhyachal. This method was selected due to the low water depth in the stretches. An independent Double observer survey was carried out from Vindhyachal to Chausa in the mainstream Ganga, as adequate depth and channel width were present in this stretch. Boat in tandem surveys were carried out in the tributaries - Yamuna, Chambal, Rapti, Sharda, Geruwa-Kauriala, and part of Gandak and Ghaghara rivers (100 Km). The remaining part of the Ghaghara River was completed using the Double observer method.

In Uttar Pradesh, the total survey effort was 86 days and the total distance covered was 3453 Km. In the mainstream of Ganga in Uttar Pradesh, an effort of 36 survey days was needed to cover 1308 Km, while in the tributaries a total of 2145 Km was covered in 50 days (Table 5.1). The Ganges River Dolphin population in the Ganga (including its tributaries) in Uttar Pradesh was estimated to be 2397 (2251-2548), with a least count of 1898 dolphins. The overall encounter rate was 0.7 per kilometer.

5.3.1 Bijnor Barrage to Narora Barrage

There was no report of dolphin presence above the Bijnor Barrage in the main Ganga, which is the northern limit for the Ganges River Dolphin (Behera, 1995; Smith *et al.,* 2000). In earlier studies, it was reported that the Bijnor to Kanpur stretch was one of the most suitable habitats for Ganges River Dolphins in Uttar Pradesh (Behera & Rao, 1999). Bashir *et al*., (2010) recorded 56 Ganges River Dolphin between 165 Km of Bijnor Barrage to Narora Barrage. The Hastinapur Wildlife Sanctuary, established in 1986, is the only protected area in the mainstream in Uttar Pradesh covering the western part. This stretch is home to the Ganges River Dolphins, Gharials, Muggers, turtles, and waterfowl.

Our recent assessment of the Ganges River Dolphin population, covering a total of 183 Km (Bijnor Barrage to Narora Barrage) led to the estimation of 114 (103-125) dolphins with an encounter rate of 0.6/Km with the least count of 85 dolphins (Table 5.2 & Figure 5.2). The maximum dolphin sightings in this stretch were between Sirejpur to Kunda and Avantika Devi to Narora Barrage.

5.3.2 Narora Barrage to Kanpur Barrage

Low water depth is a major challenge in this section of the river, with only intermittent small stretches of deep-water pools (Srivastava *et al*., 2020). This stretch of the river has an average depth of 2.36±1.05 m, lower than other stretches. Ganga confluences with the Ramganga at Katri Haidarabad, located 120 km upstream of Kanpur. This confluence brings a much-needed source of water into this stretch.

Our recent assessment of the Ganges River Dolphin population, covering a total of 366 Km (Narora Barrage - Kanpur Barrage) lead to the estimation of 50 (44-56) dolphins with an encounter rate of 0.1/Km with the least count of 39 dolphins (Table 5.2 & Figure 5.2). The stretch between Aligarh and Kannauj had a very low number of dolphins, with almost a 120 Km area between this stretch having no dolphin presence at all, and thus is termed as a 'coldspot' (Figure 5.2).

5.3.3 Kanpur Barrage to Vindhyachal

The stretch between Atal Ghat and Vindhyachal Ghat includes multiple bridges and a barrage. The average water depth in this stretch was 3.94 ± 2.6 m, and it was observed to have a healthy dolphin population.

Our recent assessment of the Ganges River Dolphin population, covering a total of 380 Km (Kanpur Barrage - Vindhyachal) lead to the estimation of 718 (681-755) dolphins with an encounter rate of 1.9/Km with the least count of 545 dolphins (Table 5.2 & Figure 5.2). The highest dolphin sighting in this stretch was observed between Fatehpur Bridge to Naubasta Ghat. The stretch between Aril Ghat and Gopiganj Bridge also recorded a substantially large number of dolphins.

5.3.4 Vindhyachal to Chausa

This stretch of Ganga is famous for major pilgrimage sites such as the Vindhyavasini Temple in Vindhyachal and Assi (eighty) Ghat of Varanasi, also the famous Kashi Vishwanath Temple is located in this stretch. All of these are major centers of attraction, bringing millions of people annually to these locations on the banks of the river Ganga.

Our recent assessment of the Ganges River Dolphin population, covering a total of 260 Km (Vindhyachal to Chausa) led to the estimation of 334 (320-348) dolphins with an encounter rate of 1.3/Km (Table 5.2) with the least count of 278 dolphins. The highest dolphin sightings were observed between Varanasi to Chausa (Figure 5.2). The depth of the Ganga in this stretch of Uttar Pradesh is sufficient for sustaining a good population of the Ganges River Dolphin (5.14±3.40).

5.3.5 Chausa to Revalganj

The Chausa to Revalganj stretch of the Ganga River falls between two states, Uttar Pradesh and Bihar. In Uttar Pradesh, a river length of 119 Km was surveyed by a Double observer survey method, between 9th-10th March 2022 (Table 5.1). As the river is shared between both states, the dolphin population is distributed equally between the two states.

Our recent assessment of the Ganges River Dolphin population led to the estimation of 81 (78-85) dolphins with an encounter rate of 0.7/Km with the least count of 68 dolphins (Table 5.2 & Figure 5.2).

5.3.6 Chambal

Chambal River is one of the major tributaries of the Ganga River and passes through the Chambal Sanctuary. It is geographically located in the semi-arid zone of the north-western part of India, at the border of the tri-state (Madhya Pradesh, Rajasthan, and Uttar Pradesh).

Our recent assessment of the Ganges River Dolphin population, covering a total of 146 Km (Pinahat to Pachnada) in 5 days, led to the estimation of 203 (192-215) dolphins with an encounter rate of 1.3/Km with the least count of 166 dolphins (Table 5.2 & Figure 5.2).

Discussed below are the parts of the river which fall in the administrative boundaries of Uttar Pradesh.

5.3.6.1 Pinahat-Bhind (MP-UP)

This stretch of the river between Pinahat and Bhind is 99 Km in length and is shared between Uttar Pradesh and Madhya Pradesh. The Ganges River Dolphin estimation was carried out between 13th to 15th January 2022 for 3 days (Table 5.2). The total population (157) of Ganges River Dolphins in this stretch is shared equally between Uttar Pradesh and Madhya Pradesh, and hence the population estimate for the state of Uttar Pradesh in this part of Chambal is 78 (74-83) (Table 5.2). The encounter rate of dolphins was 0.8/Km (Figure 5.2).

5.3.6.2 Bhind- Pachnada

From Bhind to Pachnada, Chambal flows entirely through Uttar Pradesh. The estimate for this stretch, covering a distance of 47 Km (Table 5.1), was 125 (118-132), with an encounter rate of 2.7/Km (Table 5.2 & Figure 5.2). This stretch has the highest population density of dolphins in Chambal Sanctuary and has an average water depth of 5.6±4.22 m.

5.3.7 Yamuna

Yamuna Setu (Etawah)- Sangam Ghat (Prayagraj):

In the past, it was reported that the river Yamuna had an abundance of river dolphins. Anderson (1878) in his expedition mentions that the river dolphin in the Yamuna could be found as upstream as Delhi. However, this is not the case today, and the last Ganges River Dolphin was recorded from the capital in 1967 (Smith, *et al., 2000*). In the River Yamuna, the upstream range of dolphins is restricted because of low water depth and rocky river bottoms (Anderson, 1878; Sinha, 1997). Over the years, several surveys have been conducted across this stretch. A survey conducted by WWF in 2012 estimated the presence of around 50-60 Ganges River Dolphins in the Yamuna River, while a survey conducted by the Uttar Pradesh Forest Department in 2018 reported a decline in the population to just 22 individuals.

Our recent assessment of the Ganges River Dolphin population, covering a total of 536 Km (Yamuna Setu, Etawah to Sangam Ghat, Prayagraj) led to the estimation of 104 (96-112) dolphins with an encounter rate of 0.2/Km with the least count of 82 dolphins (Table 5.2 & Figure 5.2). The survey was carried out between 15th November to 1st December 2022, spanning 13 survey days (Table 5.1) using the Boat in tandem method due to low water depth.

In the Yamuna River, the Ganges River Dolphin distribution was found to be very patchy with multiple coldspots, and the only hotspot with a substantial population was near the Yamuna-Chambal Confluence (Pachnada). This population till Prayagraj is disjunct and patchily distributed.

5.3.8 Rapti

Rapti Barrage - Rapti - Ghaghara Confluence

There are very limited surveys focusing on understanding the status of the Ganges River Dolphin population in the Rapti River. After 2010, only one survey was carried out in the Rapti River using direct count methodology, in which 8 dolphins were recorded from a 30 Km stretch with an encounter rate of 0.26/Km (Behera *et al.*, 2014). During this survey, a total of 532 Km of the river was surveyed, starting from Rapti Barrage and ending at the Rapti - Ghaghara Confluence in Uttar Pradesh (Figure 5.1). The survey was completed in 12 days (Table 5.1).

The overall Ganges River Dolphin population in the Rapti river was 152 (143-161) dolphins. The least count of dolphins detected in the river was 124 with an encounter rate of 0.3/Km (Table 5.2 & Figure 5.2). In Rapti River, more dolphins were found downstream of the barrage, with no or low presence for around 170 Km from the start point of the barrage. The water depth in this area was also poor with an average depth of 2.55±1.55 m.

5.3.9 Sharda

Mayapurighat (Lagabhaga) - Sharda - Ghaghara Confluence (Srirampurva)

The Sharda River flows adjacent to Pilibhit Tiger Reserve as it enters India from Nepal. In previous surveys, it was evident that the dolphin population in the main channel is critically low or possibly extinct. However, it is still possible for dolphins to occasionally migrate from the Geruwa and Ghaghara river systems due to their connection (Sinha & Sharma, 2003b; Sinha & Kannan, 2014).

Our survey started from Mayapuri Ghat at Lagabhaga near the Indo-Nepal border to Sharda-Ghaghara Confluence at Srirampurva in Uttar Pradesh (Figure 5.1). A total of 246 Km of the river was surveyed and was completed in 5 days (Table 5.1). Boat in tandem methodology was used for surveying this stretch of the river. The survey was carried out between 17th to 22nd November 2022 (Table 5.1). The overall Ganges River Dolphin population in the Sharda River was 58 (50-66). The least count of the dolphins detected in the river was 44, with an encounter rate of 0.2/Km (Table 5.2 & Figure 5.2).

5.3.10 Geruwa - Kauriala

Amba - Kailashpuri Dam

The Geruwa river originates in the Himalayas in Nepal as the Karnali, which, when entering India's plains, breaks up into two channels, Geruwa and Kauriala. Kauriala later joins with Geruwa at the Kailashpuri Dam/Girija Barrage.

The Geruwa River is enclosed by the Katerniaghat Wildlife Sanctuary and acts as a safe haven for the Ganges River Dolphin and other associated fauna. The current study was carried out by Boat in tandem methodology and the survey was carried out on 25th November 2022 (Table 5.1). The survey started from Amba near the Indo-Nepal border to the Kailashpuri Dam and in the Kauriala River to the Kauriala Ghat-Geruwa Confluence (Figure 5.1).

The Geruwa River within the Katerniaghat Wildlife Sanctuary in Uttar Pradesh holds a substantial population of Ganges River Dolphins within this small area. The overall Ganges River Dolphin population in the Geruwa-Kauriala River was 21 (15-27). The least count of dolphin detected in the river was 16 with an encounter rate of 0.7 (Table 5.2 & Figure 5.2). In Geruwa River, the dolphin population was 14 (11-17), with a least count of 11 dolphins and in Kauriala River it was 7 (5-11), with the least count of 5 dolphins.

5.3.11 Ghaghara

Kailashpuri Dam-Barchuncha

Ghaghara River is the largest tributary of the Ganga in terms of the annual flow contribution. After flowing through Uttar Pradesh and Bihar, the river joins the Ganga near Revalganj. Ghaghara River is rich in biodiversity with the presence of Ganges River Dolphins, a wide variety of freshwater fish species, Gharials, Muggers, and freshwater turtle species like the Indian Flapshell Turtle and Indian Softshell Turtle. The river holds almost 30% of the freshwater turtle and tortoise species found in India (Singh *et al.*, 2021).

A combination of the Boat in tandem method and the Double observer method was used for surveying this stretch. The survey was carried out between the 16th to 27th of November 2022 (Table 5.1) and was completed in 12 days. The survey started at Kailashpuri Dam and ended at Barchuncha near the Uttar Pradesh-Bihar Border. The overall Ganges River Dolphin population in Ghaghara (Uttar Pradesh) was estimated at 497 (472-521). The river is shared between Uttar Pradesh and Bihar for 96 Km and the dolphin population number of this stretch was equally shared between both states. The least count of dolphins detected in the river was 403 with an encounter rate of 0.8/Km (Table 5.2 & Figure 5.2).



5.3.12 Gandak

Bankasia - Jwalapur

Gandak river flows mainly through Bihar and enters Uttar Pradesh near Bankasia. Only 35 Km of the river flows in Uttar Pradesh (Figure 5.1). In this stretch, survey was carried out by the Boat in tandem method on 15th January, 2023. The overall Ganges River Dolphin population in the Gandak River was 65 (56-76). The least count of the dolphin detected in the river was 48 with an encounter rate of 1.9/Km (Figure 5.2 & Table 5.2).

5.4 Associated Fauna

During the survey of the main stretch of the Ganga River (Bijnor to Chausa), and its tributaries (Yamuna, Chambal, Sharda, Ghaghara, Rapti, Geruwa, and Kauriala) in Uttar Pradesh, a total of 164 species of associated fauna were recorded. This included 142 species of birds, 15 species of reptiles, and seven species of mammals.

5.4.1 Ganga

The Ganga River sustains a very wide variety of flora and fauna. 107 species were recorded in the Ganga River, including 96 bird species, nine reptiles, and two mammals.

5.4.1.1 Birds

We recorded 96 species of birds during the survey (Appendix 1.1). The Endangered bird species recorded in the survey were the Indian Skimmer (n=107), Black-bellied Tern (n=111), and Egyptian Vulture (n=129). The Vulnerable species recorded in the survey were Sarus Crane (n=40), River Tern (n=219), Greater Spotted Eagle (n=1), and Common Pochard (n=13). In addition, 8 species of birds belong to Near Threatened, Black-headed Ibis (n=1), Black-necked Stork (n=12), Eurasian Curlew (n=226), Great Thick-knee (n=124), Oriental Darter (n=49), Painted Stork (n=185), River Lapwing (n=2561) and Asian Woolly-necked Stork (n=124) were recorded. Indian Skimmers were primarily visible in the lower reaches of the Ganga from Prayagraj to Chausa in Uttar Pradesh (Figure 5.3).

Numerous migratory waterbirds from the northern latitudes and coastal areas winter in the Gangetic plains. During this survey 55 such migratory bird species were recorded, notable among them are the Eurasian Spoonbill, Great Crested Grebe, Northern Pintail, Tufted Duck, etc.

5.4.1.2 Herpetofauna

Nine species of herpetofauna were recorded in the survey, this included the Gharial (Figure 5.4), one Checkered Keelback, and 7 species of turtles. Among the seven species of turtles encountered during the survey were the Critically Endangered Three-striped Roofed Turtle (n=2), the Endangered species viz. Ganges Soft-shelled Turtle (n=10), and Peacock Soft-shelled Turtle (n=1), Vulnerable species viz. Indian Flap-shelled Turtle (n=1), Indian Roofed Turtle (n=108) and Near Threatened species Brown Roofed Turtle (n=496) (Appendix 1.2).

Gharial is endemic to the Indian subcontinent and is categorized as Critically Endangered, and 80% of the global Gharial population is concentrated in the Chambal River (Lang, 2021). During the survey, 25 Gharials were spotted in various locations across the river stretch. Gharials were mostly present between the Bijnor Barrage to Narora Barrage and in Fatehpur.

5.4.1.3 Mammals

Two species of mammals apart from dolphins were recorded during the survey, Nilgai (n=19), and Golden Jackal (n=5) (Appendix 1.3). Both species are considered common in this region. Nilgai is endemic to the Indian subcontinent and is considered a pest in several north Indian states, as they ravage crop fields and cause considerable damage.

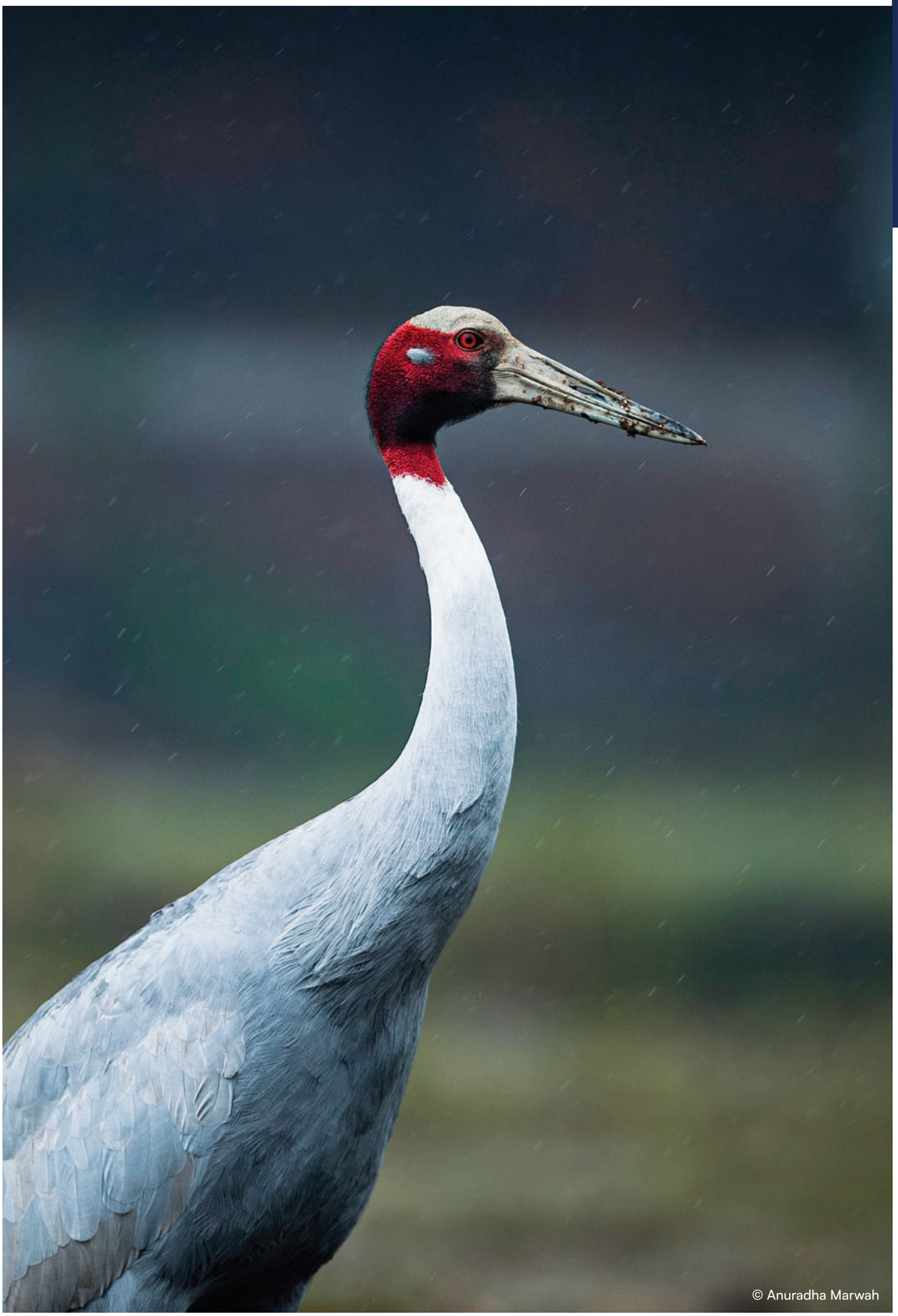
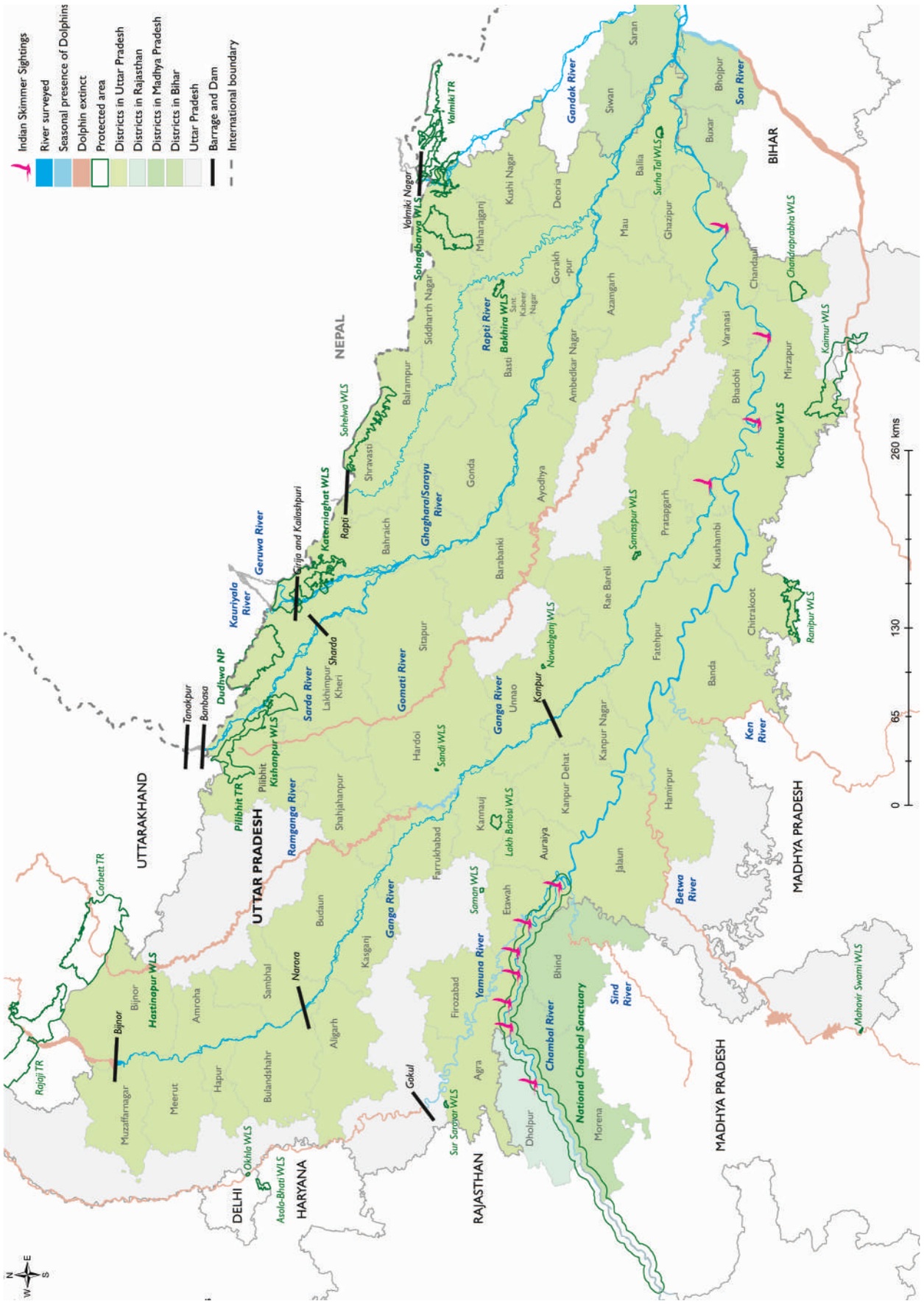

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FIGURE 5.3

Distribution of Indian Skimmer in mainstream Ganga and its tributaries Chambal, Yamuna, Ghaghara, Geruwa-Kauriala, Sharda, Rapti in Uttar Pradesh.



5.4.2 Chambal (Madhya Pradesh - Uttar Pradesh)

During the associated fauna assessment, a total of 82 species were recorded, of which 73 species of birds, six species of herpetofauna including turtles, Gharials, Muggers, and three species of mammals were recorded.

5.4.2.1 Birds

Among the species recorded were Indian Skimmer (n=151, Figure 5.3), Black-bellied Tern (n=23), and Egyptian Vulture (n=44), all of which are Endangered. In the Vulnerable species category, the most important species recorded were River Tern (n=15), Common Pochard (n=5), Greater Spotted Eagle (n=1) and Indian Spotted Eagle (n=1). A number of Near Threatened species were encountered during the survey, like River Lapwing (n=230), Dalmatian Pelican (n=118), Painted Stork (n=29), Asian Woolly-necked Stork (n=9), Black-necked Stork (n=7), Indian Oriental Darter (n=2) and Great Thick-knee (n=12) (Appendix 2.1).

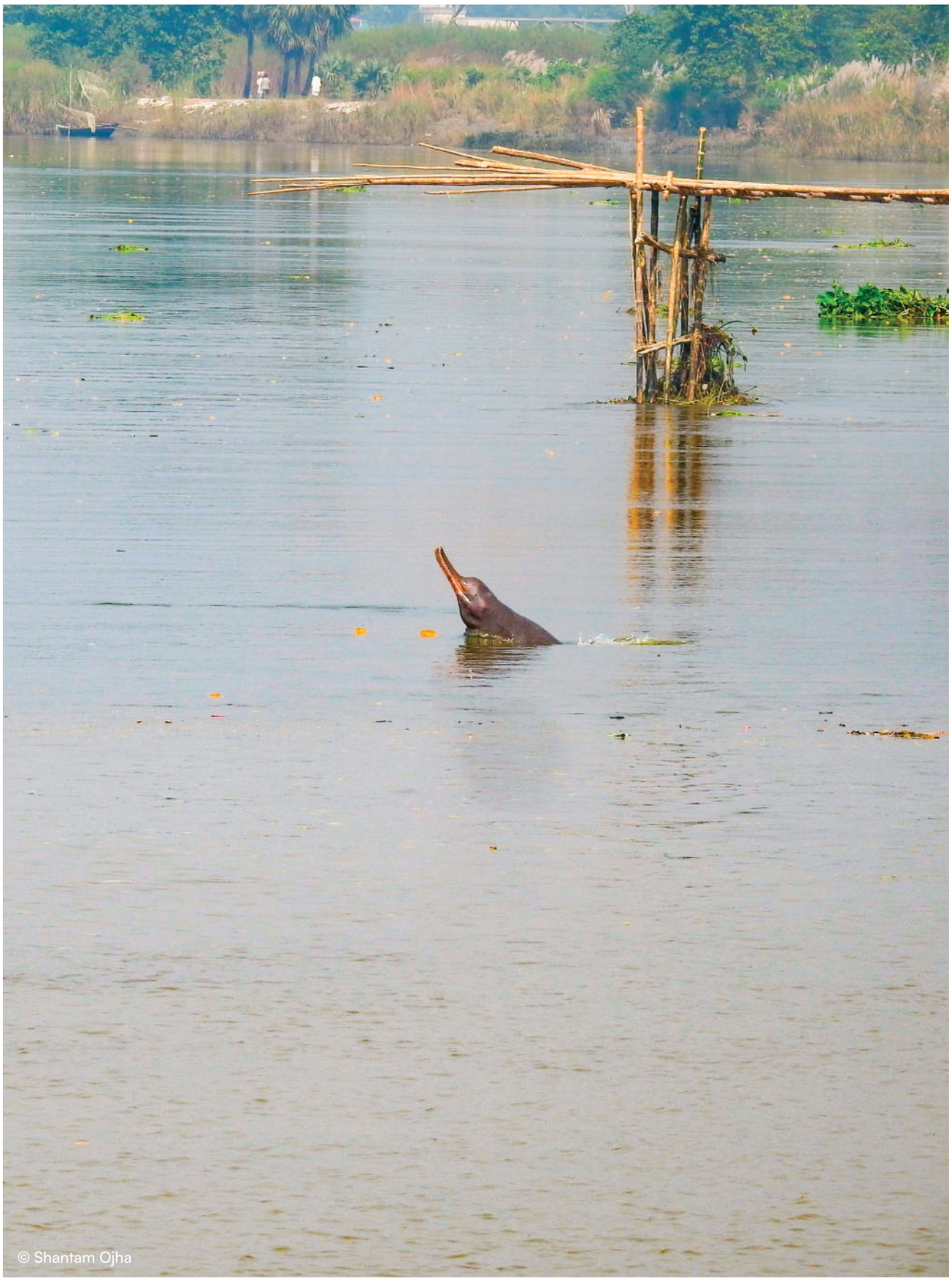
5.4.2.2 Herpetofauna

Muggers and Gharials were sighted throughout the stretch. In total, 156 Muggers (Figure 5.5) and 136 Gharials (Figure 5.4) were encountered in Uttar Pradesh. However, this is likely to be an underestimate as the survey was not designed for these species. A total of 103 turtles belonging to 4 species, Critically Endangered Red-crowned Roofed Turtle (n=3), Endangered Ganges Soft-shelled Turtle (n=1) and Narrow-headed soft-shelled Turtle, (n=1) were recorded (Appendix 2.2).



5.4.2.3 Mammals

During the survey, three species of mammals were recorded, the Near Threatened Striped Hyena and Blue Bull or Nilgai and Golden Jackal (Appendix 2.3).



5.4.3 Yamuna

Gharials were seen regularly in the Yamuna River and near the Yamuna-Chambal Confluence before the 1980s, however by 1978 only seasonal migrants could be occasionally seen (Singh, 1978; Whitaker *et al.*, 1974). These sighting records of Gharials were mainly in the Yamuna-Chambal Confluence (Singh, 2003; Sharma, 2006a; De *et al.*, 2020). Narain *et al.*, (1999) reported six species of turtles in the Yamuna at Etawah, Indian Tent Turtle, Red-crowned Roofed Turtle, Three-striped Roofed Turtle, Indian Flap-shelled Turtle, Ganges Soft-shelled Turtle, and Narrow-headed soft-shelled Turtle. Also, the river holds a good population of avian biodiversity.

During our survey of 536 Km from Yamuna Setu at Etawah to Sangamghat at Prayagraj, Uttar Pradesh, a total of 90 species were recorded, of which 80 species were birds, seven were reptiles and three species were mammals.

5.4.3.1 Birds

Of the 80 species of birds recorded, two species were Endangered Black-bellied Tern (n=3) and Egyptian Vulture (n=243). Three species were Vulnerable Common Pochard (n=3), River Tern (n=6), and Sarus Crane (n=15). Nine species were Near Threatened such as the Black-necked Stork (n=2), Oriental Darter (n=11), Painted Stork (n=211), River Lapwing (n=1845), Asian Woolly-necked Stork (n=113), Great Thick-knee (n=24), Eurasian Curlew (n=24), Black-tailed Godwit (n=4) and Marbled Teal (n=86) (Appendix 3.1).

5.4.3.2 Herpetofauna

Seven species of herpetofauna were recorded in the survey (Appendix 3.2). This included two Critically Endangered species, Gharial (n=23) (Figure 5.4) and Red-crowned Roofed Turtle (n=50). Two Endangered turtle species were also recorded, the Ganges Soft-shelled Turtle (n=50) and the Narrow-headed soft-shelled Turtle (n=2). One Vulnerable species was also recorded the Indian Flap-shelled Turtle (n=2).

5.4.3.3 Mammals

Three species of mammals were recorded during the survey. These were Golden Jackal, Northern Plains Gray Langur, and Nilgai. All three species are under the Least Concern category (Appendix 3.3).

5.4.4 Rapti

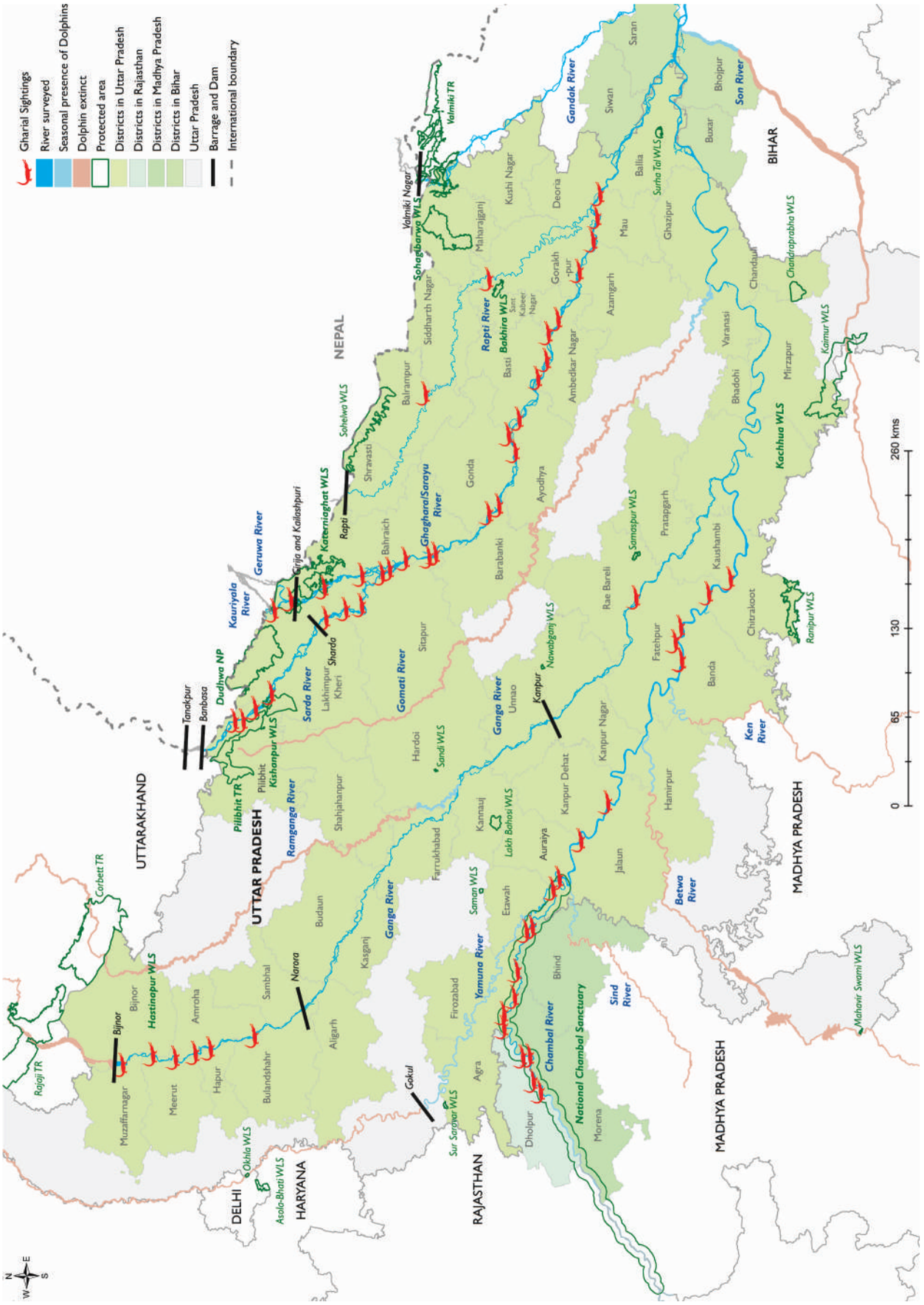
The Rapti River which originates from Nepal, flows through the Indian state of Uttar Pradesh and is a well-known habitat for several birds, both migratory and native. Rapti and other water bodies such as wetlands are home to many endangered avian fauna species including vultures, this terai region also provides breeding, staging, roosting, and feeding sites for many migratory and non-migratory birds (Mishra et al., 2019). A total of 98 species were recorded from Rapti River, of which 85 species were birds, nine species were reptiles and four species were mammals.

5.4.4.1 Birds

A total of 85 bird species were recorded in this stretch (Appendix 4.1). Among these, one species was the Endangered Egyptian Vulture (n=135), and four Vulnerable species, Sarus Crane (n=54), Common Pochard (n=10), Indian Spotted Eagle (n=2), and River Tern (n=14). The Near Threatened species include Asian Woolly-necked Stork (n=57), Black-necked Stork (n=1), Great Thick-knee (n=7), Himalayan Griffon (n=21), Bar-tailed Godwit (n=12), Painted Stork (n=44), Eurasian Curlew (n=40) and River Lapwing (n=840).

FIGURE 5.4

Distribution of Gharial in mainstream Ganga and its tributaries Chambal, Yamuna, Ghaghara, Geruwa- Kauriala, Sharda, Rapti in Uttar Pradesh.



5.4.4.2 Herpetofauna

Nine species of herpetofauna were recorded in the survey, including Critically Endangered Gharial (n=2) (Figure 5.4), Endangered turtle species, Ganges Soft-shelled Turtle (n=19), Vulnerable species, Indian Flap-shelled Turtle (n=2) and Indian Roofed Turtle (n=7) and Near Threatened species Brown Roofed Turtle (n=942) and Red Sand Boa (n=1) (Appendix 4.2).

5.4.4.3 Mammals

Four species of mammal, Golden Jackal, Nilgai, Northern Plains Gray Langur, and Indian Grey Mongoose were recorded during the survey all of which fall under the Least Concern category of IUCN (Appendix 4.3).

5.4.5 Sharda

River Sharda with its unique habitat having a low gradient, large numbers of exposed sandbars, and shallow water provides basking substrate for turtles, Gharials, and Muggers and feeding and foraging substrate for different species of birds. The river is home to a wide variety of fauna and flora including eight different species of turtles belonging to seven different genera (Sinha & Sharma, 2003b), a wide variety of birds, especially water birds such as waders, ducks, cranes, and storks are found which migrate to the river during the winter months. The diversity of birds also includes some of the endangered species such as the Indian Skimmer and Black-bellied Tern. Large reptiles such as Gharials and Muggers are also reported from this river system (Sinha & Sharma, 2003b). The river is also known to harbour all three otter species found in India, Smooth-coated Otter, Small-clawed Otter, and Eurasian Otter (Everard & Kataria, 2010).

During the survey from Lagabhaga near the Indo-Nepal border to the Sharda-Ghaghara Confluence, we recorded a total of 70 species of associated fauna with 62 species of birds, one species of mammal, and seven species of reptiles.

5.4.5.1 Birds

The total number of recorded bird species during the survey was 62 (Appendix 5.1). Of these, two species were Endangered, namely the Black-bellied Tern (n=3) and the Egyptian Vulture (n=25). Two Vulnerable birds, Indian Spotted Eagle (n=2) and Common Pochard (n=21) and seven species of Near Threatened birds were also recorded, Black-necked Stork (n=10), Great Thick-knee (n=9), Oriental Darter (n=7), Painted Stork (n=77), River Lapwing (n=120), Asian Woolly-necked Stork (n=49) and Black-headed Ibis (n=50).

5.4.5.2 Herpetofauna

Seven species of herpetofauna were recorded in the survey, including Critically Endangered Gharial (n=27) (Figure 5.4), Endangered turtle species, Ganges Soft-shelled Turtle (n=6), Vulnerable species, Mugger (n=21), Indian Flap-shelled Turtle (n=3) and Indian Roofed Turtle (n=10). Only one Near Threatened species was recorded, which was the Brown Roofed Turtle (n=839) (Appendix 5.2).

5.4.5.3 Mammal

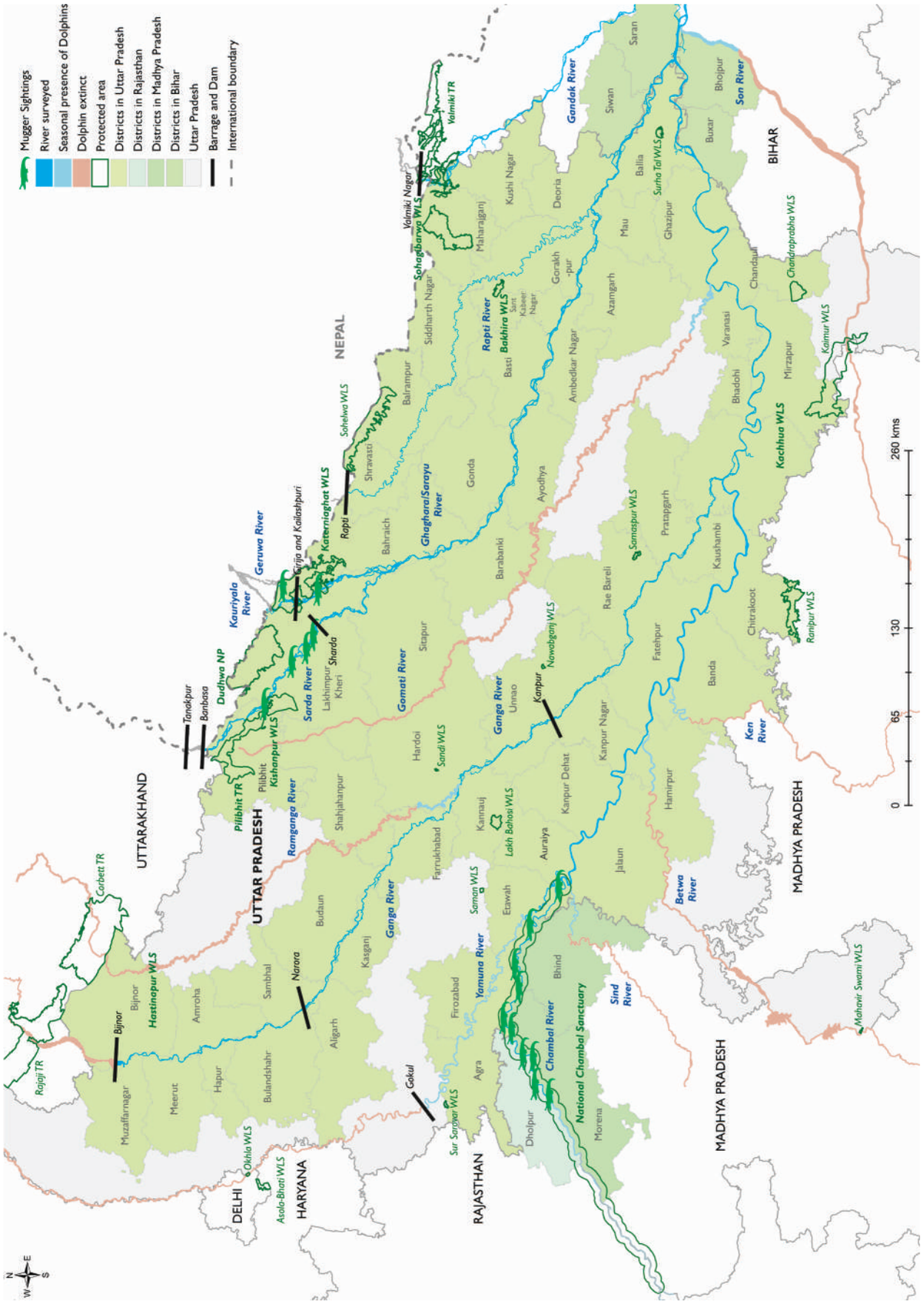
Only one species of mammal, the Golden Jackal was recorded during the survey which comes under the Least Concern category (Appendix 5.3).

5.4.6 Ghaghara

The Ghaghara River is home to a diverse range of aquatic fauna and flora, including fish, reptiles and mammals. There are approximately 62 fish species belonging to 48 genera and 24 families. The major families include Cyprinidae, Bagridae, Siluridae and Clariidae. These fish are important food and income sources for the local communities living along the riverbank (Kumar *et al.*, 2020). The river bank provides a diverse range of habitat for many bird species (Singh *et al.*, 2017), including the Indian Skimmer, River

FIGURE 5.5

Distribution of Mugger in mainstream Ganga and its tributaries Chambal, Yamuna, Ghaghara, Geruwa- Kauriala, Sharda, Rapti in Uttar Pradesh.



Lapwing, Common Kingfisher, White-throated Kingfisher and Pied Kingfisher (Mital *et al.*, 2016).

A total of 86 species of associated fauna were recorded during the survey, of which, 73 species were birds, eight species were reptiles and five species were mammals.

5.4.6.1 Birds

73 species of birds were recorded, of which one was the Endangered Egyptian Vulture (n=29), two Vulnerable species, Common Pochard (n=32) and Indian Spotted Eagle (n=1). Seven Near Threatened species, Oriental Darter (n=3), Asian Woolly-necked Stork (n=154), Black-necked Stork (n=4), Painted Stork (n=403), Eurasian Curlew (n=72), Black-headed Ibis (n=47) and River Lapwing (n=65) were recorded (Appendix 6.1).

5.4.6.2 Herpetofauna

Eight herpetofauna species were recorded. Several species of concern were observed including the Critically Endangered Gharial (n=191) (Figure 5.4), Endangered Ganges Soft-shelled Turtle (n=4), Vulnerable Mugger (n=1) and the Near Threatened Brown Roofed Turtle (n=1460) (Appendix 6.2).

5.4.6.3 Mammals

Five species of mammals were recorded. Among these, one species was of conservational importance which is the Endangered Hog Deer (n=1) (Appendix 6.3).

5.4.7 Geruwa - Kauriala

The Geruwa river, located within Katerniaghat Wildlife Sanctuary, is home to a highly diverse range of wildlife. It is inhabited by species such as the Endangered Ganges River Dolphins, the Critically Endangered Gharials, and the Vulnerable Muggers, as well as a rich variety of avian species. However, due to the lack of research on the Geruwa river, there is a lack of knowledge about the river and its diversity (Singh & Behera, 2018).

A total of 31 associated fauna was recorded from the river with 27 bird species and four reptiles.

5.4.7.1 Birds

A total of 27 bird species were recorded including the Endangered Egyptian Vulture (n=1). Six Near Threatened species such as the Black-necked Stork (n=1), Grey-headed Fish-Eagle (n=1), Oriental Darter (n=2), Painted Stork (n=7), River Lapwing (n=28) and Asian Woolly-necked Stork (n=5) were recorded (Appendix 7.1).

5.4.7.2 Herpetofauna

Four species of herpetofauna were recorded, including the Critically Endangered Gharial (n=98, Figure 5.4), Vulnerable Mugger (n=46, Figure 5.5) and two species of turtles, the Endangered Ganges Soft-shelled Turtle (n=1) and the Near Threatened Brown Roofed Turtle (n=10) (Appendix 7.2)..

The Ganga Plain which holds a wide variety of flora and fauna is being affected by the increasing anthropogenic activities in the river such as sand mining, unsustainable fishing, bank encroachment, agriculture, pollution, etc. The future survival of all these species is likely to be at risk due to increasing anthropogenic activities such as the construction of dams and barrages, and mortality due to entanglement in fishing nets in the case of Ganges River Dolphins, turtles, etc.

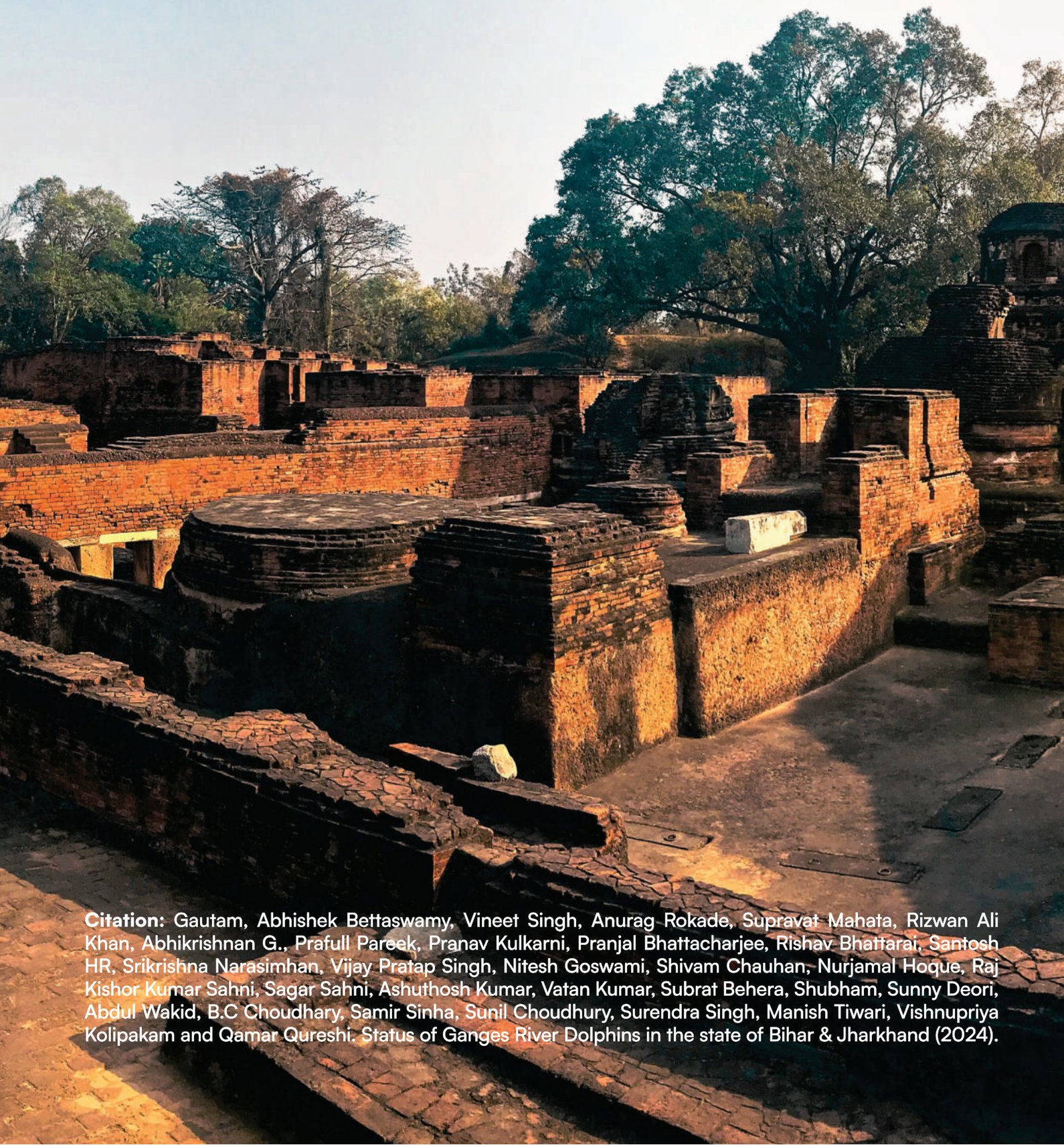
5.5 Conclusion

The critical areas identified are the areas that currently hold substantial populations and are sources that need inputs for enhancing the livelihood of people as well as promoting dolphin conservation. Currently, the dolphin population in Uttar Pradesh appears in pockets, and from Bijnor to Kanpur the population is fragmented and small. The major population lies in the lower Ganga stretch from Fatehpur to the Bihar border with critical areas in the main Ganga falling in the districts of Prayagraj, Bhadohi, Mirzapur, Ghazipur, Varanasi, and Chandauli. Other than this, Hastinapur Wildlife Sanctuary and National Chambal Sanctuary, Kachhua Sanctuary, and Katerniaghat Wildlife Sanctuary are also dolphin critical areas. It is crucial to maintain critical dolphin areas of at least 150 Km segment of the Ganga. We have identified critical areas in the mainstream which consists of the area around the Narora Barrage and Kanpur Barrage (Bulandshahr, Sambhal, Aligarh, Kanpur Nagar, Unnao, and Fatehpur districts) and in the tributaries, Yamuna River in Pachnada (Auraiya, Jalaun, and Kanpur Dehat districts); in and around Sharda Barrage in the Kheri district; Sant Kabeer Nagar and Gorakhpur in Rapti; Barbanki, Gonda Ayodhya and Basti in the Ghaghara River. These critical areas are important for the Upper Ganga to ensure the long-term survival of dolphins.


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VI : BIHAR & JHARKHAND





Citation: Gautam, Abhishek Bettaswamy, Vineet Singh, Anurag Rokade, Supravat Mahata, Rizwan Ali Khan, Abhikrishnan G., Prafull Pareek, Pranav Kulkarni, Pranjal Bhattacharjee, Rishav Bhattarai, Santosh HR, Srikrishna Narasimhan, Vijay Pratap Singh, Nitesh Goswami, Shivam Chauhan, Nurjamal Hoque, Raj Kishor Kumar Sahni, Sagar Sahni, Ashuthosh Kumar, Vatan Kumar, Subrat Behera, Shubham, Sunny Deori, Abdul Wakid, B.C Choudhary, Samir Sinha, Sunil Choudhury, Surendra Singh, Manish Tiwari, Vishnupriya Kolipakam and Qamar Qureshi. Status of Ganges River Dolphins in the state of Bihar & Jharkhand (2024).

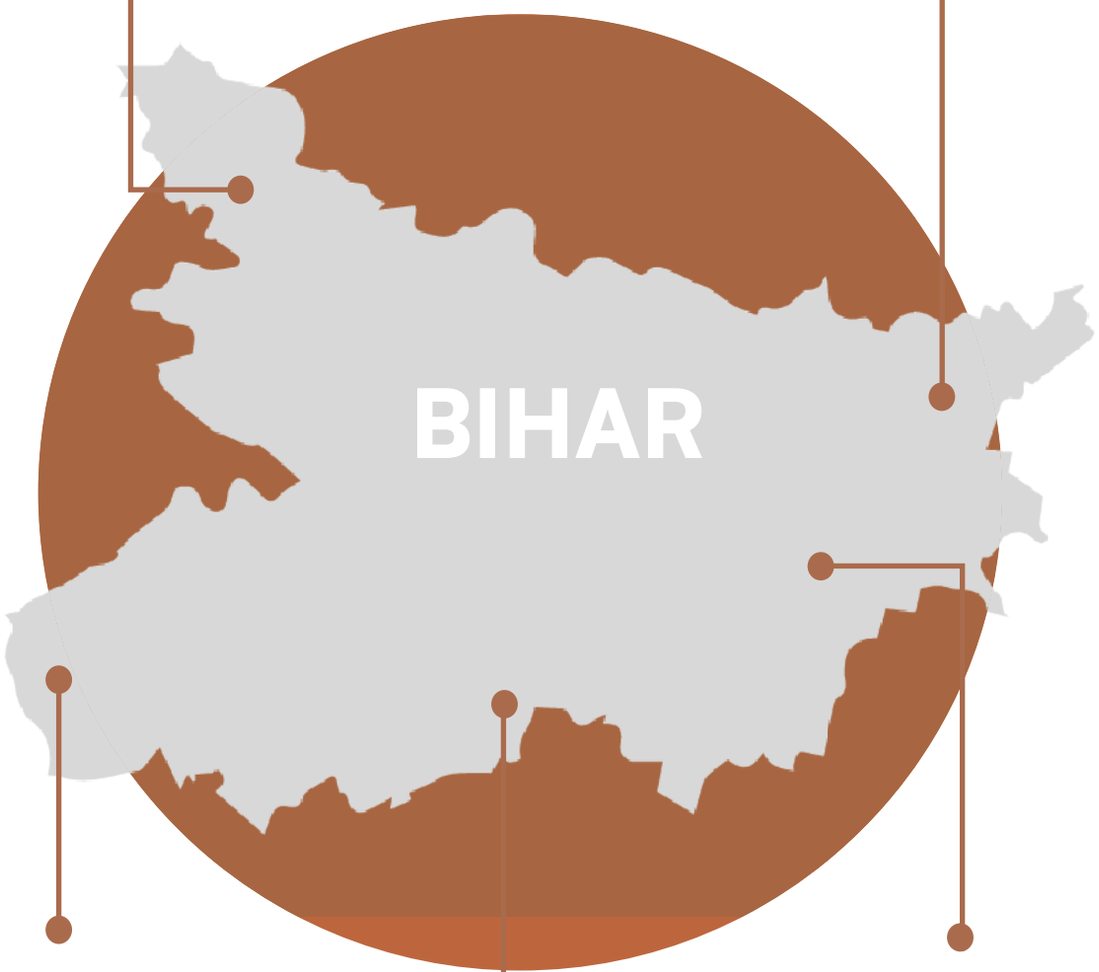


POPULATION ESTIMATE

2220 (2118-2329)

NUMBER OF KILOMETERS SURVEYED

1368



NUMBER OF SURVEY DAYS

38

NUMBER OF RIVERS SURVEYED

5

LEAST COUNT

1813

POPULATION ESTIMATE

162 (152-172)

NUMBER OF KILOMETERS SURVEYED

59



NUMBER OF SURVEY DAYS

1

NUMBER OF RIVERS SURVEYED

1

LEAST COUNT

130

6.1 Background

Bihar inhabits the largest Ganges River Dolphin population, with a maximum encounter rate between the border of Uttar Pradesh-Bihar (Chausa) and Farakka (Sinha & Kannan, 2014, Qureshi et al., 2018). The important stretches for dolphins in the Ganges river basin are identified as the stretch between Chausa and Manihari Ghat, and the stretch surrounding Katihar (near Manihari Ghat) (Qureshi et al., 2021). Similarly, river stretches with confluences including Ghaghara, Gandak, and Kosi harbor a significant population of Ganges River Dolphins. These confluence points are also critical links to maintaining a viable dolphin population, as they connect the rivers of Nepal with Ganga. Begusarai, Barh, and Naugacchia form other critical areas that require regular monitoring (with appropriate monitoring infrastructure), to ensure the survival of dolphins in the future. Vikramshila Gangetic Dolphin Sanctuary forms an important habitat for the species.

6.2 Study Area

The mainstream of the Ganga River flows through Bihar between Chausa and Manihari Ghat, covering approximately 590 Km and 59 Km from Manihari Ghat to Rajmahal in Jharkhand. In addition, around 798 Km of tributaries of the Ganga flow through Bihar including Ghaghara, Gandak, Kosi, and Mahananda. These tributaries bring substantial flow of water and nutrient-rich silt and sediment loads into the Ganga River, helping to replenish and recharge the main stem of the Ganga as it passes through Bihar (Figure 6.1). In several places, Ganga is braided, forming many small side channels (Chausa to Farakka), and among these, three side channels, Patna to Bhaktiyarpur, Rani Diyara to Bhawanipur, and Rampur to Rajmahal are prominent in terms of channel length, depth, and dolphin presence (Qureshi *et al.*, 2020). However, rivers Kamla, Balan, Bagmati (tributaries of Kosi) and Burhi Gandak (tributary of Ganga) have reported seasonal presence of dolphins during monsoon, and were not surveyed due to navigability issues.

In total 1368 Km was surveyed at Bihar. The entire stretch was covered in 39 days. In Jharkhand, the characteristic of the river is its large width, as even in the lean season the river has an average width of 4-5 Km and at some locations even more than 6-7 Km. This stretch also has an important confluence of Mahananda River at Rajmahal, with another important side channel between Rampur to Rajmahal. In Jharkhand, 59 Km was covered over two survey days (Table 6. 1 & Figure 6.1).

FIGURE 6.1

Ganga River from Chausa to Manihari and its tributaries Gandak , Mahananda, Kosi and part of Ghaghara in Bihar, and Manihari to Rajmahal in Jharkhand.

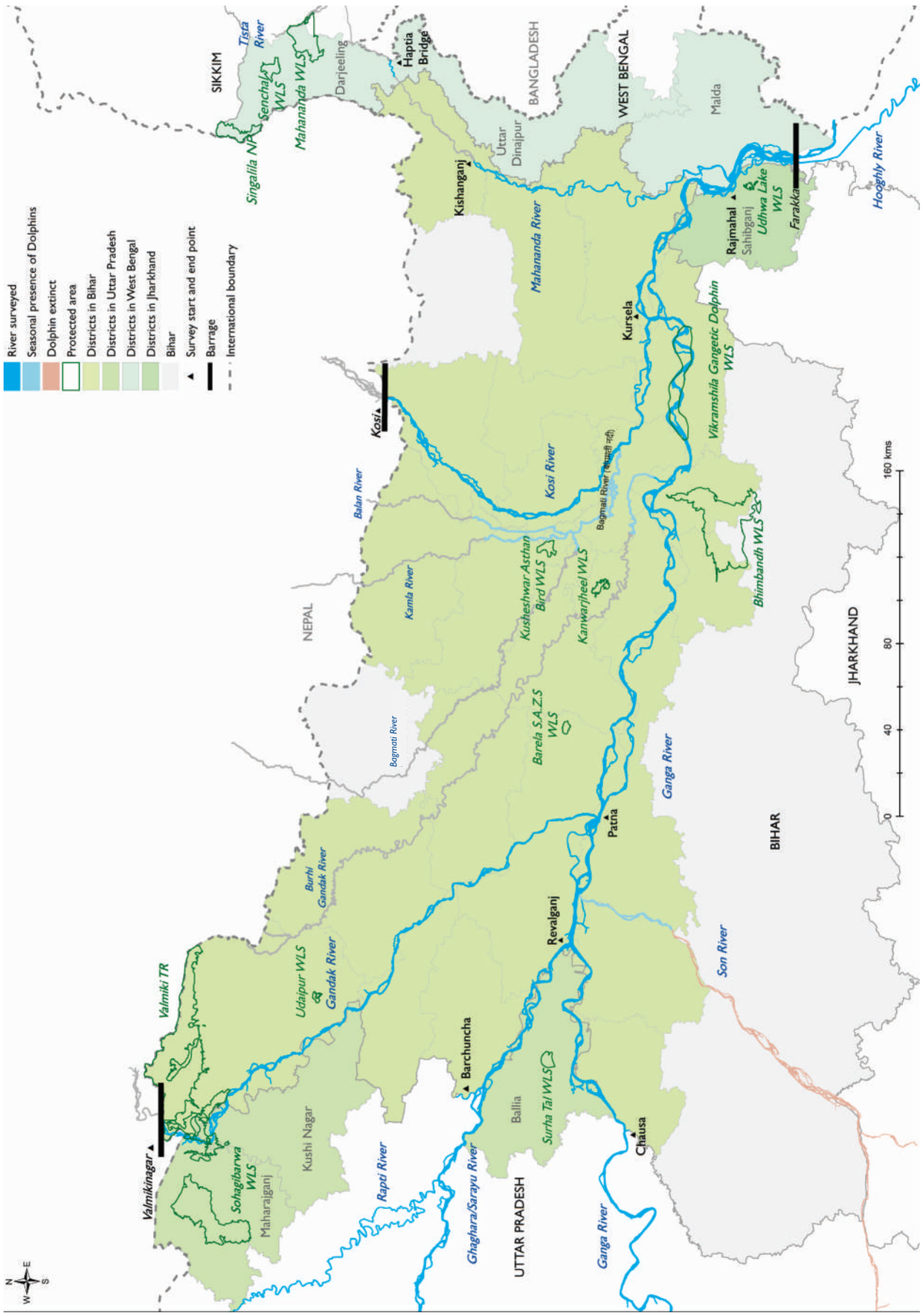


TABLE 6.1

Effort and method used for the Ganges River Dolphin survey from Chausa to Manihari and its tributaries Gandak , Mahananda, Kosi and part of Ghaghara in Bihar, and Manihari to Rajmahal in Jharkhand.

State	River	Stretch	Method	Distance surveyed (in Km)	Survey dates	Survey days	Total effort (in hrs.)
Bihar	Ganga	Chausa - Manihari (Bihar)	Double observer	**590***	9th - 28th March,2022	13	53 hrs.
	Gandak	Valmikinagar Barrage-Gandak - Ganga Confluence (Patna)	Boat in tandem	**280**	15th- 23rd January, 2023	8	35 hrs.
	Mahananda	Kishanganj Bridge - Gauripaur	Boat in tandem	**154***	26th December -04th January, 2023	7	23 hrs. 9 min
	Kosi	Kosi Barrage (near Indo - Nepal border) - Kosi - Ganga Confluence (Kursela)	Double observer	**242**	13to - 18th December, 2022	6	29 hrs. 52 min
	Ghaghara	Barchuncha - Revalganj	Boat in tandem & Double observer	**102***	27th -28th November, 2022	2	17 hrs. 19 min
Jharkhand	Ganga	Manihari Ghat to Rajmahal	Double observer	**59**	29th - 31st March, 2022	**2***	6 hrs.
Bihar & Jharkhand				**1427**	March 2022, January 2023	**38**	**164 hrs. 20 min**

**119 Km between Chausa-Manihari (Ganga) is shared between Bihar and Uttar Pradesh, *96 Km of Ghaghara is shared between Bihar and Uttar Pradesh, *18 Km of Mahananda is shared between Bihar and West Bengal.*

**Days shared between Bihar and Jharkhand*

FIGURE 6.2

Encounter rate of Ganges River Dolphin from Chausa to Manihari and its tributaries Gandak , Mahananda, Kosi and part of Ghaghara in Bihar, and Manihari to Rajmahal in Jharkhand.

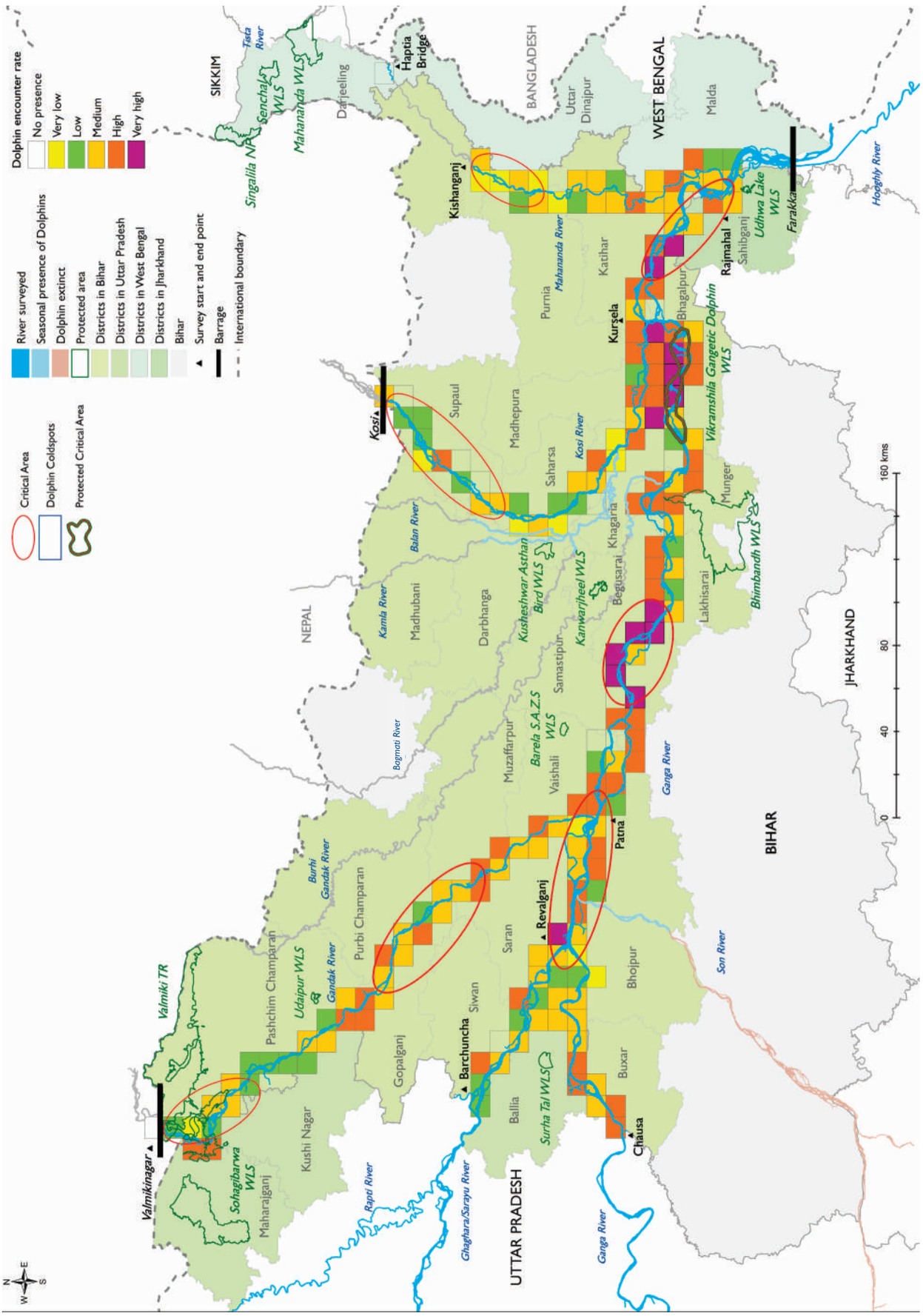


TABLE 6.2

Ganges River Dolphin population estimate in Ganga from Chausa to Manihari and its tributaries Gandak , Mahananda, Kosi and part of Ghaghara in Bihar, and Manihari to Rajmahal in Jharkhand.

N_O is the observer corrected population estimate, and ER_O is the observer corrected encounter rate (per Km). N_{OA} is the observer and availability corrected population estimate and ER_{OA} is the observer and availability corrected encounter rate (per Km).

River	River Stretch	N_{OA}	ER_{OA}
Ganga	Chausa - Manihari (Bihar)	1297 (1244-1351)	2.2
	Manihari- Rajmahal (Jharkhand)	162 (152-172)	2.8
Gandak	Valmikinagar Barrage - Gandak - Ganga Confluence (Patna)	377 (359-396)	1.3
Mahananda	Haptia Bridge - Kishanganj Bridge - Bhaluka	155 (143-169)	1
Kosi	Kosi Barrage (near Indo-Nepal border) - Kosi - Ganga Confluence (Kursela)	331 (317-347)	1.4
Ghaghara	Barchuncha - Revalganj	60 (55-66)	0.6
	Bihar	2220 (2118-2329)	1.6
	Jharkhand	162 (152-172)	2.8
	Overall Bihar and Jharkhand	**2382 (2270-2501)**	**1.7**

6.3 Population Estimation

6.3.1 Ganga (Bihar)

A combination of both the Boat in tandem and the Double observer method was used for surveying the length of the Ganga and its tributaries in the state of Bihar. A total of 1368 Km was covered in 36 days. The overall Ganges River Dolphin population in Bihar was estimated at 2220 (2118-2329), with a least count of 1813 dolphins.

6.3.1.1.1 Chausa-Manihari

The population estimation of Ganges River Dolphins in the Bihar stretch of Ganga (Chausa-Manihari) was estimated to be 1297 (1244-1351), with an encounter rate of 2.2/Km (Figure 6.2). In this stretch, a total of 590 Km was surveyed (including one side channel of 31 Km, between Patna to Bakhtiyarpur in the mainstream Ganga) between 9th March 2022 to 28th March 2022 (Table 6.1). Out of 590 Km, 119 Km was shared between Bihar and Uttar Pradesh, and the dolphin population in this stretch was equally divided between both states. The Ganges River Dolphin population for this part was 81 (78-85). This entire stretch has multiple dolphin hotspots which seem to shift depending on river morphological changes (Figure 6.2, Table 6.2). It is found that most of the dolphin population is seen in the places of counter-eddy currents like river confluences, braiding channels, mid-channel islands, sand bars, and bridges (Smith 1993; Smith, et al., *2000*; Sinha and Sharma 2003a).

6.3.2 Gandak

Valmikinagar Barrage - Gandak - Ganga Confluence (Patna)

Gandak River flows across the Gangetic plain of Bihar state and eventually merges with Ganga near Hajipur, Patna. Before merging with river Ganga near Patna, it flows through the districts of Champaran, Saran, and Muzaffarpur. In an earlier study, 257 dolphins were estimated and found to be influenced by river channel depth and the existence of meanders (Choudhary *et al.*, 2012).

The survey was carried out by Boat in tandem method which was used for surveying rivers with low water depth. The survey was carried out between 15th to 23rd January 2023 (Table 6.1). The overall Ganges River Dolphin population in the Gandak River was 377 (359-396) dolphins. The least count of dolphins detected in the river was 302 with an encounter rate of 1.3/Km (Figure 6.2, Table 6.2). This tributary of Ganga is unique in terms of its landscape and is a very important habitat for the thriving population of both Gharials, Muggers, and turtles. The upper stretch of Gandak near Valmikinagar Barrage comes under the Valmikinagar Tiger Reserve.

6.3.3 Mahananda

Kishanganj Bridge-Rajmahal

Mahananda flows from Darjeeling, having its origin at Mahaldiram, entering into the plains at Siliguri, thus contributing to one of the largest tributaries of the river Ganga which passes through Bihar, West Bengal, and Bangladesh.

Mahananda River is a recent addition to the Ganges River Dolphin distribution in India (Kelkar & Dey, 2021). Before the current survey, only one other survey was conducted in Mahananda. A total of 154 Km of the river stretch was surveyed. Initially, the survey started from the Haptia Bridge near the Indo-Bangladesh border. However, due to the very low water depth, the small motorized boat used in the survey was unable to navigate this section. The survey was restarted from the Kishanganj Bridge to the Mahananda-Ganga Confluence at Rajmahal in Jharkhand (Figure 6.1). The river flows through both Bihar and West Bengal for 18 Km, over this stretch, and the resulting estimate of the dolphin population is equally distributed for both Bihar and West Bengal. The survey was completed in 7 days (Table 6.1). The overall Ganges River Dolphin population in the Mahananda River was found to be 155 (143-169). The least count

of the dolphins detected in the river was 120, with an encounter rate of 1/Km (Figure 6.2).

6.3.4 Kosi River

Kosi Barrage (near Indo-Nepal) border to Kosi- Ganga Confluence at Kursela in Bhagalpur

The Kosi River originates in the Tibetan plateau and the river merges with the Ganga at Kursela, Bihar (Sinha & Sharma, 2003a). It is one of the most important antecedent tributaries of the Ganges (Sinha & Jain, 1998). The river is infamously known as the "Sorrow of Bihar", due to the recurring floods in its floodplains (Danish *et al.*, 2013). Earlier surveys conducted in the Kosi River, reported a population of 78 dolphins (Sinha & Sharma, 2003a). Whereas in a subsequent survey by Choudhary *et al.*, 2019(a, b) a total of 82 and 79 dolphins from the Kosi River were recorded respectively.

In the Kosi River, a total of 242 Km of the river stretch was surveyed between the Kosi Barrage (near Indo-Nepal) border to the Kosi-Ganga Confluence at Kursela (Figure 6.1). The survey was completed in 6 days (Table 6.1) from 13th to 18th December 2022, using the Double observer method. The overall Ganges River Dolphin population in Kosi River was estimated at 331 (317-347). The least count of dolphins detected in the river was 273 with an encounter rate of 1.4/Km (Figure 6.2, Table 6.2)..

6.3.5 Ghaghara

The Ganges River Dolphin estimate for the Ghaghara River in Bihar was 60(55-66) and the encounter rate was 0.6/Km. The least count of dolphins detected in this stretch was 48.

6.3.6 Ganga (Jharkhand)

The Ganga River in the Jharkhand part consists of a wide channel, braided channels, and a mid-channel island (WII- GACMAC, 2018). The flow regime over this stretch is good as river Kosi brings in more water into the river. The estimated abundance of Ganges River Dolphin in the Jharkhand segment of Ganga between (Manihari-Sahibganj Bridge to Rajmahal) was 162 (152-172) and has a least count (Figure 6.2 & Table 6.2) of 130 dolphins. The encounter rate was 2.8/Km, the highest encounter rate of river dolphins in the mainstream Ganga in the country.

6.4 Associated Fauna

In the state of Bihar, a total of 121 species of associated fauna were recorded from the river Ganga and its tributaries, of which 109 species of birds, five species of reptiles, and seven species of mammals.

6.4.1 Ganga (Bihar)

A total of 86 species of associated fauna was recorded in a stretch of 590 Km. Out of the 86 species, 81 species of birds, four species of mammals, and one species of turtle were recorded. Of these, 12 species were found to be of conservation concern, which includes two Endangered, three Vulnerable, and seven Near Threatened species.

6.4.1.1 Birds

Out of 81 bird species recorded in Ganga, 10 species are of conservation concern. The Endangered Black-bellied Tern (n= 2), Greater Adjutant (n= 19), Vulnerable Lesser Adjutant (n= 37), River Tern (n= 3) and the Near Threatened Black-headed Ibis (n= 414), Eurasian Curlew (n= 7), Painted Stork (n= 171), River Lapwing (n=87), Asian Woolly-necked Stork (n=232) and Black-necked Stork (n=21) were recorded. 38 species of migratory birds like Caspian Tern, Palla's Gull, Black-headed Ibis, Ruddy Shelduck, Bar-headed Goose, etc., were recorded. The sighting of the Greater Adjutants was mainly in and around the Vikramshila Gangetic Dolphin Sanctuary, which shows the importance of this protected area for the conservation of not only dolphins but also other fauna (Figure 6.3) (Appendix 8.1).

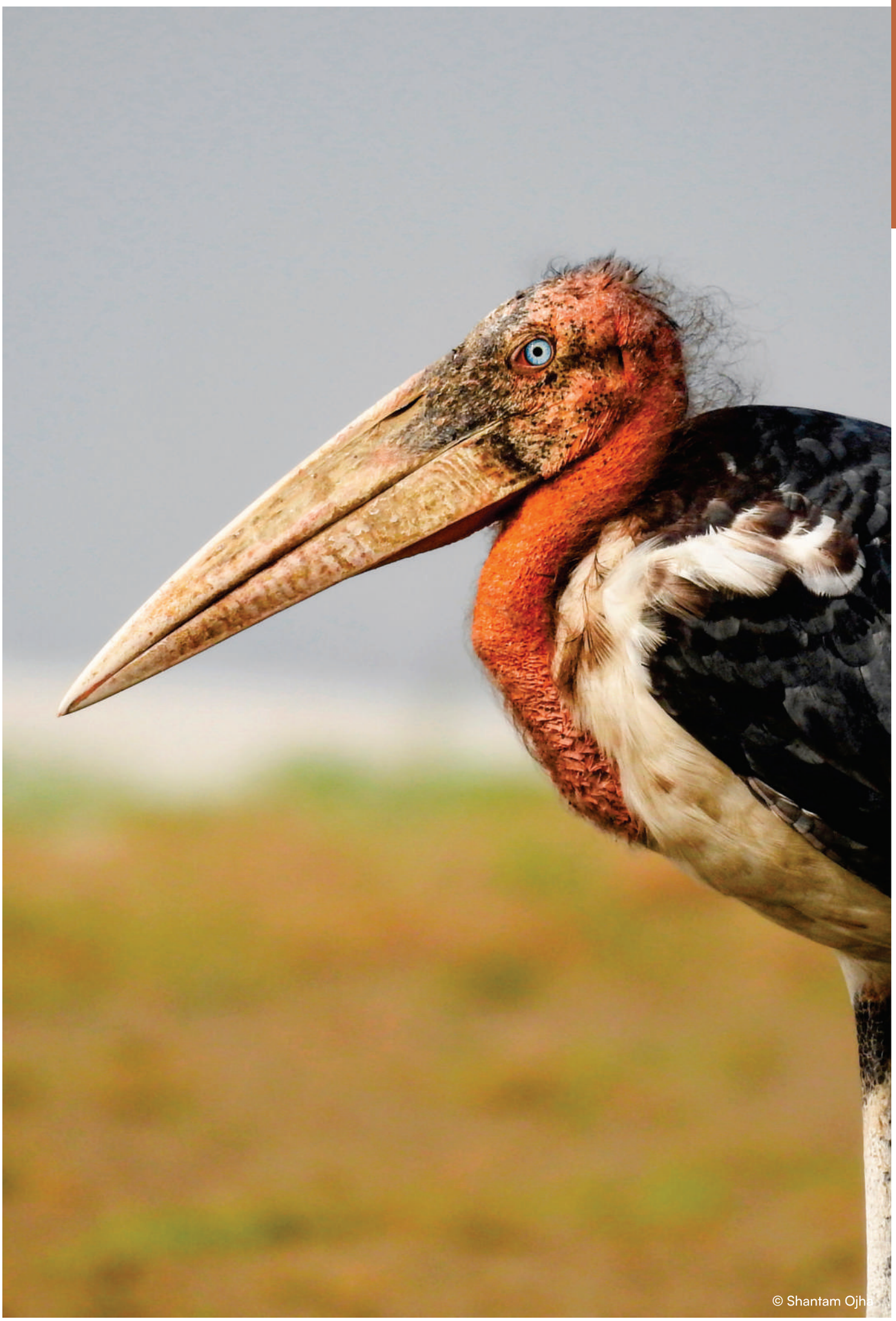
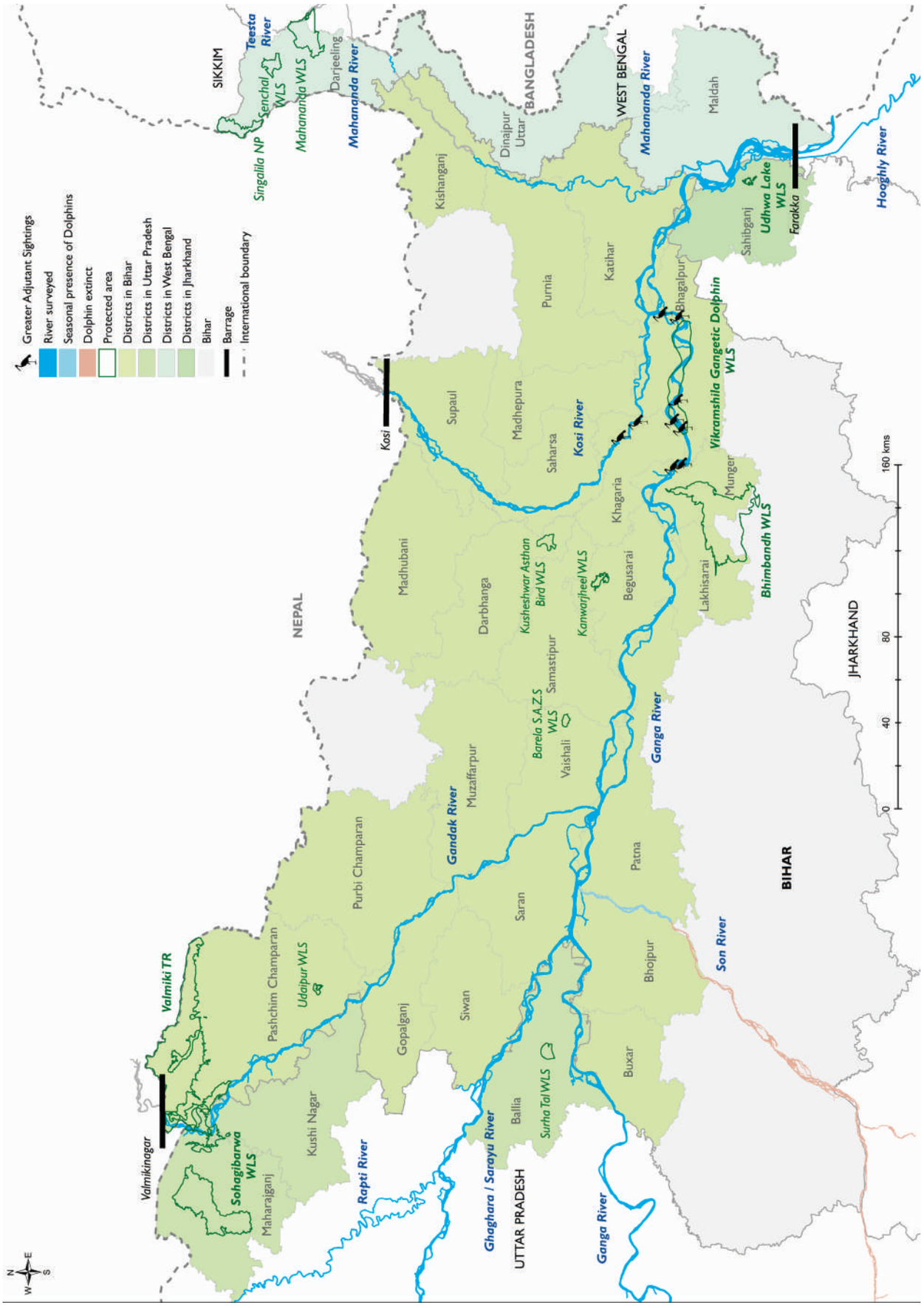

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FIGURE 6.3

Distribution of Greater Adjutant in Ganga from Chausa to Manihari and its tributaries Gandak , Mahananda, Kosi and part of Ghaghara in Bihar, and Manihari to Rajmahal in Jharkhand.



6.4.1.2 Herpetofauna

In Bihar, only 17 individuals of the Near Threatened Brown-roofed Turtles were recorded at a single location in Balahpur (Appendix 8.2).

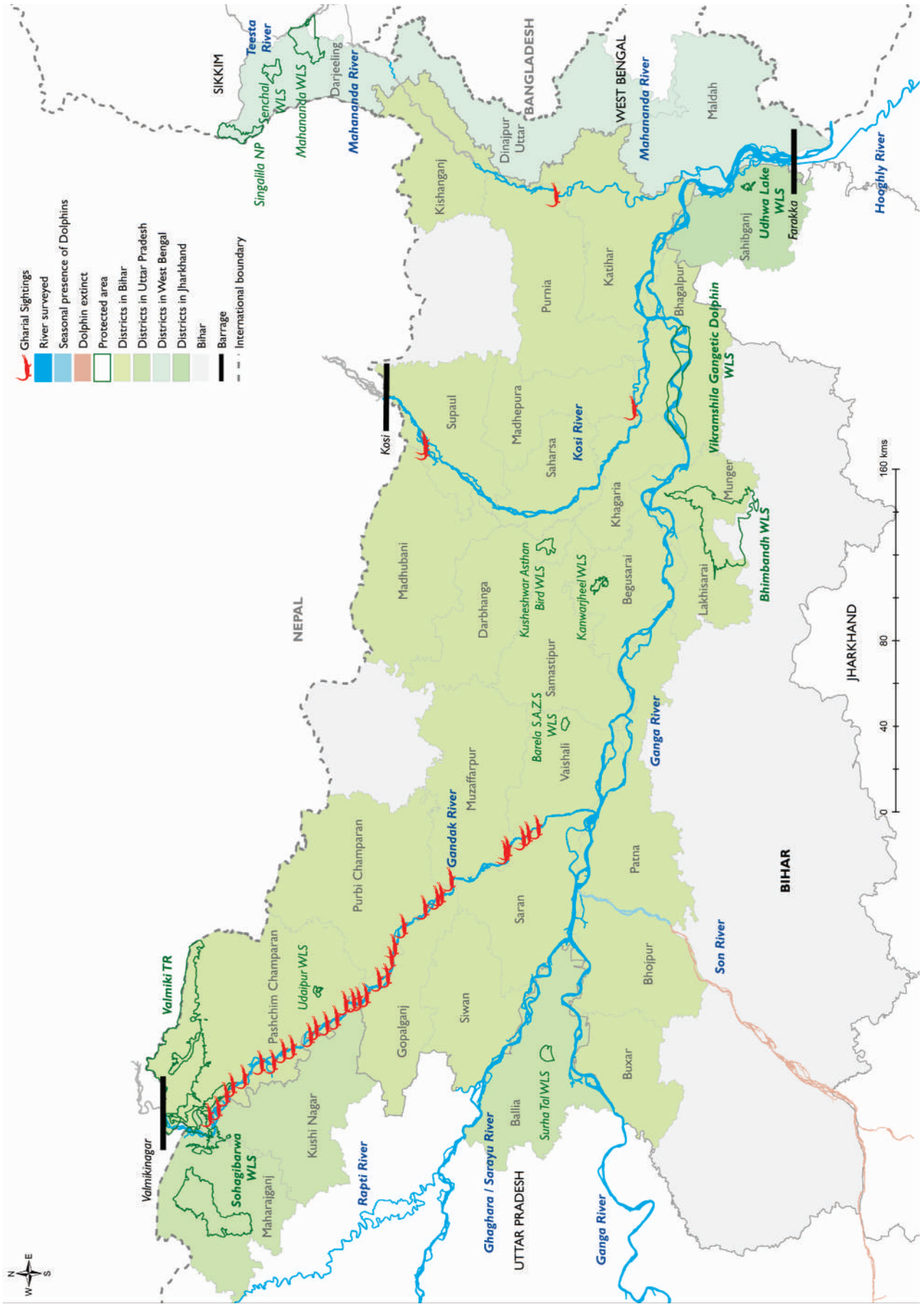


6.4.1.3 Mammals

Four species of mammals were encountered during the survey. Nilgai was seen at various locations foraging and two Golden Jackals were recorded. Hundreds of Flying foxes were recorded from a single location, at Bagder in Bihar. Three Smooth-coated Otters were seen at meanderings in Begusarai and Munger (Figure 6.6) (Appendix 8.3).

FIGURE 6.4

Distribution of Gharial in Ganga from Chausa to Manihari and its tributaries Gandak , Mahananda, Kosi and part of Ghaghara in Bihar, and Manihari to Rajmahal in Jharkhand.



6.4.2 Gandak

Gandak River in its unique habitat characteristics, inhabits a wide range of associated fauna including Gharials, Muggers, Smooth-coated Otters, jackals, turtles, leopards, and multiple species of resident as well as migratory waterfowls. There is currently a good population of Gharial present in the Gandak River (Choudhary, 2010). The presence of a large number of water birds is an indicator of good habitat quality. Due to the increasing agricultural activities, the land which is cultivated in riparian wetlands leads to a decrease in bird diversity (Mensing *et al.*, 1998). During the survey from the Valmikinagar Barrage near the Indo-Nepal Border to the Gandak-Ganga Confluence at Patna, we recorded a total of 59 species of associated fauna with 51 species of birds, three species of mammals, and five reptiles.

6.4.2.1 Birds

The total recorded bird species during the survey was 51, of which, species of conservation concern were the Endangered Egyptian Vulture (n=1) and the Near Threatened Eurasian Curlew (n=4), Painted Stork (n=1), Asian Woolly-necked Stork (n=17) and Oriental Darter (n=1) (Appendix 9.1).

6.4.2.2 Herpetofauna

Five species of herpetofauna were recorded in the survey, including the Critically Endangered Gharial (n=175), the Near Threatened Brown-roofed Turtle (n=214) and the Vulnerable Mugger (n=9) (Appendix 9.2).

6.4.2.3 Mammals

A total of three species of mammals were recorded during the survey, none of which were of any conservation concern. The species consist mainly of primates such as Rhesus Macaque, Northern Plains Gray Langur, and Nilgai (Appendix 9.3).

6.4.3 Mahananda

Mahananda holds a wide variety of avifauna. A total of 123 bird species were recorded (Kelkar & Dey, 2021). Historically, there was no presence of Gharial, Muggers, and otters in the Mahananda River. During the survey from Kishanganj to Mahananda-Ganga Confluence at Rajmahal, we recorded a total of 51 species of associated fauna with 49 species of birds, one species of mammal, and one reptile.

6.4.3.1 Birds

The total number of recorded bird species during the survey was 49, of these species of conservation concern were the Vulnerable Indian Spotted Eagle (n=1), Lesser Adjutant (n=2), and the Near Threatened Asian Woolly-necked Stork (n=3), Black-headed Ibis (n=1), River Lapwing (n=37) and Northern River Lapwing (n=151) (Appendix 10.1).

6.4.3.2 Herpetofauna

During our survey, we recorded only one species of herpetofauna, the Critically Endangered Gharial (n=1). There are no earlier reports of the Gharial sightings from the river. However, there are reports of Gharials moving from Kosi to Mahananda during flood season. No turtle species were recorded, which supports the observations of Kelkar & Dey, 2021 (Appendix 10.2).

6.4.3.3 Mammals

Only one species of mammal, the Golden Jackal was recorded during the survey (Appendix 10.3).

6.4.4 Kosi

The Kosi River contains a wide variety of biodiversity, and several endangered species like the Ganges

River Dolphin (Smith et al., *2000*) and the Greater Adjutant (Choudhary *et al.*, 2022). The river has a high diversity of crustaceans and molluscs (Joshi, 2009). The river also holds a good number of gastropods, around 20 species which are used locally for various purposes like food and treatment of ailments like rickets, arthritis, and asthma (Prabhakar & Roy, 2009). Two independent surveys of the Kosi River stretch passing through the Saharsa district of Bihar by Choudhary *et al.*, (2019 a, b) have recorded 41 species of birds, 22 Brown Roofed Turtle and two Gharials (one adult and one juvenile). According to this study, these Gharials were sighted after a very long interval of more than 50 years in the Kosi River. Also, in another survey (Choudhary, 2016) in the same district of Bihar, 99 bird species were recorded along the river stretch and associated floodplain wetlands as well as one Kachuga species. In our survey from Kosi Barrage near the Indo-Nepal border to Kosi-Ganga Confluence at Kursela, we have recorded a total of 65 species of associated fauna with 59 species of birds, two species of mammal, and four reptiles.

6.4.4.1 Birds

The total recorded bird species during the survey was 59, of which 10 species were of conservation concern. Near Threatened species are the Oriental Darter (n=1), Asian Woolly-necked Stork (n=14), Black-necked Stork (n=1), Painted Stork (n=111), Black-headed Ibis (n=15), River Lapwing (n=14), Vulnerable species include the Indian Spotted Eagle (n=2), Lesser Adjutant (n=23), River Tern (n=1) and the Endangered Greater Adjutant (n=7) (Appendix 11.1).

6.4.4.2 Herpetofauna

Four species of herpetofauna were recorded in the survey, including two species of conservation concern, the Critically Endangered Gharial (n=3) and the Near Threatened Brown Roofed Turtle (n=176) (Appendix 11.2).

6.4.4.3 Mammals

Two species of mammals, the Golden Jackal and Nilgai were recorded during the survey (Appendix 11.3).

6.4.5 Ganga (Jharkhand)

The associated fauna assessment conducted in Jharkhand recorded 51 species of birds. No species of mammals and herpetofauna were recorded.

6.4.5.1 Birds

A total of 51 bird species were recorded, five are of conservation concern, the Vulnerable Lesser Adjutant (n=2), the Near Threatened Black-headed Ibis (n=75), Eurasian Curlew (n=4), River Lapwing, (n=4) and Asian Woolly-necked Stork (n=24). 25 migratory bird species such as Citrine Wagtail, Great Crested Grebe, Kentish Plover, etc were recorded. (Appendix 12.1).

In comparison to the previous survey by Wildlife Trust of India, where 90 species of birds were encountered along the river Ganga between Sahebganj to Chausa (Kumari *et al.*, 2014). As the region also attracts several winter migrant birds, the season of the survey influences the encountered species diversity. Fewer encounters with reptiles and mammals have occurred since the survey was not intended to focus on these species and was designed particularly for the Ganges River Dolphin survey.

FIGURE 6.5

Distribution of Mugger in Ganga from Chausa to Manihari and its tributaries Gandak , Mahananda, Kosi and part of Ghaghara in Bihar, and Manihari to Rajmahal in Jharkhand.

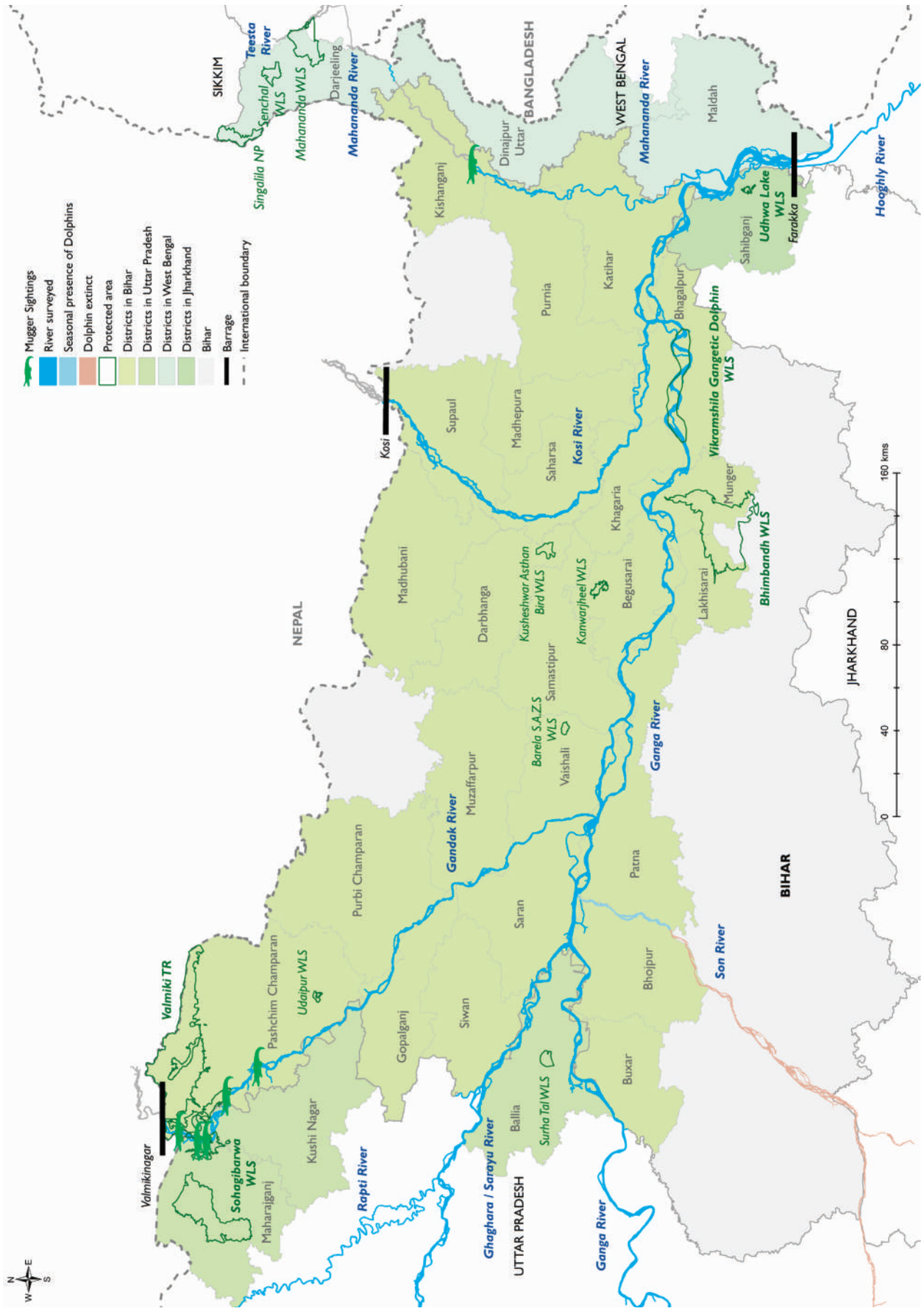
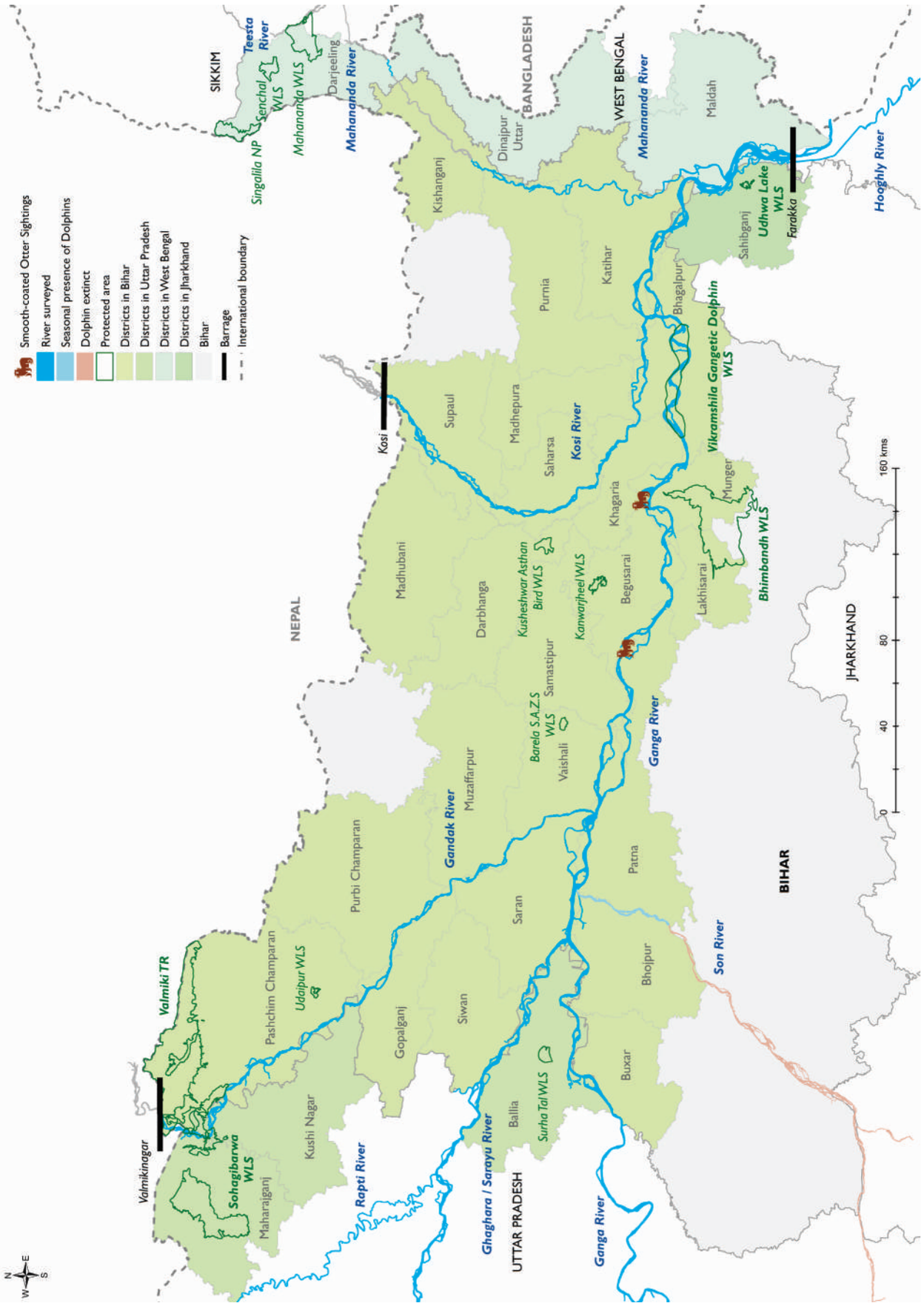


FIGURE 6.6

Distribution of Smooth-coated Otter in Ganga from Chausa to Manihari and its tributaries Gandak , Mahananda, Kosi and part of Ghaghara in Bihar, and Manihari to Rajmahal in Jharkhand.



6.5 Conclusion

Bihar has a fairly even distribution of dolphins with a high presence around confluences. In mainstream Ganga, the important areas are Revalganj-Patna, Begusarai, Katihar-Sahibganj, and Vikramshila Gangetic Dolphin Sanctuary. In the tributaries, 'critical areas' are present in Supaul (downstream of Kosi Barrage) in the Kosi River, Purnia in the Mahananda River, and Paschim Champaran (downstream of Valmiki Barrage) and Purbi Champaran in the Gandak River (Figure 6.2).



VII. RAJASTHAN & MADHYA PRADESH



Citation: Aaranya Gayathri, Merin Jacob, Kanad Roy, Vineet Singh, Mohd. Shahnawaz Khan, Ayan Dutta, Hiyashri Sarma, Syeda Tabassum Tasfia, Sneha Shivaji Mane, Supravat Mahata, Vijay Pratap Singh, Jitul Kalita, Gunjan Chawla, Sajal Sharma, Rizwan Ali Khan, Shah Alom, Bhaskar Dixit, Atul Srivastav, Sunny Deori, S.P. Singh, Anil Kumar Yadav, Abdul Wakid, Suresh Babu, Vishnupriya Kolipakam & Qamar Qureshi. Status of Ganges River Dolphins in Madhya Pradesh & Rajasthan (Chambal) (2024).

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MADHYA PRADESH

NUMBER OF RIVERS SURVEYED

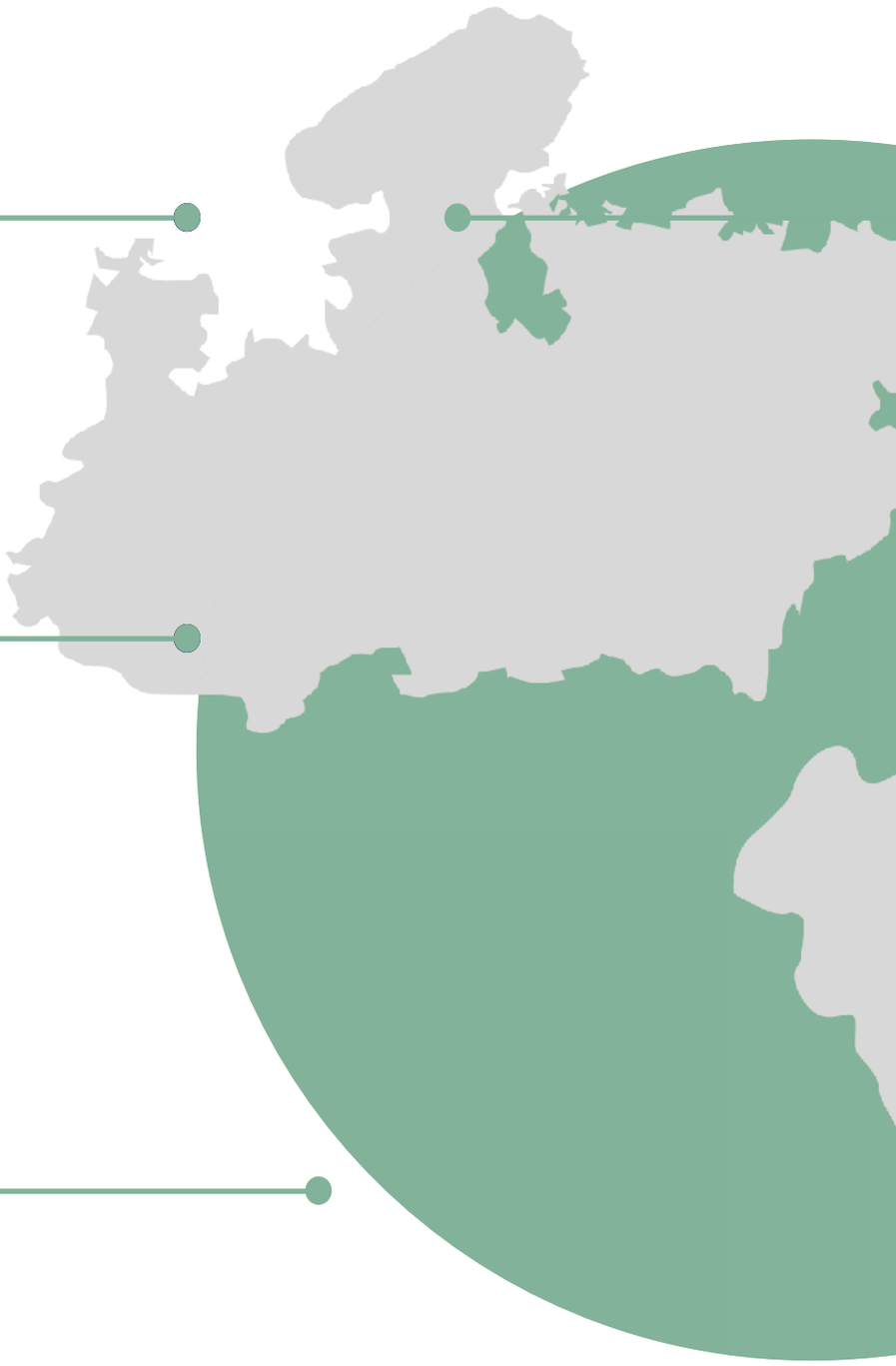
1

NUMBER OF KILOMETERS SURVEYED

195

NUMBER OF SURVEY DAYS

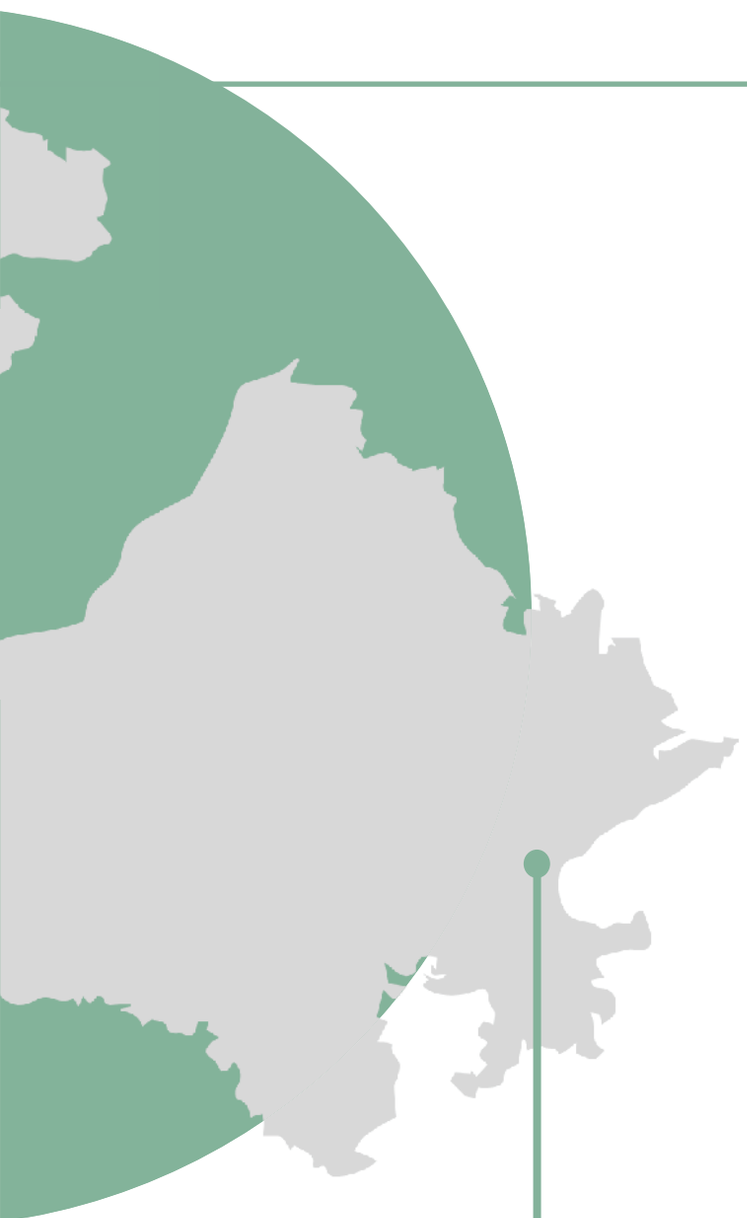
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RAJASTHAN

LEAST COUNT

76



POPULATION ESTIMATE

95 (87-105)

7.1 Background

Chambal lies on the border of Madhya Pradesh, Rajasthan, and Uttar Pradesh. A part of the Chambal River was declared a protected area in 1978 under the Wild Life (Protection) Act, 1972, designated as the National Chambal Sanctuary. This 5400 Km2 area is managed by the forest departments of all three states. Chambal is considered a clean river (Hussain, 1999), based on the parameters related to water pollution (Gupta et al., 2022), having fewer pollutants and high dissolved oxygen (DO). National Chambal Sanctuary is known for its largest Gharial population (Hussain, 1991; Singh, 1985), and a substantial resident population of Ganges River Dolphins, Indian Skimmer (Aktar et al., 2009; Rao et al., 1989), and Red-crowned Roofed Turtle. Apart from this, the river is home to at least 78 species of wetland birds, seven species of freshwater turtles, Marsh Crocodile, Smooth-coated Otter (Hussain, 1996, 1999; Hussain & Choudhury, 1992; Hussain & Choudhury, 1993; Sharma, 2006b; Sharma & Singh, 1986).

7.2 Study Area

A total of 195 Km river length from Nagar to Bhind encompassing Madhya Pradesh and Rajasthan was covered in 6 days. Out of the total of 195 Km, 96 Km and 99 Km from Nagar to Pinahat (Rajasthan and Madhya Pradesh), and Pinahat to Bhind (Madhya Pradesh) respectively were surveyed for 3 days each (Table 7.1, Figure 7.1). The details of the remaining stretch of the Chambal River, which lies in Uttar Pradesh are provided in Sections 5.3.6 and 5.3.6.1.

TABLE 7.1

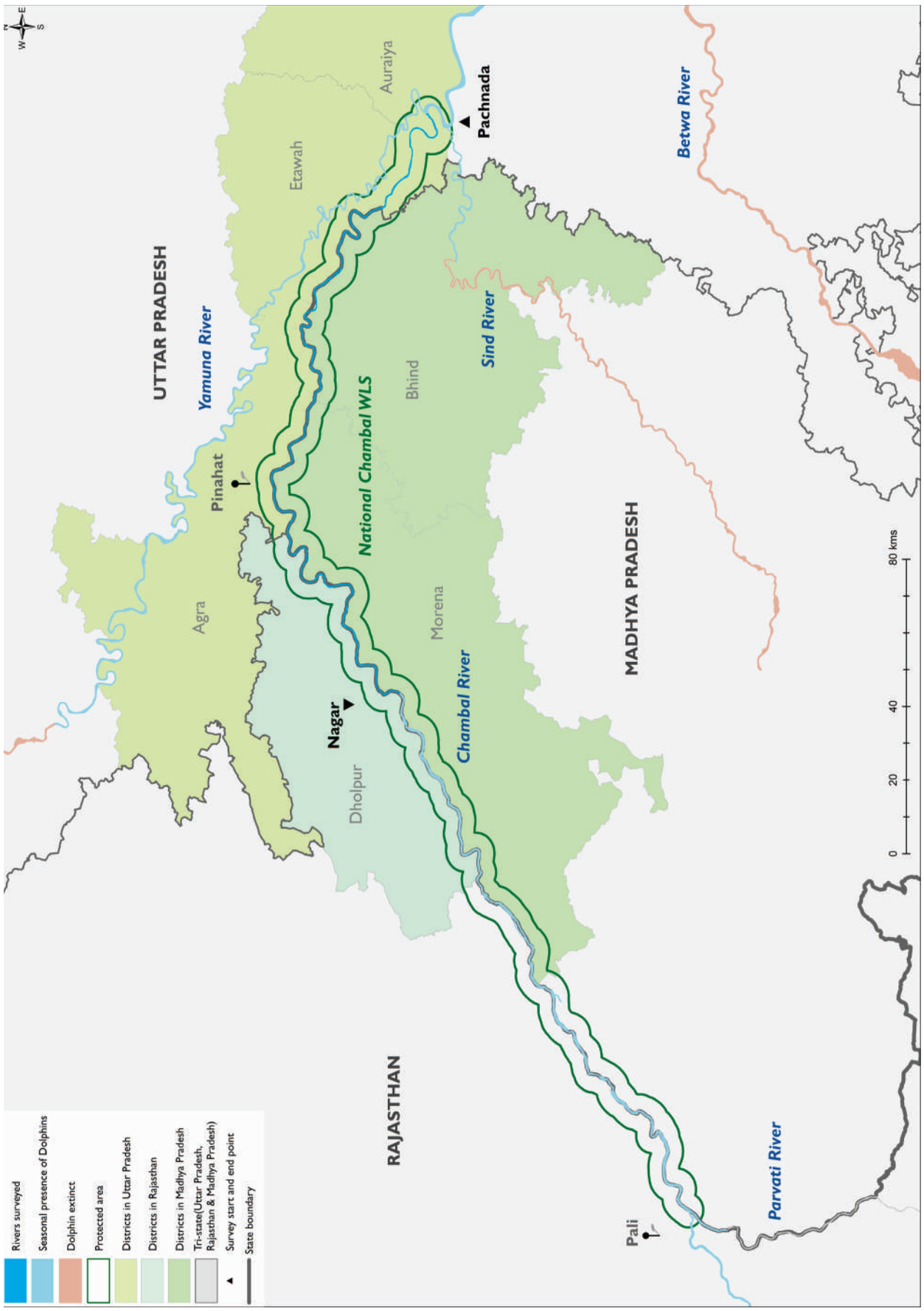
Effort and method used for the Ganges River Dolphin survey in Chambal River in Rajasthan and Madhya Pradesh.

River	State	Stretch	Method	Distance surveyed (Km)	Survey dates	Survey days	Total effort (hrs.)
Chambal	Rajasthan - Madhya Pradesh	Nagar-Pinahat	Boat in Tandem	96	10th -12th Jan, 2022	3	11 hrs.
	Madhya Pradesh	Pinahat - Bhind		99*	13th -15th Jan, 2022	3	11 hrs.
				195	10th -15th January, 2022	6	22 hrs.

**99 Km is shared between Madhya Pradesh and Uttar Pradesh and one day is shared between Madhya Pradesh and Uttar Pradesh.*

FIGURE 7.1

Chambal River in Rajasthan and Madhya Pradesh.



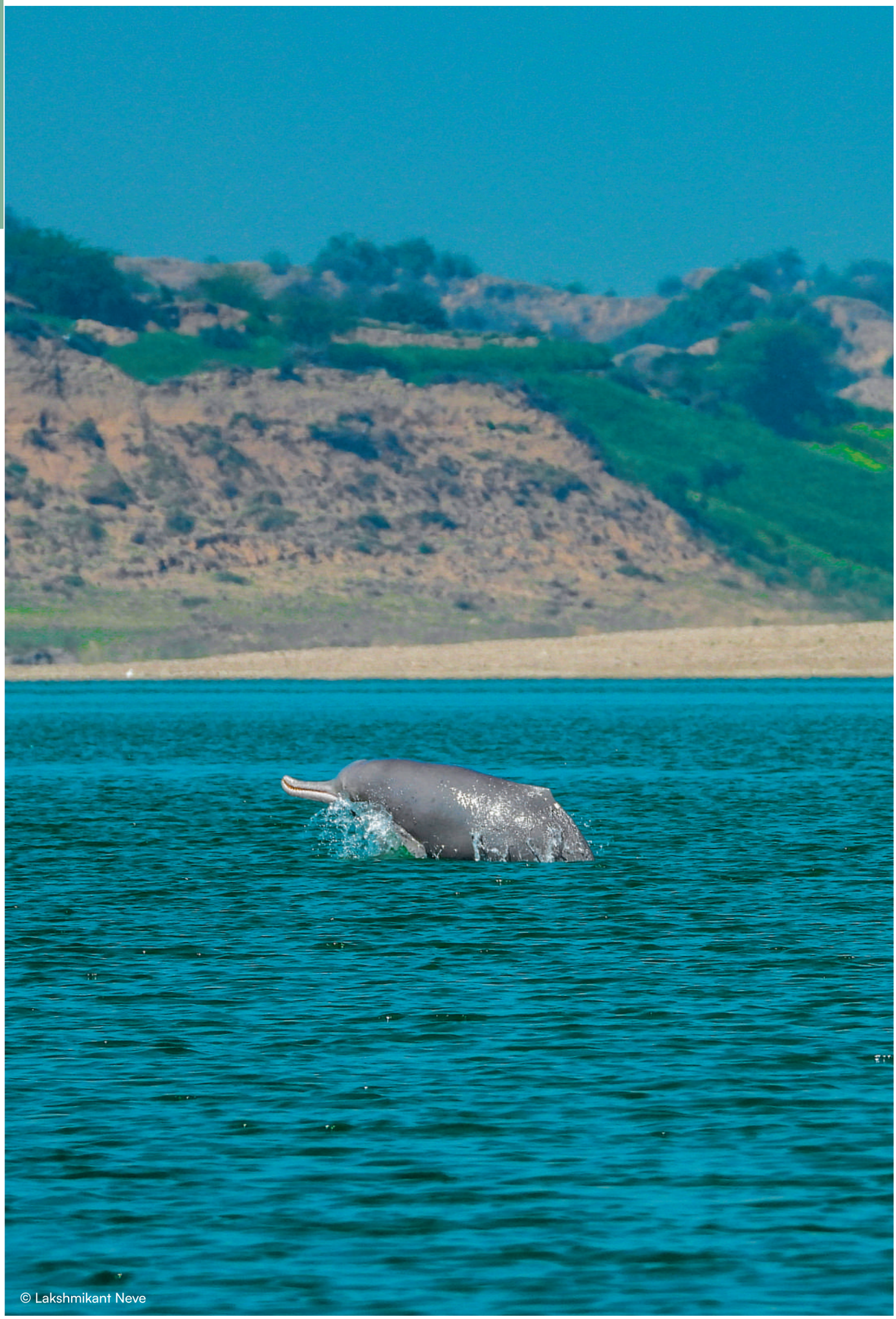

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FIGURE 7.2

Encounter rate of Ganges River Dolphin in Chambal River in Rajasthan and Madhya Pradesh.

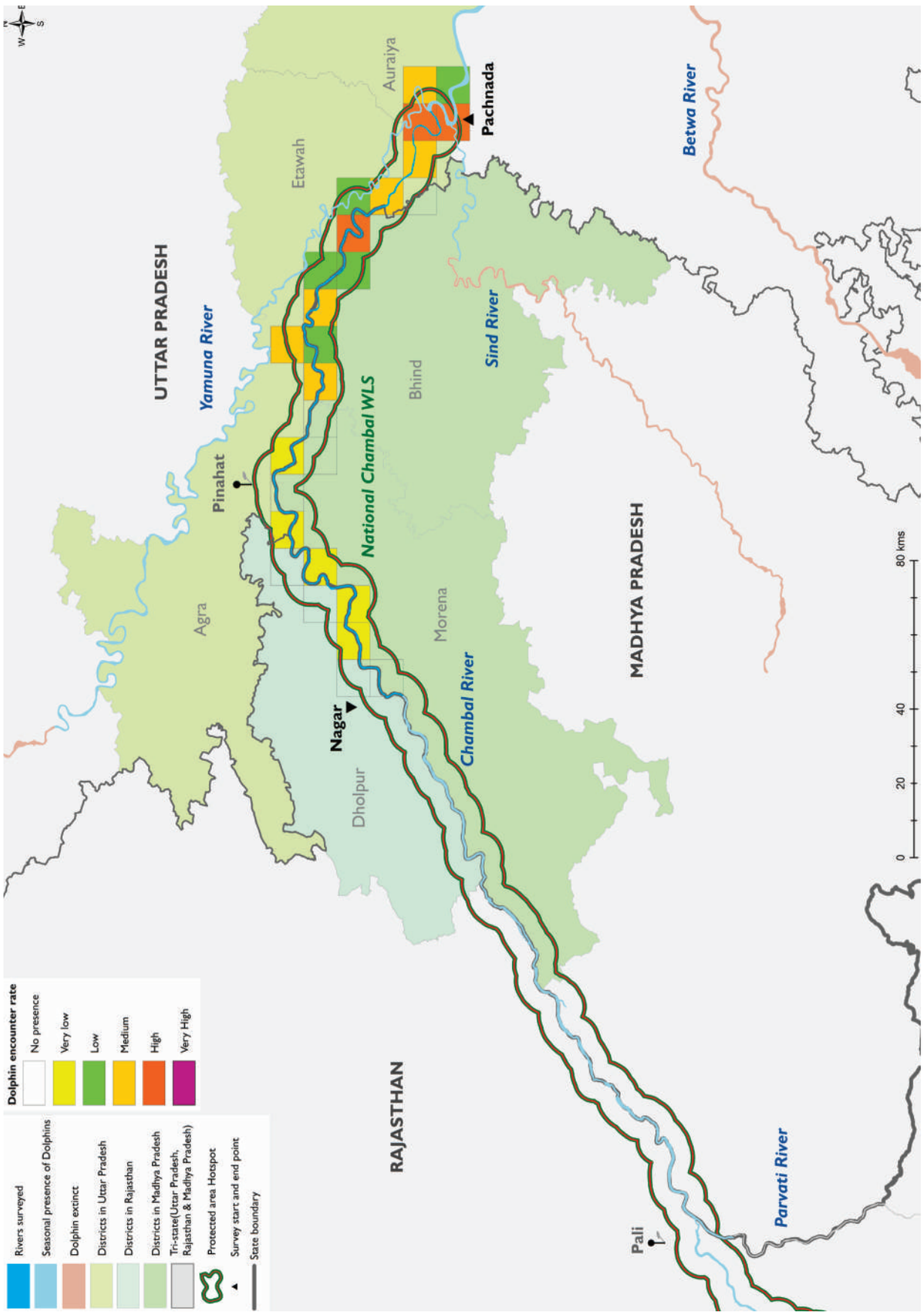


TABLE 7.2

Ganges River Dolphin population estimate in Chambal River in Rajasthan and Madhya Pradesh. N_O is the observer corrected population estimate, and ER_O is the observer corrected encounter rate (per Km). N_{OA} is the observer and availability corrected population estimate and ER_{OA} is the observer and availability corrected encounter rate (per Km).

River	N_{OA}	ER_{OA}
Nagar - Pinahat	17 (13-22)	0.2
Pinahat - Bhind	78 (74-83)	0.8
Nagar - Bhind (Madhya Pradesh & Rajasthan)	95 (87-105)	0.5

7.3 Population Estimation

The overall population of the Ganges River Dolphin in the states of Madhya Pradesh and Rajasthan is 95 (87-105) (Table 7.2, Figure 7.2). The population of the Ganges River Dolphin between Nagar to Pinahat, which is shared between Rajasthan and Madhya Pradesh was estimated to be 17 (13-22), with a least count of 13 dolphins and an encounter was 0.2/Km. A total population of 157 was recorded between Madhya Pradesh and Uttar Pradesh in the Chambal River between Pinahat and Bhind. This population is shared between both states. The population of Ganges River Dolphin in Madhya Pradesh for this stretch was 78 (74-83) (Figure 7.2 & Table 7.2), with an encounter rate of 0.8/Km.

Previous population estimations based on the direct count method across the Chambal River (including Uttar Pradesh), was 80 dolphins (Qureshi *et al.*, 2021). There are reports of Ganges River Dolphins moving from certain areas in the dry season, probably to avoid shallow depth or for breeding (Singh & Rao, 2012). The low number of dolphins in the upper stretches of the Chambal River, as compared to the lower stretch (Uttar Pradesh), could largely be due to river fragmentation and very low depth of water in these areas (Figure 7.6 & Figure 7.7). The past population estimates were considerably lower, i.e., 93 in 2002, 81 in 2005, and 91 in 2012 (WWF-India, Unpublished; Singh & Rao, 2012). However, these are largely from single-observer surveys of the surfacing dolphins and suffer from an underestimation due to observer and unavailability bias. During this survey, the use of a much more robust survey methodology and correction for the unavailability and observer bias has resulted in a more accurate estimation of Ganges River Dolphins in Chambal.

7.4 Associated Fauna

During the associated fauna assessment, a total of 58 species were recorded, of which 50 species of birds, seven species of reptiles, including turtles, Gharials, Mugger, and one species of mammal.

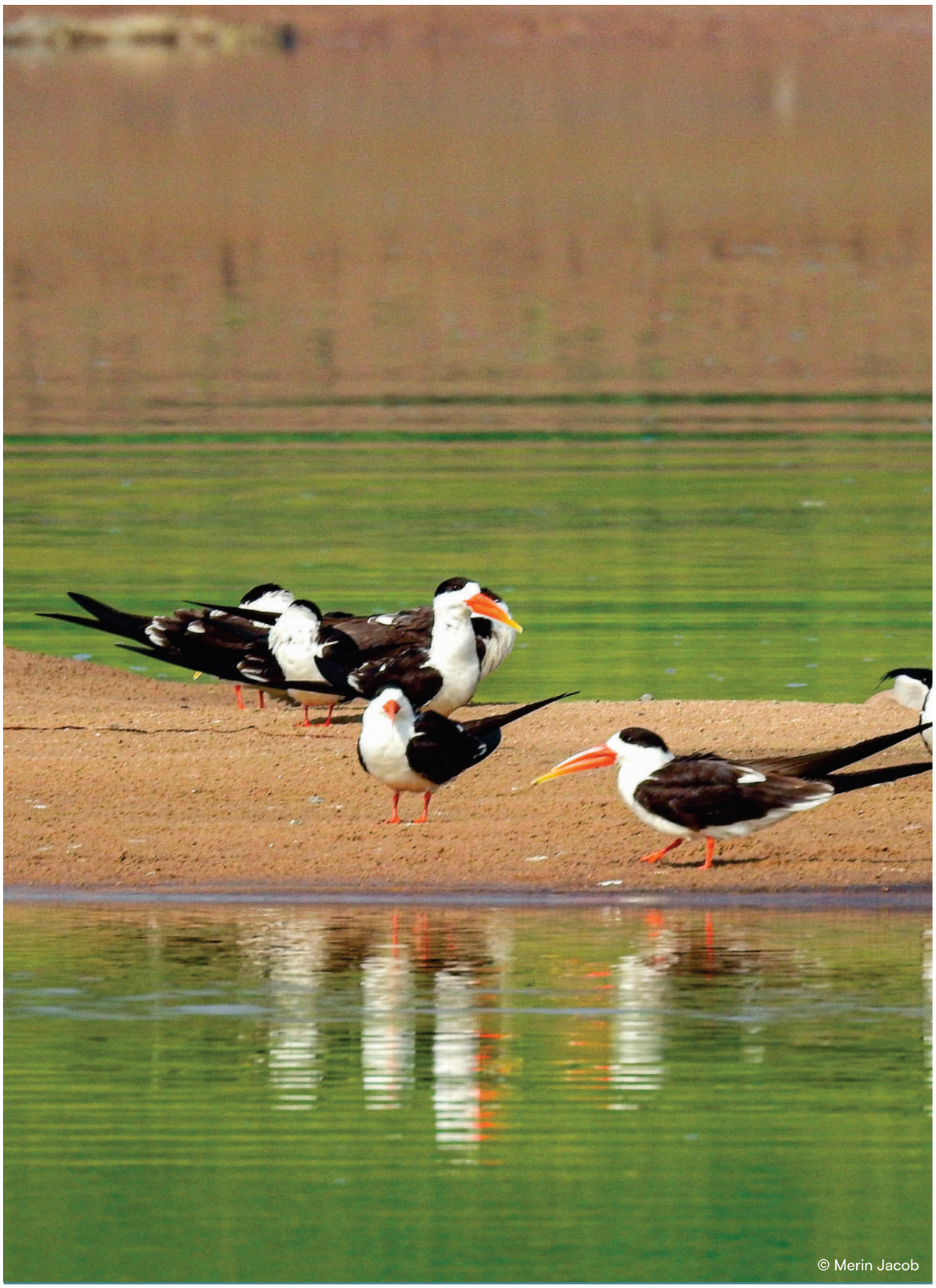
7.4.1 Birds

Fifty species of birds including the Endangered, Indian Skimmer (n=51) and Egyptian Vulture (n=28) were recorded. Other species of concern were the Near Threatened River Lapwing, (n=78), Painted Stork (n= 8), and Great Thick-knee (n= 7) (Figure 7.3) (Appendix 13.1).

7.4.2 Herpetofauna

Muggers and Gharials were sighted throughout. A total of 185 Muggers (Figure 7.4, Figure 7.5) and 212 Gharials were encountered on the survey. However, this is likely to be an underestimate as the survey

was not designed for these species. The Critically Endangered Three-striped Roofed Turtle (n=4) and Red-crowned Roofed Turtle (n=1) and the Endangered Ganges Soft-shelled Turtle (n=5) were recorded during the survey (Appendix 13.2).





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FIGURE 7.3

Distribution of Indian Skimmer in Chambal River in Rajasthan and Madhya Pradesh.

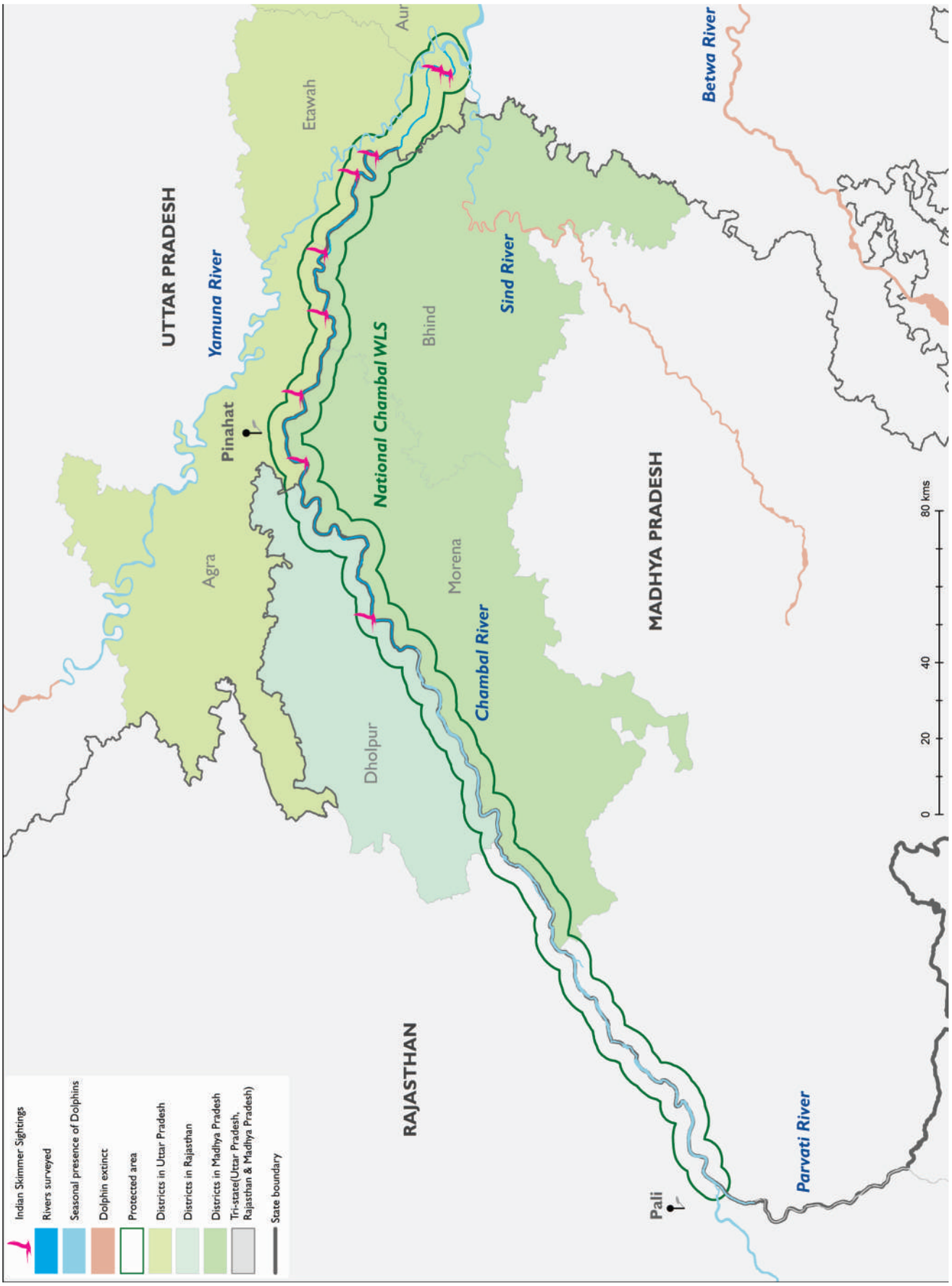


FIGURE 7.4

Distribution of Gharial in Chambal River in Rajasthan and Madhya Pradesh.

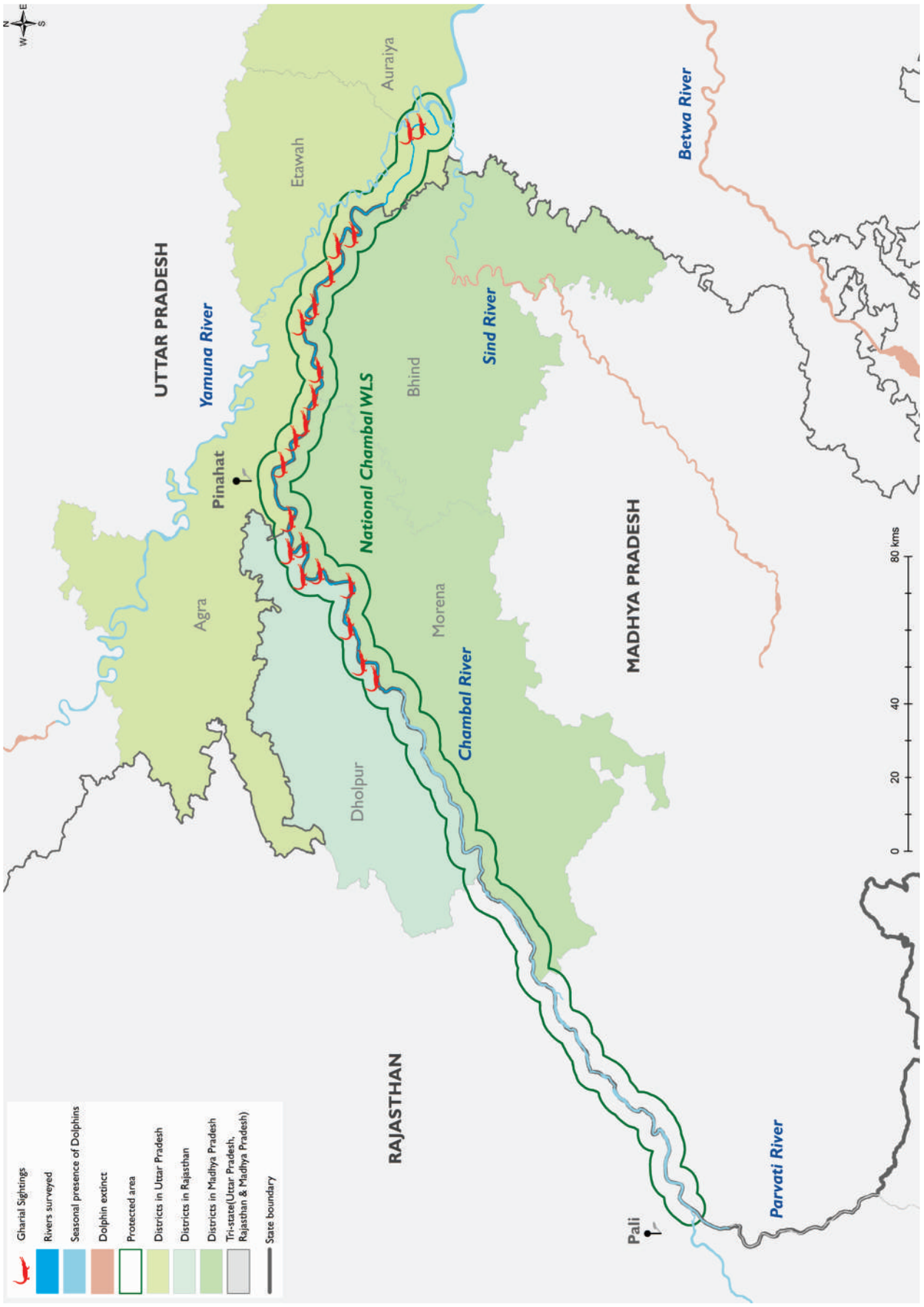
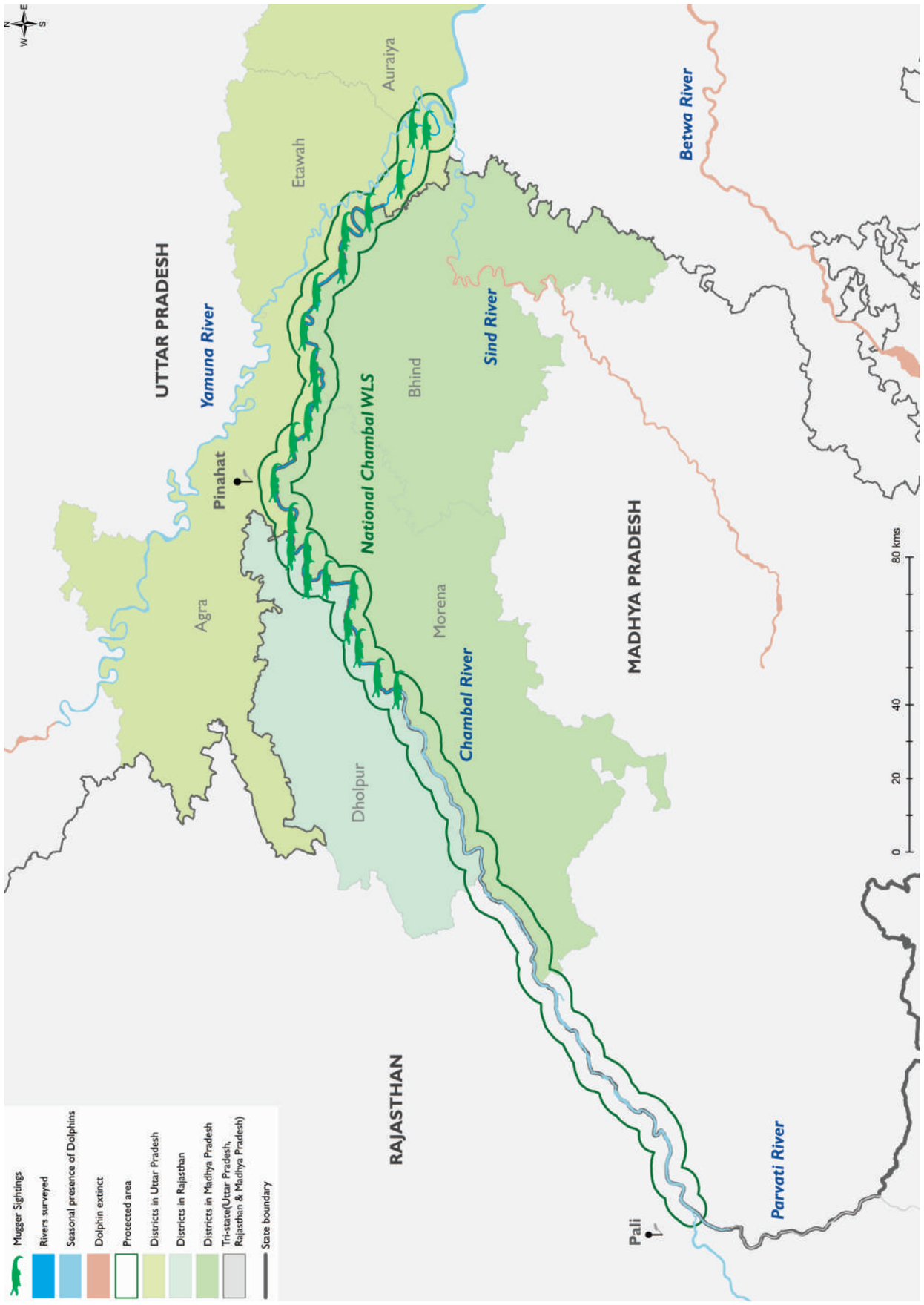


FIGURE 7.5

Distribution of Mugger in Chambal River in Rajasthan and Madhya Pradesh.



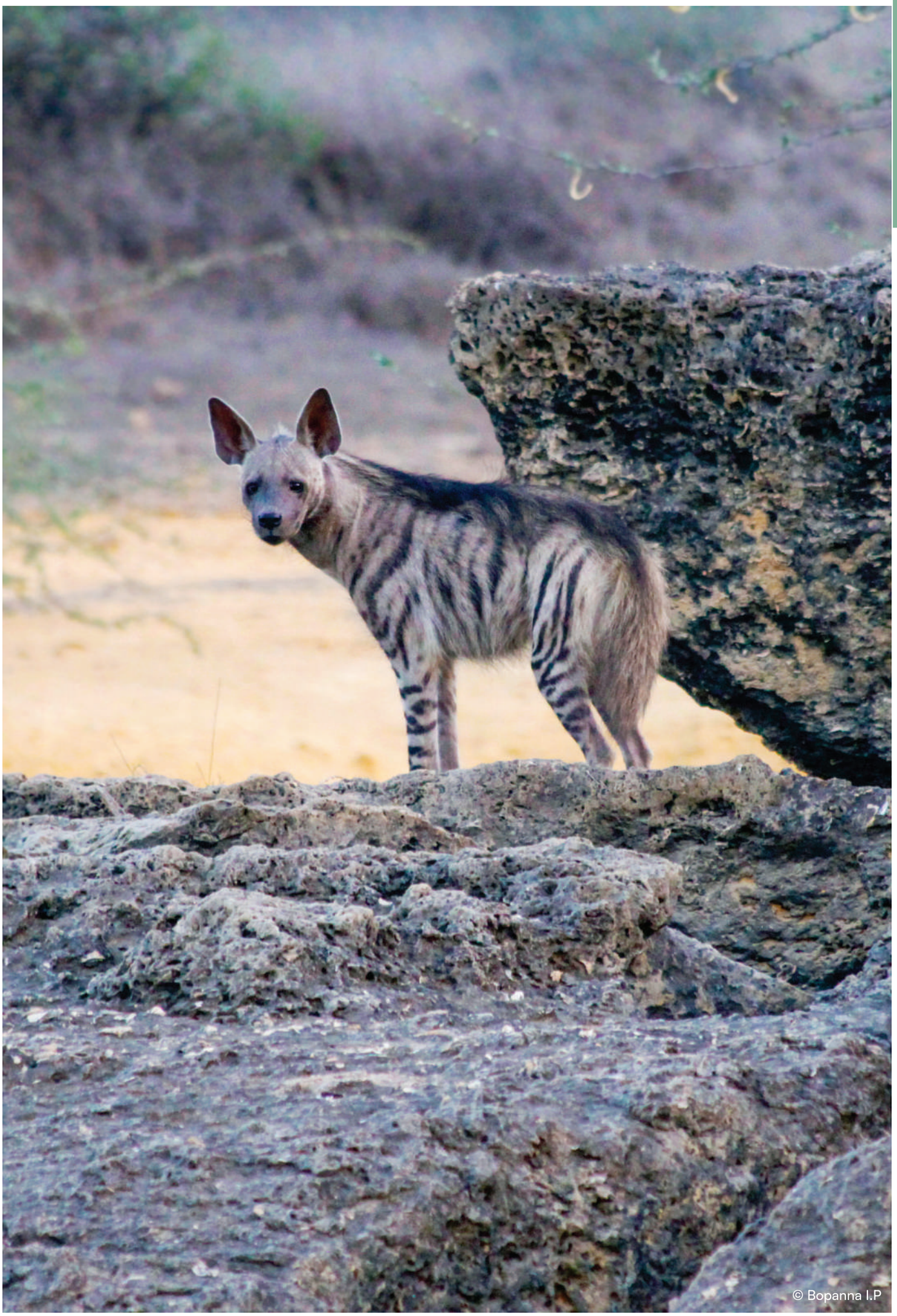
7.4.3 Mammals

During the survey, only one species of mammal was recorded from this stretch, the Least Concern Nilgai (Appendix 13.3).

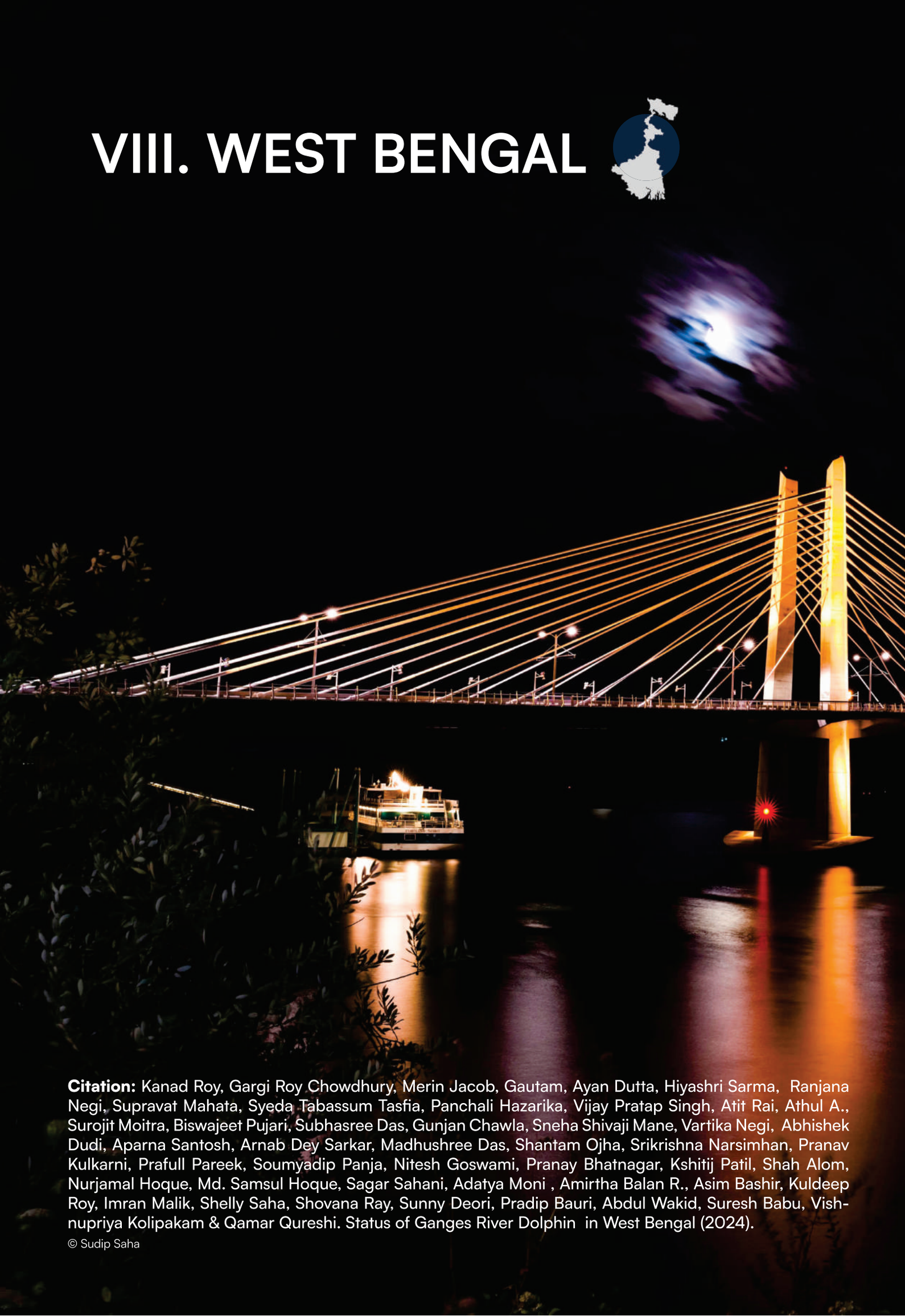
Chambal River holds 80-90% of the recorded global Gharial population (Lang, 2021). In the current survey of 242 Km, which is half the distance of the previous Gharial population surveys, 212 individuals were recorded. The survey technique adopted for river dolphin estimation is probably not best suited for Gharial or Mugger estimation. Usually, surveys for these species are undertaken during their peak basking period. However, the current survey would still provide a relative encounter rate across different stretches, given the short survey period. Breeding colonies of Indian Skimmers have been historically recorded from Chambal Sanctuary (Mishra *et al.,* 2016*; WI*I-GACMC, 2017). National Chambal Sanctuary is one of the important aquatic bird areas in India as it is an important breeding site for Indian Skimmers (Das, 2015; Shaikh *et al., 202*1).

7.5 Conclusion

The important areas identified in Madhya Pradesh and Rajasthan are essential for dolphin conservation. The dolphin population in the Chambal River, which flows through the National Chambal Sanctuary (NCS), has significant concentrations from Nagar to Bhind. Key areas for conservation include the entire stretch of the NCS, which supports a viable population of Gharials and a significant breeding population of Indian Skimmers. The river section also hosts critically endangered species such as the Three-Striped Roofed Turtle and the Red-crowned Roofed Turtle, along with the endangered Ganges Soft-shelled Turtle.


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VIII. WEST BENGAL



Citation: Kanad Roy, Gargi Roy Chowdhury, Merin Jacob, Gautam, Ayan Dutta, Hiyashri Sarma, Ranjana Negi, Supravat Mahata, Syeda Tabassum Tasfia, Panchali Hazarika, Vijay Pratap Singh, Atit Rai, Athul A., Surojit Moitra, Biswajeet Pujari, Subhasree Das, Gunjan Chawla, Sneha Shivaji Mane, Vartika Negi, Abhishek Dudi, Aparna Santosh, Arnab Dey Sarkar, Madhushree Das, Shantam Ojha, Srikrishna Narsimhan, Pranav Kulkarni, Prafull Pareek, Soumyadip Panja, Nitesh Goswami, Pranay Bhatnagar, Kshitij Patil, Shah Alom, Nurjamal Hoque, Md. Samsul Hoque, Sagar Sahani, Adatya Moni , Amirtha Balan R., Asim Bashir, Kuldeep Roy, Imran Malik, Shelly Saha, Shovana Ray, Sunny Deori, Pradip Bauri, Abdul Wakid, Suresh Babu, Vishnupriya Kolipakam & Qamar Qureshi. Status of Ganges River Dolphin in West Bengal (2024).

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WEST BENGAL

NUMBER OF RIVERS SURVEYED

12

NUMBER OF KILOMETERS SURVEYED

2366

NUMBER OF SURVEY DAYS

64





LEAST COUNT

665

POPULATION ESTIMATE

815 (763-870)

8.1 Background

The occurrence of the Ganges River Dolphin was first documented in 1801 by William Roxburgh in the Hooghly River (Roxburgh, 1801). The IUCN/SSC group conducted the first survey in 1995 from Farakka to Calcutta. The survey was carried out during lean water season using the direct count method, and the best count was 152 dolphins. The dolphin population declined and became genetically isolated after the construction of the Farakka Barrage, commissioned in 1975. Although a sizeable population exists in the Hooghly River (Qureshi *et al*., 2018), recent studies and surveys suggest that the range of dolphins in West Bengal has decreased (Mitra *et al*., 2015; Sharma, 2010). The stretch between Farakka Feeder Canal to Kakdwip in West Bengal sustains a population of about 358 (±10) dolphins (Qureshi *et al*., 2018). The East Coast Canal, which is part of NW-5, links the Haldia River in West Bengal to the Matai River in Orissa (IWAI). Dolphins from West Bengal sometimes venture into this canal. In 2014, a team rescued an adult dolphin from Badasigharpur village at the mouth of the Salandi River and released it 8 km upstream at Dhanakhania Ghat (Behera Pers. Comm.). Furthermore, in 2021, a dolphin carcass was discovered entangled in a fisherman's net in the Salandi River, and this was confirmed by the DFO in charge of the Bhadrak Wildlife Division (Rawat, 2021).

There is no known range description of the species from the Sundarbans. However, historical records suggest that the species used estuarine habitats of the region (Anderson, 1878; Jones, 1982). Wakid *et al*., (2015) recorded a group abundance of 92 Irrawaddy dolphins and 7 Indo-Pacific Humpback Dolphins. However, no Ganges River Dolphins were recorded in the Indian Sundarbans.

8.2 Study Area

The population estimation of the Ganges River Dolphin in the mainstream of the Bhagirathi-Hooghly River of Ganga (Figure 8.1) was carried out from Rajmahal to Farakka (40 Km), Farakka to Diamond Harbour (483 Km), Diamond Harbour to Ganga Sagar (39 Km) and from Farakka Barrage to Indo-Bangladesh border (21 Km). Mahananda River traversing through West Bengal was also surveyed along with various tributaries of the Bhagirathi-Hooghly River, such as Rupnarayan and its tributaries. Survey of the Rupnarayan River from Bandar (Confluence of Shilabati and Dwarakeswar) to Gadiara (where Rupnarayan drains into Bhagirathi-Hooghly River) covers 79 Km. The survey also included 6 Km of Shilabati River (Ghatal to Bandar), 4 Km of Dwarakeswar River (Singhapur to Bandar), 6 Km of Bakshi Canal (Shaifon to Bakshi), and 7 Km of Mundeswari River (Gorur Ghat to Bakshi), Torsa, Kaljani, Haldi and Churni. A total of 2366 Km was covered in 62 days (Figure 8.1 & Table 8.1).

TABLE 8.1

Effort and method used for Ganges River Dolphin survey in Bhagirathi - Hooghly and its tributaries Rupnarayan (its tributaries - Mundeswari, Shilabati, Bakshi Canal and Dwarakeswar), Torsa, Kaljani, Churni, Haldi; and the Sundarbans in West Bengal.

State	River	Stretch	Method	Distance Surveyed (in Km)	Survey dates	Survey days	Total effort (in hrs)
West Bengal	Ganga	Rajmahal- Farakka Barrage	Double observer	41	31st March,2022	1*	4 hrs.
		Farakka Barrage - Diamond Harbour	Double observer	483	18th March-02nd April, 2022	14	47 hrs. 39 min
		Diamond Harbour - Ganga sagar	Double observer	39	10th February,2023	1	2 hrs. 55 min
		Farakka Barrage - Nimtitta (India -Bangladesh border)	Boat in tandem	21	2nd March, 2023	1	1 hrs. 53 min
	Mahananda	Gauripaur - Rajmahal	Boat in tandem	51	04th - 05th January,2023	2	3 hrs.
	Rupnarayan	Bandar - Gadiara	Double observer	79	6th April and 21st September, 2022	2	7 hrs. 2 min
	Mundeswari	Gorur Ghat - Bakshi	Double observer	7	22nd September, 2022	1*	45 min
	Bakshi Canal	Shaifon Bridge - Bakshi	Double observer	6	22nd September, 2022	1*	46 min
	Shilabati	Ghatal - Bandar	Double observer	6	21st September, 2022	1*	38 min
	Dwarakeswar	Singhapur - Bandar	Double observer	4	21st September, 2022	1*	33 min
	Torsa	Purba Kathalbari - Jhaljhali	Double observer	55	11th and 21st September, 2022	2	5 hrs. 15 min
	Kaljani	Bhuchungmari - Deocharai	Double observer	21	13th September, 2022	1	2 hrs. 56 min
	Churni	Anulia Bridge - Mangaldeep	Double observer	10	18th September, 2022	1	1 hrs. 24 min
	Haldi	Teropakhya Ghat - Haldia	Double observer	19	23rd September, 2022	1	1 hrs. 44 min
	Sundarban Tiger Reserve (STR) and Sundarban Biosphere Reserve (SBR)	86 river channels	Double observer	1524	02nd -26th February and 10th-25th February, 2023	34	115 hrs. 20 min
				2366	March,2022 - February,2023	**64**	**195 hrs.** 50 min

**Days are the one which is covered in a single day.*

FIGURE 8.1

Bhagirathi-Hooghly, Rupnarayan (Mundeswari, Shilabati, Bakshi Canal, Dwarakeswar), Torsa, Kaljani, Churni and Haldi in West Bengal.




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FIGURE 8.2

Encounter rate of Ganges River Dolphin population in Bhagirathi-Hooghly River and its tributaries Rupnarayan (Mundeswari, Shilabati, Bakshi Canal, Dwarakeswar), Torsa, Kaljani, Churni and Haldi in West Bengal.

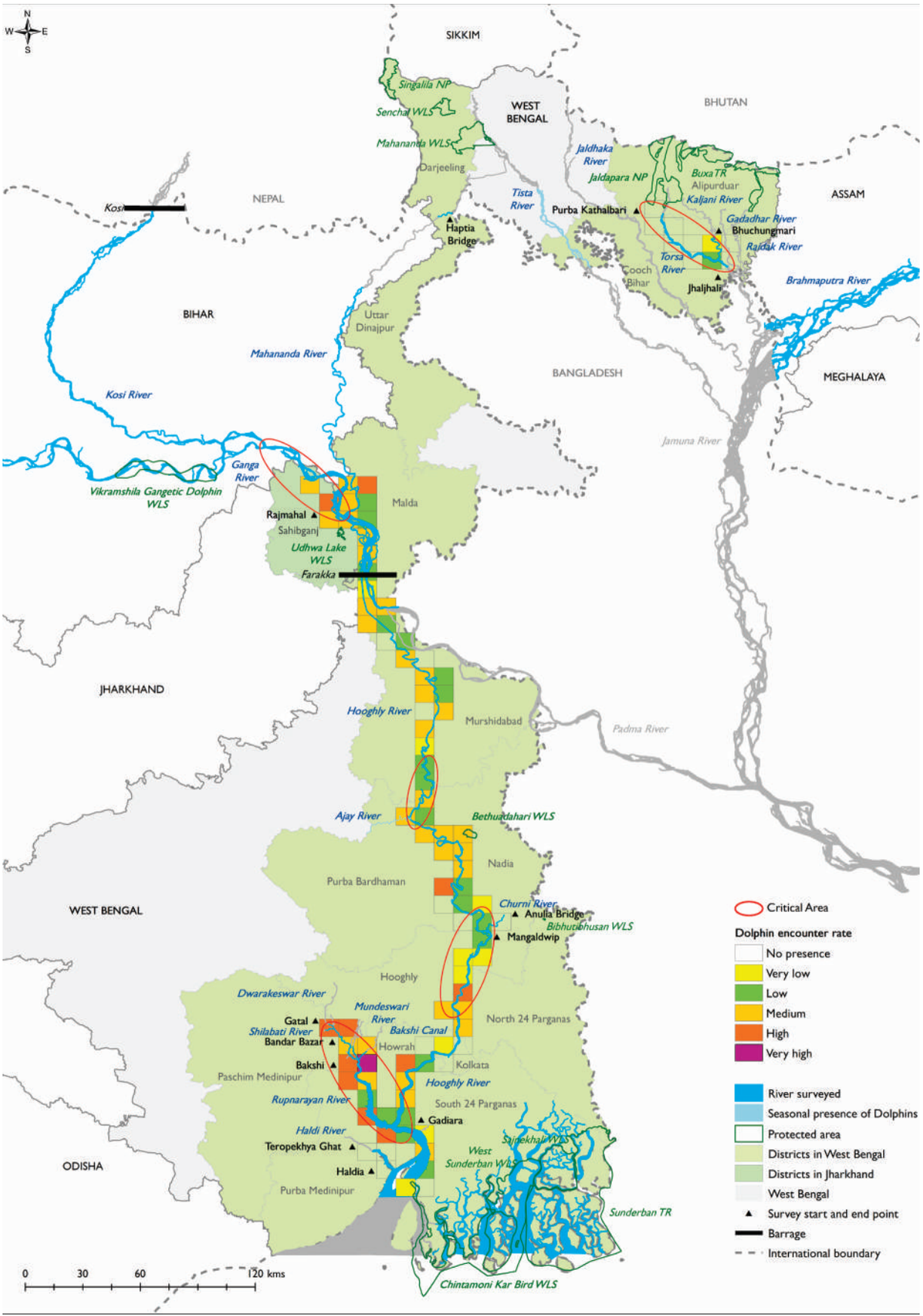


TABLE 8.2

Ganges River Dolphin estimate in Bhagirathi-Hooghly and its tributaries Rupnarayan (Mundeswari, Shilabati, Bakshi Canal, Dwarakeswar), Torsa, Kaljani, Churni and Haldi in West Bengal.

N_O is the observer corrected population estimate and ER_O is the observer corrected encounter rate (per Km). N_{OA} is the observer and availability corrected population estimate and ER_{OA} is the observer and availability corrected encounter rate (per Km).

River	River Stretch	N_{OA}	ER_{OA}
Ganga	Rajmahal - Farakka Barrage	48 (43-53)	1.2
	Farakka Barrage - Diamond Harbor	429 (408-450)	0.9
	Diamond Harbor - Ganga Sagar	30 (24-36)	0.8
	Farakka Barrge - Nimtita (Indo-Bangladesh border)	12 (11-14)	0.6
Mahananda	Gauripaur - Rajmahal	64 (58-73)	1.3
Rupnarayan	Bandar - Gadiara	167 (160-175)	2.1
Mundeswari	Gorur Ghat - Bakshi	12 (11-13)	1.8
Bakshi Canal	Shaifon Bridge - Bakshi	21 (20-22)	3.6
Shilabati	Ghatal - Bandar	17 (15-18)	2.9
Dwarakeswar	Singhapur - Bandar	0	0
Torsa	Purba Kathalbari - Jhaljhali	1	0.02
Kaljani	Bhuchungmari - Deocharai	5	0.3
Churni	Ranaghat - Mangaldeep	7	0.7
Haldi	Teropakhya Ghat - Haldia	0	0
		813 (761-868)	**1**
Sundarbans	Sundarban Tiger and Biosphere Reserve	2	0.001
West Bengal		**815 (763-870)**	0.3

8.3 Population estimation

The overall Ganges River Dolphin estimation in the state of West Bengal in Bhagirathi-Hooghly and its tributaries was 813 (761-868), with a least count of 663 dolphins and an encounter rate of 1/Km. In Sundarbans, two Ganges River Dolphins were recorded (Table 8.2).

8.3.1 Rajmahal - Farakka

The Rajmahal to Farakka stretch of the Ganga River falls in West Bengal. The population of the Ganges River Dolphin in this stretch was 48 (43-53), with a least count of 38 and an encounter rate of 1.2/Km (Figure 8.2, Table 8.2).

8.3.2 Farakka - Diamond Harbor

The survey was carried out for 11 days, from 18th March to 2nd April 2022. The non-tidal zone extends from Farakka to Nabadwip and from Nabadwip to Diamond Harbor is a tidal zone. The population of the Ganges River Dolphin in the mainstream of the Bhagirathi-Hooghly River was 429 (408-450), with an encounter rate of 0.9/Km (Figure 8.2, Table 8.2). The highest dolphin encounter was observed in the Agradwip to Nabadwip stretch (46 Km) and Jangipur to Azimganj stretch (56 Km) (Figure 8.2). The population in 44 Km Feeder Canal was low (21 dolphins), and the sightings in Feeder Canal were least in January (6 dolphins) (Qureshi *et al.*, 2018).

8.3.3 Diamond Harbor - Ganga Sagar

Diamond Harbor is an important port town and the survey started from here to Ganga Sagar where the Hooghly River meets the Bay of Bengal. It is a popular tourist destination and attracts visitors from all over the world. The place is known for its scenic beauty and the confluence of the river and the sea. Sagar Island is located at the mouth of the Hooghly River and is an important pilgrimage site for Hindus and attracts a large number of visitors during the annual Ganga Sagar Mela. The island is also home to the Kapil Muni Temple, which is believed to be the place where the sage Kapil meditated.

The Ganges River Dolphin population in this stretch was found to be 30 (24-36), with an encounter rate of 0.8/Km. The least count of the dolphins in this stretch was 23.

8.3.4 Farakka Barrage - Nimtita (Indo-Bangladesh Border)

The Ganga Padma River is a distributary of the Ganga River in the Murshidabad district of West Bengal. It flows through the town of Nimtita, which is located on its eastern bank. The river is an essential source of water and livelihood for the people living in and around Nimtita. The Ganga Padma River near Nimtita has faced several environmental challenges in recent years. One of the significant challenges is the erosion of riverbanks, which has resulted in the loss of land and property.

The Ganges River Dolphin population in this part of the river was 12 (11-14), with an encounter rate of 0.6/Km. The least count of dolphins detected was 11 (Figure 8.2, Table 8.2).

8.3.5 Rupnarayan River System

The most prominent tributary of the river Hooghly is the Rupnarayan River, which includes the sub-tributaries of the Damodar, Dwarakeswar, Kangsabati, Shilabati and Mundeswari Rivers (Das *et al.*, 2021). The rivers Shilabati and Dwarakeswar come together at Bandar, forming the Rupnarayan River. This combined flow then merges with the Mundeswari River and the Bakshi Canal, which connects to the Damodar River, at Bakshi. Finally, the Rupnarayan River empties into the Hooghly River at Geonkhali after traveling a distance of 78 kilometers (Biswas *et al.*, 2015). Currently, there is a lack of comprehensive research and surveys in the Rupnarayan River system, with a focus on the Ganges River Dolphin.

The Ganges River Dolphin population in the Rupnarayan River system including all its tributaries was

found to be 217 (207-228).

8.3.5.1 Rupnarayan

The survey was carried out by following the Double observer methodology on 06th April (Rupnarayan from Gadiara to Bakshi) and 21st September 2022 (Rupnarayan from Bandar to Bakshi) (Table 8.1). The Ganges River Dolphin population in the Rupnarayan River was found to be 167 (160-175), with an encounter rate of 2.1/Km and a least count of 140 dolphins (Figure 8.2, Table 8.2).

8.3.5.2 Shilabati

In the Shilabati River starting from Ghatal to Bandar, the Ganges River Dolphin population was 17 (15-18) with a least count of 15 dolphins and an encounter rate of 2.9/Km. The presence of 17 dolphins in a 6 Km stretch indicates the importance of this area for conservation (Figure 8.2, Table 8.2).

8.3.5.3 Mundeswari

In the Mundeswari River, the Ganges River Dolphin population was 12 (11-13) from Gorur Ghat to Bakshi. The encounter rate of dolphins was 1.8/Km. The least count of the Ganges River Dolphins in the river was 11 dolphins (Figure 8.2, Table 8.2).

8.3.5.4 Bakshi Canal

Bakshi Canal has a presence of Ganges River Dolphins. It has a population of 21 (20-22) with an encounter rate of 3.6/Km. The least count of dolphins in this section was 18 (Figure 8.2, Table 8.2).

8.3.5.5 Dwarakeswar

No dolphins were recorded in the Dwarakeswar River.

8.3.6 Haldi

Aside from a report by Mallick (2010) which mentioned the Haldi River as the known habitat of Ganges River Dolphins in South West Bengal, there have been no proper surveys to estimate the dolphin population, and no dolphins have been sighted in recent years.

The Haldi River survey was carried out by following the Double observer method. The survey was carried out on 23rd September, 2022 (Table 8.1). No dolphins were recorded during the survey.

8.3.7 Churni

There has been no sighting of dolphins in previous surveys (Mallick, 2013). The survey conducted in Churni River was carried out by following the Double observer method. The survey was carried out in one day (18th September 2022) (Table 8.1). The overall Ganges River Dolphin population in the Churni River was 7. The least count of dolphins detected in the river was 6 with an encounter rate of 0.7/Km (Figure 8.2, Table 8.2).

8.3.8 Torsa

Between 2009 and 2011, surveys conducted in the Torsa River's Balabhut area confirmed the presence of Ganges River Dolphins in various seasons (Chatterjee *et al.*, 2015).

The survey was done following the Double observer method. The survey was carried out on 12th and 13th September 2022 (Table 8.1). The overall Ganges River Dolphin population in the Torsa River was one dolphin, with an encounter rate of 0.02/Km (Figure 8.2, Table 8.2).

8.3.9 Kaljani

Dolphins were previously observed in the Kaljani River during surveys (Chatterjee *et al.*, 2015). Recent rescue incidents suggest that Ganges River Dolphins migrate up to 30 kilometers upstream in the river (Chatterjee *et al.*, 2015).

The current survey was conducted using the Double observer method. The survey was carried out on 13th September 2022 (Table 8.1). The overall Ganges River Dolphin population in the Kaljani River was 5. The least count of dolphins detected in the river was 5 with an encounter rate of 0.3/Km (Table 8.2, Figure 8.2, Table 8.2).

8.4 Associated Fauna

8.4.1 Bhagirathi-Hooghly

According to Avibase - Bird Checklists of the World, Hooghly River and its surrounding basin harbors 425 species of terrestrial and aquatic birds. Out of these, 23 species are listed as globally threatened (Lepage, 2022). The state of West Bengal is home to diverse migratory waterbirds that utilize the East Asian-Australasian Flyway (EAAF) and the Central Asian Flyway (CAF). The Farraka Barrage and adjacent wetland area, as well as the Naya Bandh Wetland, are significant bird and biodiversity areas situated on the river Ganga in the Malda district, West Bengal. Historically, West Bengal with the Bhagirathi-Hooghly River basin, used to be a hotspot for many turtle species, especially Pangshura species. Due to high anthropogenic activities and poaching of turtles, colonization of sandbanks, etc., turtle distribution was severely impacted (Paira and Ray, 2022). The wetlands on the banks of the river Ganga are extremely important from the perspective of avifaunal conservation (Rahmani *et al.*, 2016).

A total of 75 species were observed, out of which three were mammals, and the rest were birds.

8.4.1.1 Birds

During the survey, we recorded the Endangered, Indian Skimmer (n=5) (Figure 8.4). Other species of conservation concern were the Vulnerable Common Pochard (n=1) and the Near Threatened Black-headed Ibis (n=160), Oriental Darter (n=1) and River Lapwing (n=28) (Appendix 14.1). Indian Skimmers sighted in our survey were found foraging by the river bank in the Balagarh region of Hooghly district. The previously documented sighting had been in January 2007, in Nidoyachar region, where six individuals had been found foraging (Sharma, 2008). Various waders were also found during the survey.

8.4.1.2 Herpetofauna

No herpetofauna species were sighted during the survey.

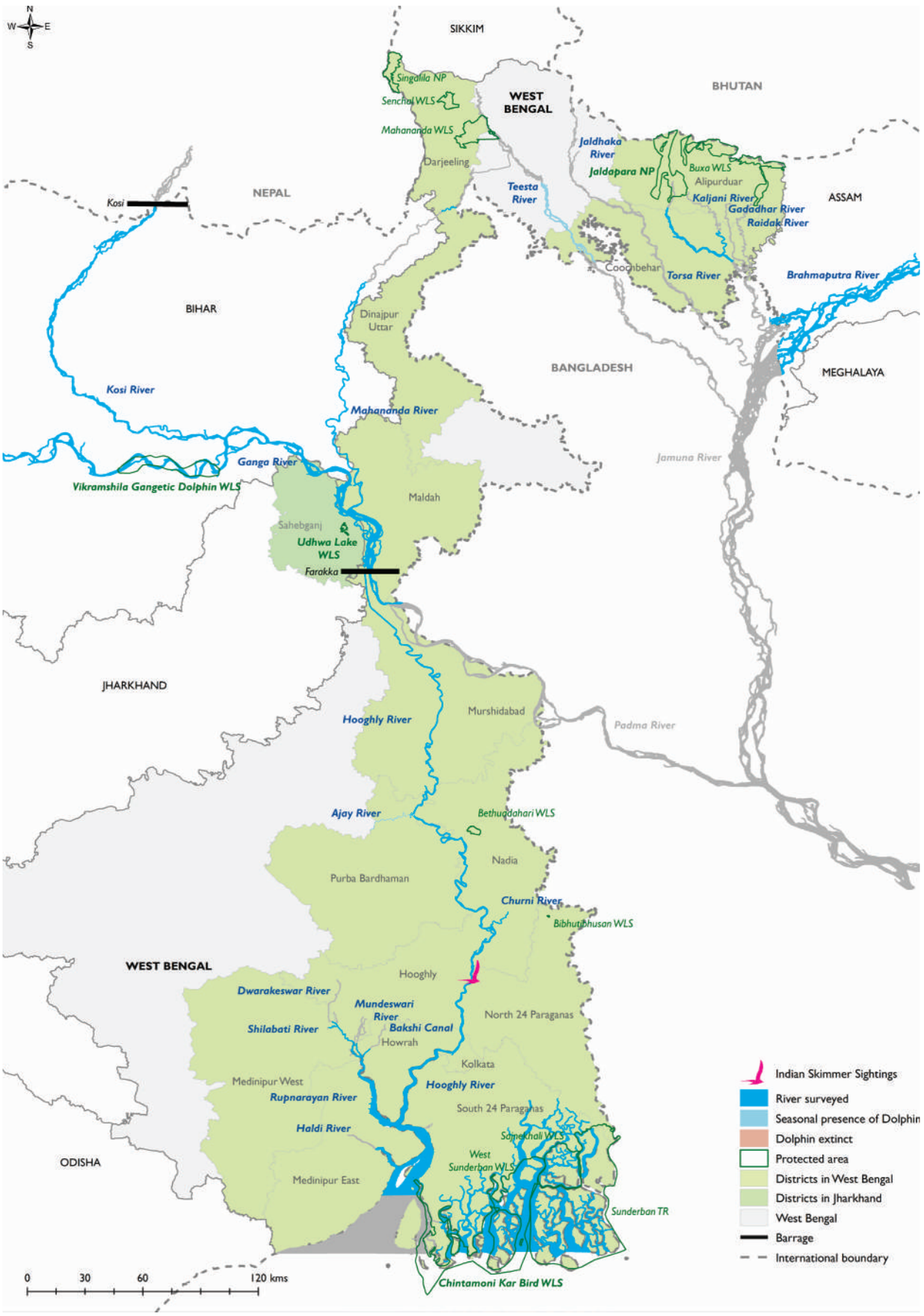
8.4.1.3 Mammals

The three mammal species that were sighted during this survey were the Golden Jackal, Northern Plains Gray Langur, and Indian Flying Fox (Appendix 14.2).


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FIGURE 8.3

Distribution of Indian Skimmer in Bhagirathi-Hooghly River and its tributaries Rupnarayan (Mundeswari, Shilabati, Bakshi Canal, Dwarakeswar), Torsa, Kaljani, Churni and Haldi in West Bengal.



8.4.2 Rupnarayan River System

In the Rupnarayan River system, except for fish (Roy *et al.*, 2013; Ghorai, 2018; Bera & Mishra, 2021), no other biodiversity study has been conducted. Data regarding the bird species is available through the e-Bird database.

The total species recorded in this river system was 25, with 23 species of birds, one species of reptile (in Mundeswari & Dwarakeswar), and one mammal. No species of conservation concern was reported from any of the tributaries of the Rupnarayan River system.

8.4.2.1 Rupnarayan

A total of 23 species of associated fauna were recorded during the survey, all of which were avian species.

8.4.2.1.1 Birds

During the survey of Rupnarayan, we recorded a total of 23 species of birds, all of which belong to the Least Concern category of the IUCN Red List (Appendix 15.1).

8.4.2.2 Shilabati

A total of seven species of birds were recorded during the survey of Shilabati.

8.4.2.2.1 Birds

During the survey, seven different bird species, all belonging to the Least Concern category of the IUCN Red List were identified (Appendix 16.1).

8.4.2.3 Mundeswari

A total of 11 species were recorded from the Mundeswari River, which includes ten avian species and one reptile species. No species of conservation concern were recorded from this river.

8.4.2.3.1 Birds

Ten bird species were recorded during the survey. Similar to other tributaries, all the species belong to the Least Concern category (Appendix 17.1).

8.4.2.3.2 Herpetofauna

In the Rupnarayan River system, the herpetofauna was only recorded from this tributary, which was the Bengal Monitor (Appendix 17.2).

8.4.2.4 Bakshi Canal

A total of 13 species of associated fauna were recorded during the survey, all of which were avian species.

8.4.2.4.1 Birds

Thirteen avian species belonging to Least Concern category of the IUCN Red List were recorded during the survey (Appendix 18.1).

8.4.2.5 Dwarakeswar

In Dwarakeswar River, although no dolphins were sighted, a total of 11 species of associated fauna with nine species of birds, one species of mammal, and one reptile species were recorded.

8.4.2.5.1 Birds

Nine species of birds were recorded during the survey, all are of Least Concern (Appendix 19.1).

8.4.2.5.2 Herpetofauna

Only Bengal Monitor was recorded from the Dwarakeswar River (Appendix 19.2).

8.4.2.5.3 Mammals

Only one mammal species was recorded during the survey, the Least Concern, Indian Grey Mongoose in Dwarakeswar River (Appendix 19.3).

8.4.3 Haldi River

During the survey from Teropakhya Ghat of Mahisadal in East Medinipore to Haldi-Bhagirathi-Hooghly Confluence, covering a total distance of 19 Km, we recorded a total of 19 species of birds. No species of herpetofauna and mammals were recorded from this river.

8.4.3.1 Birds

A total of 19 bird species were recorded during the survey. All species of birds belong to the IUCN Least Concern category (Appendix 20.1).

8.4.4 Churni River

During the 10 Km survey in the Churni River from Anulia Bridge near Ranaghat to Churni-Bhagirathi-Hooghly Confluence near Mangaldeep in Payradanga, we recorded a total of 24 species of which, 22 were birds, one mammal, and one reptile.

8.4.4.1 Birds

The total recorded bird species during the survey was 22 with none of the species falling under the conservation concern category (Appendix 21.1).

8.4.4.2 Herpetofauna

Only Indian Rat Snake was recorded in the survey (Appendix 21.2).

8.4.4.3 Mammal

Only Golden Jackal was recorded during the survey (Appendix 21.3).

8.4.5 Torsa

In a study led by Das and Das (2016), on the avifaunal diversity over 111 species of birds had been identified from the study area around Torsa. Additionally, 60 different types of resident bird species were recorded, which use the area for foraging and other activities. During the survey, we have recorded a total of 22 species of birds. Herpetofauna and mammals were not recorded during our survey.

8.4.5.1 Birds

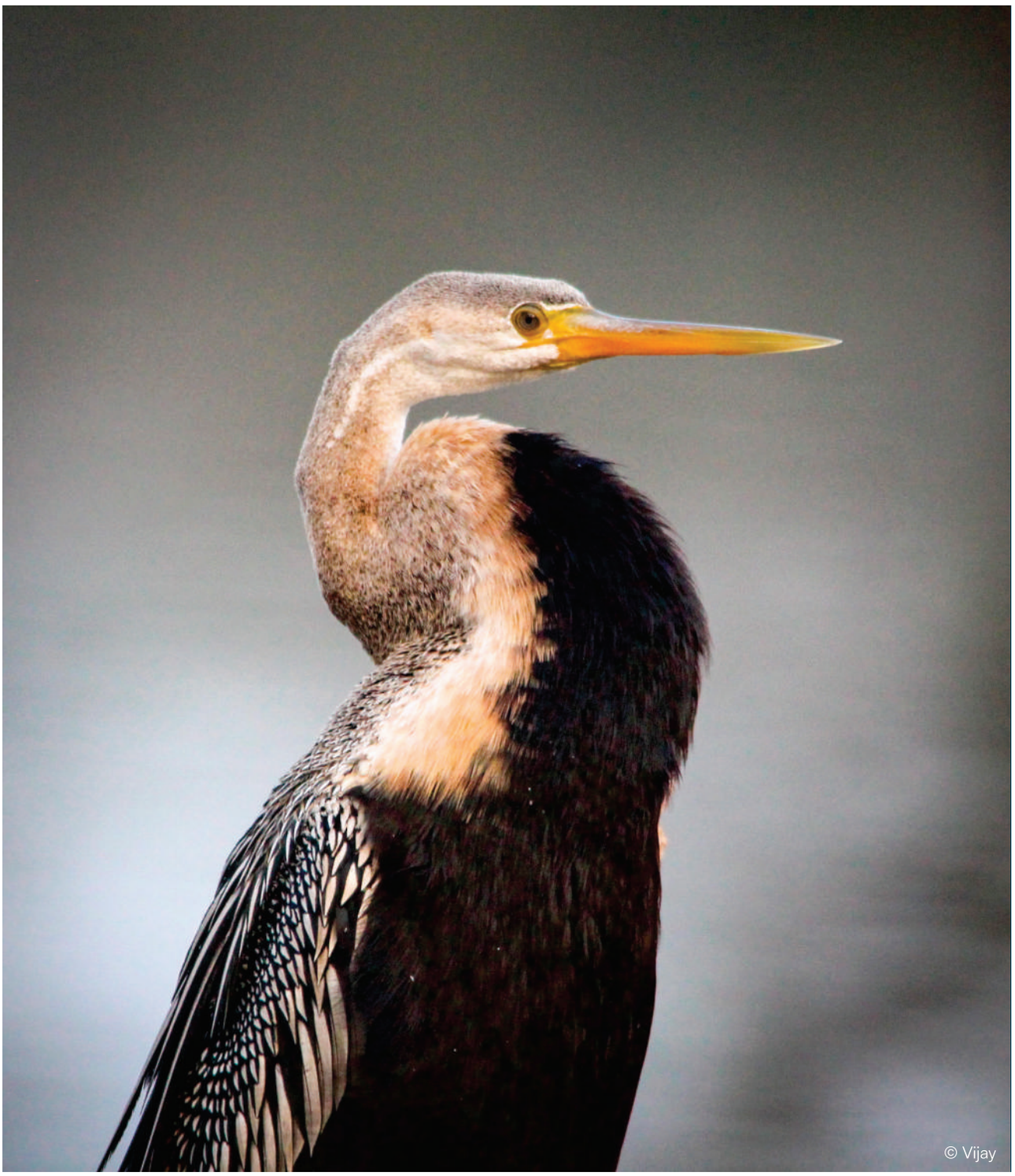
A total of 22 bird species were recorded, of which one was the Near Threatened River Lapwing (n=148) (Appendix 22.1).

8.4.6 Kaljani River

During the Kaljani survey, we recorded a total of 19 birds. Herpetofauna and mammals were not recorded during our survey.

8.4.6.1 Birds

A total of 19 bird species were recorded, of which only the Near Threatened River Lapwing was of conservation concern (Appendix 23.1).



8.5 Sundarbans

Sundarbans is the largest contiguous estuarine mangrove forest formed at the mouth of the Ganga-Brahmaputra-Meghna River system. It spreads across Bangladesh and India, covering an area of approximately 10,000 km2, of which 62% lies in Bangladesh (Khan, 2004; Barlow, 2009; Danda et al., 2011). The Indian Sundarbans, at the tip of the Bay of Bengal, is located on the southern fringe of the state of West Bengal, straddling a major portion of the North and South 24 Parganas districts. The region is bordered by Bangladesh in the East, the Hooghly River in the West, the Dampier and Hodges line in the North, and the Bay of Bengal in the South. The saline intertidal hydrological system supports diverse plant and wildlife assemblages and economically significant fisheries. The name Sundarban means "beautiful forest" and in all likelihood is named after the 'Sundari' trees found in these mangroves (C. Das, 2015). Sundarbans comprises about 55% forest land and 45% water spread area, in the forms of tidal rivers, creeks, canals, and vast estuarine mouths of the rivers Hooghly, Saptamukhi, Thakuran, Matla, Gosaba, and Harinbhanga (Herobhanga), as encountered from west to east (Naskar & Guha Bakshi, 1987). It is bound on the west by river Muriganga and on the east by rivers Harinbhanga and Raimangal. River Matla divides Sundarban Reserved Forest into Sundarban Tiger Reserve (STR) on the east and Sundarban Biosphere Reserve (SBR) of South 24 Parganas Division on the west. Most of the other estuarine rivers mentioned above have lost their connections with the river Ganga.

This is the only mangrove-critical tiger land on the globe and is home to estuarine and saltwater cetaceans (Jhala *et al*., 2015). Mitra & Chowdhury (2018), indicate a possible decline in the range of Ganges River Dolphin in the Indian Sundarbans, attributing the extirpation to the combined effect of elevated sedimentation, reduced freshwater discharge, and increase in salinity. However, the Irrawaddy Dolphin continues to be found in the Indian part of the estuary. Wakid *et al*. (2015) observed the presence of Irrawaddy Dolphin and Indo-Pacific Humpback Dolphin, but no Ganges River Dolphin, in the surveyed areas of the Indian Sundarbans. The Black Finless Porpoise and Indo-Pacific Humpback Dolphin can be encountered rarely but there are no recent records of sightings of any Pantropical Spotted Dolphin in the Sundarbans (Mallick, 2012). Considering their presence in the Bangladesh portion (Smith *et al*., 2015), we presume that coastal West Bengal and the Sundarbans of West Bengal might have a good population of near-shore cetaceans, but no research has been carried out in this region. The present survey aims to determine the population abundance and distribution pattern of available dolphin species in the Indian Sundarbans.

8.5.1 Study Area

The extent of Mangrove Reserved Forests in Indian Sundarban is around 4230 Km^2 which is divided into two administrative sections. One is Sundarban Tiger Reserve, with an area of 2600 Km^2 and the other is 24 Parganas (S) Division of area 1660 Km^2, and both of these administrative sections fall under Sundarban Biosphere Reserve of area 9630 Km^2 (Reserve Forest area of 4230 Km^2 and another 5400 Km^2 of non-forest) (RIS, 2019). The Sundarban Biosphere Reserve includes the Sundarban Tiger Reserve, the Lothian Island Wildlife Sanctuary, the West Sundarban Wildlife Sanctuary, and the Haliday Island Wildlife Sanctuary. For surveying the population of dolphins within Sundarbans, we have divided the whole surveyed area into two zones: the Sundarban Tiger Reserve (STR) & Sundarban Biosphere Reserve (SBR) (Figure 8.10).

8.5.1.1 Sundarban Tiger Reserve (STR)

Sundarban Tiger Reserve is a network of rivers, channels, and creeks that form innumerable flat islands, which are submerged mostly during the high spring tides and partially during the ordinary high tides (Mallick, 2012). The southern part is the Sundarbans National Park, which forms part of the core area and meets the Bay of Bengal. To the northeast of the core area is the North 24 Parganas Reserve Forest lying within the buffer zone. The eastern face of this zone along with the national park forms a border with Bangladesh, marked by the rivers Harinbhanga, Raimangal, and Kalindi. The western edge of the North 24 Parganas Reserve Forest faces the Sajnekhali Wildlife Sanctuary that extends further west before meeting the South 24 Parganas Forest division forming part of the buffer zone. To the north of the Wildlife Sanctuary is the transition zone which is the sharp interface with highly cultivated land.

Sundarban Tiger Reserve was created in 1973 and constituted as a Reserve Forest in 1978. The current core area was established as a National Park in 1984. Recognising the region and its unique biodiversity, the National Park was listed as a World Heritage Site in 1985. The entire Sundarban area was declared a Biosphere Reserve under the UNESCO Man and Biosphere Programme. The Indian part of Sundarbans was designated a Ramsar site in 2019 (RIS, 2019).

8.5.1.2 Sundarban Biosphere Reserve (SBR-South-24-Parganas Division)

The Sundarbans Biosphere Reserve (SBR) in South 24 Parganas is defined by River Hooghly at its West and River Matla in the East. It is situated in the 24 Parganas (South) district of West Bengal which is a part of the famous "Indian Sundarbans" and covers the southwestern portion of Gangetic Delta bordering the Bay of Bengal. Out of 13 administrative blocks under the South 24 Parganas district, six blocks are island blocks and the rest are connected with the mainland. These islands are inundated twice daily during the high tides and are exposed during ebb tides with an average tidal amplitude between 3.5 - 5 m. Two forest blocks of 24 Parganas South Division on the south, part of Dulibasani, and Chulkati form the West Sundarban Wildlife Sanctuary of area 556.46 Km^2 and were declared as West Sundarban Wildlife Sanctuary by considering the adequate ecological, faunal, geomorphological, natural and zoological significance to protect, propagate and develop wildlife and its environment.

A double observer survey as part of the Rangewide River Dolphin Estimation survey was carried out in the Sundarban Tiger Reserve (STR) and Sundarban Biosphere Reserve (SBR-South 24 Parganas). The survey comprised all the rivers flowing through STR and SBR as well as the small khals, that have been formed by the tidal flow of water. A total distance of 958.52 Km (in STR) and 545.34 Km (in SBR) was covered in 21 and 13 days respectively (Table 8.9). The survey in STR was carried out between the 2nd and 26th of February 2023 and the survey in SBR was carried out between 10th and 25th February, 2023 (Table 8.9).
In the STR, which is the East zone, 54 river channels (Table 8.9) were surveyed and in SBR, which is the West zone 30 river channels were covered (Table 8.10, Table 8.11).



FIGURE 8.10

Sundarbans (Sundarban Tiger Reserve and Sundarban Biosphere Reserve) in West Bengal.

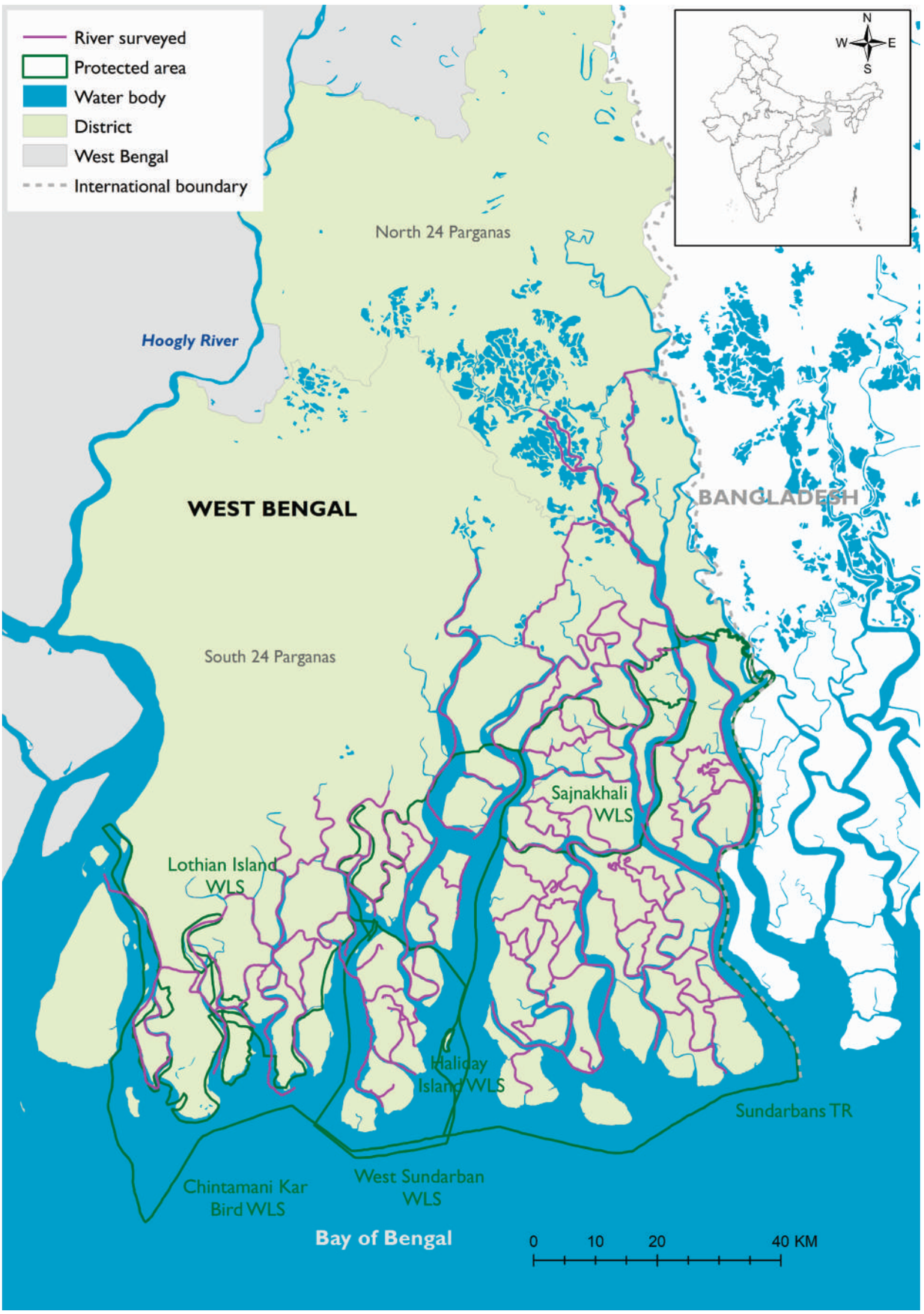


TABLE 8.9

Efforts and methods used for Ganges River Dolphin and other cetaceans survey in Sundarbans in West Bengal.

State	Area	No. of Channels	Method	Distance Survyed (in Km)	Survey dates	Survey days	Total effort (in hrs)
West Bengal	Sundarban Tiger Reserve (STR)	54	Double observer	958	02nd and 26th February, 2023	21	56 hrs 43 mins
	Sundarban Biosphere Reserve (SBR)	32	Double observer	566	10th and 25th Feb-ruary, 2023	13	58 hrs 37 mins

TABLE 8.10

Effort (in Km) in Sundarban Tiger Reserve (STR) rivers and channels.

Sl. No.	River/ Channel Name	Total Length (in Km)
1	Dansa	33
2	Bidyadhari	51
3	Raimangal	62
4	Chayakapura-Khatuajhuri	26
5	Natabarkhali Khal	8
6	Pitchaikhali Khal	18
7	Bolkhali Khal	3
8	Sarsa Gang	41
9	Sarsa-Jhilla Channel	5
10	Duttar Pasur Khal	12
11	Gomdi-Sundarkhali-Pirkhali Canal	17
12	Sajnekhali Khal	10
13	Khonakhali River	15
14	Durga Duani Khal	8
15	Sudhanyakhali Khal	8
16	Kochukhali Khal	18
17	Chhoto Molla Khali river	25
18	Jhila river	30
19	Bara Harikhali Khal	12
20	Harinbhanga River	34
21	Bhurkhunda Khal	16
22	Gona river	23
23	Khajurtola Khal	6
24	Bankra Khal	8
25	Bhankra Khal	15
26	Bakultola Khal	15
27	Chandkhali Khal	22
28	Baikuntha Hana River	7

29	Choto Chamta Khal	15
30	Nawbanki river	12
31	Gazi khali Khal	5
32	Deul Varani	5
33	Panchamukhani Khal	16
34	Baro Chamta Khal	18
35	Choto Duani Khal	8
36	Chandra Duani Khal	18
37	Store Khali Khal	23
38	Netidopani Khal	10
39	Gosaba river	50
40	Chora Mayadip Khal	5
41	Baro Hardi River	14
42	Narayantala(Kewrasuti) Khal	9
43	Chandramukhi Khal	8
44	Haldi river	21
45	Moraboni Khal	5
46	Hajra Toli Khal	8
47	Bhanga Duni river	21
48	Lakshikhali-Shaimari Khal	11
49	Bego Khali Khal	9
50	Habati Varani	4
51	Habati-Taruntola Khal	11
52	Surajmukhi Khal	9
53	Bidya river	71
54	Dutta river	24

TABLE 8.11

Effort (in Km) in Sundarban Biosphere Reserve (SBR-South 24 Parganas) rivers and channels.

Sl. No.	River/ Channel Name	Total Length (in Km)
1	Muriganga	36
2	Hatania Doania	10
3	Pitt's Creek	17
4	Saptamukhi	49
5	Bhagabatpur	17
6	Ramganga	13
7	Kalchhora	10
8	Mridangabhanga	10
9	Burge Island	3
10	GD Island	5
11	Choto Rakshaskhali	4
12	Madhya Rakshaskhali	14
13	Rakshaskhali	7

14	Curzon's creek	18
15	Mani (including Raidighi)	25
16	Thakuran	69
17	Gokultali Khari	6
18	Kalas Channel	33
19	Dhulibhasini Channel	13
20	Chulkati	3
21	Oriental Khal	38
22	Kankalmari	6
23	Ajmalmari	8
24	Birat	10
25	Dhansiri-Jagaddal	22
26	Gorankati	14
27	Chera Matla	27
28	Matla	67
29	L-Plot	5
30	Jharkhali	7



FIGURE 8.11

Encounter rate of Ganges River Dolphin in Sundarbans (Sundarban Tiger Reserve and Sundarban Biosphere Reserve) in West Bengal.



FIGURE 8.12

Encounter rate of Irrawaddy Dolphins in Sundarbans (Sundarban Tiger Reserve and Sundarban Biosphere Reserve) in West Bengal.

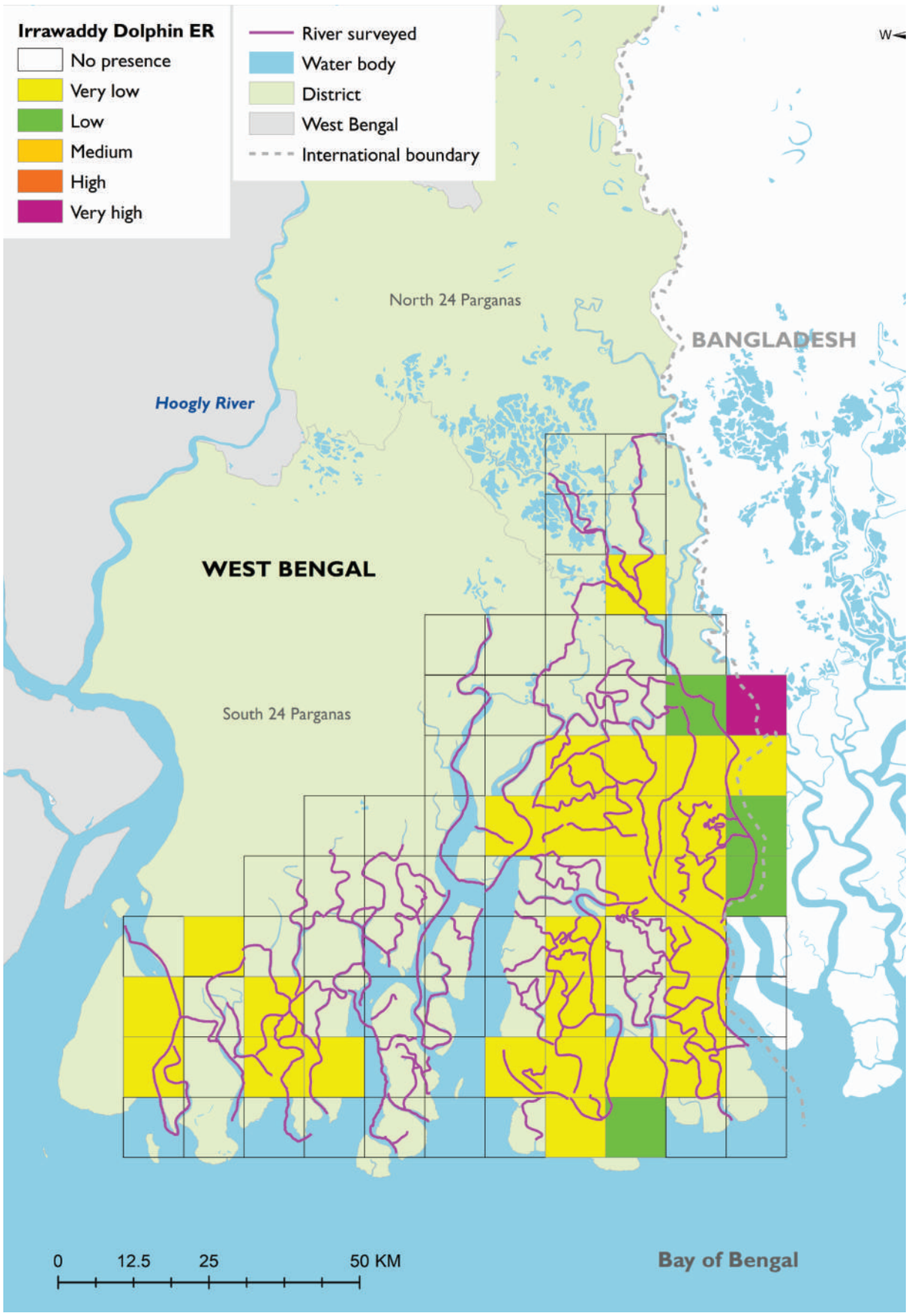


TABLE 8.12

Ganges River Dolphin population estimate in Sundarbans (Sundarban Tiger Reserve and Sundarban Biosphere Reserve) in West Bengal.

Sl. No.	River/ Channel Name	N_o	ER_o
1	Sundarban	2	0.001

TABLE 8.13

Irrawaddy Dolphin population estimate in Sundarbans (Sundarban Tiger Reserve and Sundarban Biosphere Reserve) in West Bengal, and the least count in each river channel.

Sl. No.	River/ Channel Name	N_o	ER_o
1	Sundarban Tiger Reserve (STR)	94 (75-109)	0.1
2	Sundarban Biosphere Reserve (SBR)	14 (8-25)	0.02
	Sundarbans	**108 (83-134)**	**0.07**

8.5.2 Dolphin Population Estimation

A study by Wakid *et al.*, (2015) has recorded an estimated 143 Irrawaddy Dolphins and 28 Indo-Pacific Humpback Dolphins in the Indian Sundarbans (Wakid *et al.*, 2015). In the Bangladesh part of Sundarbans, Smith *et al.*, (2006) estimated 225 Ganges River Dolphins and 451 Irrawaddy Dolphins. Also, 88 Humpback Dolphins were recorded from the northern Bay of Bengal, Bangladesh (Smith *et al.*, 2015).

In the current survey, the Ganges River Dolphin population was found only in Sundarban Tiger Reserve from a 26 Km stretch of the Chayakapura-Khatuajhuri River, where two dolphins were recorded (Table 8.12, Figure 8.11). The overall Irrawaddy Dolphin population in Sundarbans was found to be 108 (83-134), with an encounter rate of 0.07/Km. In Sundarban Tiger Reserve, the Irrawaddy Dolphin population was estimated at 94(75-109). The least count of the dolphins detected in the river was 75, with an encounter rate of 0.1/Km and in Sundarban Biosphere Reserve, 14(8-25) Irrawaddy Dolphins were estimated to have a least count of eight with an encounter rate of 0.02/Km (Figure 8.12 & Table 8.13).

Three Irrawaddy Dolphins were recorded in the Diamond Harbour river stretch of Hooghly, which brings the estimated population of Irrawaddy Dolphins in West Bengal to 111 (86-137).

8.5.3 Associated Fauna

The Sundarban Mangroves play a crucial role due to their diverse species, rich mangrove flora and fauna, abundance, and unique succession features. The Sundarbans provide a home for globally threatened species like the Royal Bengal Tiger, Fishing Cat, Ganges River Dolphin, Estuarine Crocodile, Horseshoe Crab, Water Monitor, and River Terrapin. Mangrove forests provide a large amount of fish catch (up to 80%), thereby supporting the livelihood and ensuring the food security of coastal people (S.C. Das, 2022). This mangrove ecosystem harbors 334 floral species along with 476 species of arthropods, 177 species of birds, 7 and 59 species of amphibians and reptiles respectively, 49 species of mammals, and a striking avifaunal diversity comprising 315 species (Khan *et al.*, 2021). Sundarbans has been declared a “critical tiger habitat” as well as a “Tiger Conservation Landscape” of global importance (Sen, 2019). In the Indian side of Sundarbans, 101 tigers were estimated by Qureshi *et al.*, (2023). Amongst the rich biodiversity of the Indian Sundarbans Delta, at least 13 reptiles, six birds, and five mammals are currently

classified as threatened or endangered (WWF, India). Alterations and removal of mangrove vegetation over time have led to several extirpations as well as the contraction of habitat for several species. Six species are known to now be extirpated from Indian Sundarbans, viz., Water Buffalo, Swamp Deer, Javan Rhinoceros, Great Indian One-horned Rhinoceros, Gharial and Chitra species (Chaudhuri & Choudhury, 1994; Sanyal, 1999). Although there is no agreement among experts about the past occurrence of the Great Indian One-horned Rhinoceros in the region, there are published accounts claiming its historical presence (Ghosh *et al*., 1992; Blyth, 1862; Khan, 2013). The Northern Red Muntjac is also possibly locally extinct as it was last sighted in the 1970s (Sanyal, 1999; Chatterjee, 2004).

In Sundarbans (STR and SBR), a total of 109 species of associated fauna including 102 species of birds, four species of mammals, and three species of reptiles were recorded in 1524 Km. Out of the 102 bird species recorded, 96 species were of Least Concern, four were Near Threatened and two were Vulnerable. All the mammal and reptile species recorded were of Least Concern.

Inside the Sundarban Tiger Reserve (STR) the total species recorded was 85, including 80 species of birds, three species of mammals, and two species of reptiles and in Sundarban Biosphere Reserve (SBR-South 24 Parganas) we have recorded a total of 80 species of associated fauna, including 75 species of birds, three species of mammals and two species of reptiles.



8.5.3.1 Other Cetaceans

During the survey, other than the freshwater dolphins there were recordings of marine dolphins. The Indo-Pacific Humpback Dolphin population was recorded in a 69 Km stretch of Thakuran River in the Sundarban Biosphere Reserve, where the population was 13 (9-17) and an encounter rate of 0.2/Km (Figure 8.13). Likewise, only one individual of Finless Porpoise was also found in Sundarban Biosphere Reserve in an 18 Km stretch of Curzon's Creek Channel (Figure 8.13).

8.5.3.2 Birds

There are various studies on the avifauna of Sundarbans. Mandal & Nandi (1989) have reported a total of 161 birds, of which 111 were resident and 50 were migratory. Rahmani *et al*., (2016) mentioned the occurrence of 365 birds from the Sundarbans. A lot of migratory birds from higher latitudes visit the park in the winter months and inhabit the Sundarban Wildlife Sanctuary.

From our survey in Sundarbans (STR and SBR), a total of 102 species of birds were recorded, of which 96 species were Least Concern, four were Near Threatened, and two were Vulnerable.

The total recorded bird species during the survey in Sundarban Tiger Reserve (STR) was 80, of which one was the Vulnerable Lesser Adjutant (n=30). Furthermore, four were the Near Threatened Alexandrine Parakeet (n=10), Black-headed Ibis (n=10), Brown-winged Kingfisher (n=9) and Eurasian Curlew (n=33) (Appendix 25.1).

The total recorded bird species during the survey in Sundarban Biosphere Reserve (SBR) was 77, of which two were the Vulnerable Lesser Adjutant (n=5) and River Tern (n=3) and three were the Near Threatened Black-headed Ibis (n=86), Brown-winged Kingfisher (n=7), and Eurasian Curlew (n=75). (Appendix 24.1).

8.5.3.3 Herpetofauna

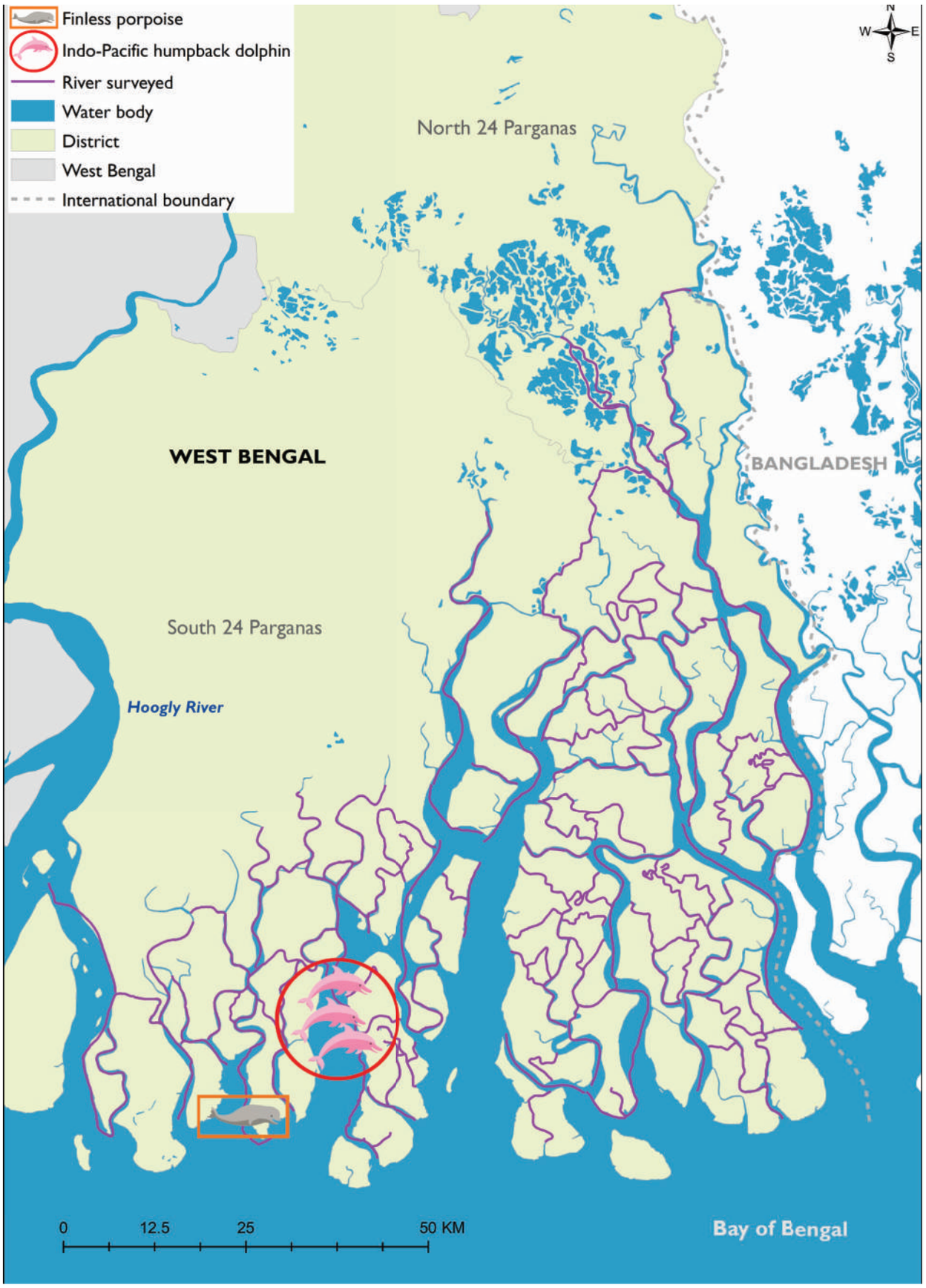
The delta harbours large reptiles like the Monitor Lizard, the Estuarine Crocodile, and the Olive Ridley Turtle (Katsineris, 2014). A species of river turtle called Northern River Terrapin is found on Mechau Beach. The aquatic habitat of the Sundarbans, i.e., rivers and estuaries, is used by the Estuarine Crocodile. It forages and hunts in rivers and estuaries, and uses the riverbanks for basking and egg-laying. Crocodiles seemed to have a patchy distribution with more signs and sightings recorded on the Indian side. The Bhagabatpur Crocodile Project in the Sundarban at the confluence of the Saptamukhi river system, is a significant hatchery for estuarine crocodiles, rearing crocodiles of varying ages (Das & Jana, 2018).

In our survey, we documented two reptile species in the Sundarban Tiger Reserve (STR), both of which are categorized as Least Concern on the IUCN Red List. Our observation included Saltwater Crocodiles (n=16) and Water Monitor (n=1). (Figure 8.14) (Appendix 25.2).

In Sundarban Biosphere Reserve (SBR), all the reptile species recorded were Least Concern. We encountered two species namely, Saltwater Crocodile (n=16) and Dog-faced Water Snake (n=3) (Figure 8 .14) (Appendix 24.2).

FIGURE 8.13

Distribution of Indo-Pacific Humpback Dolphin and Finless Porpoise in Sundarbans (Sundarban Tiger Reserve and Sundarban Biosphere Reserve) in West Bengal.



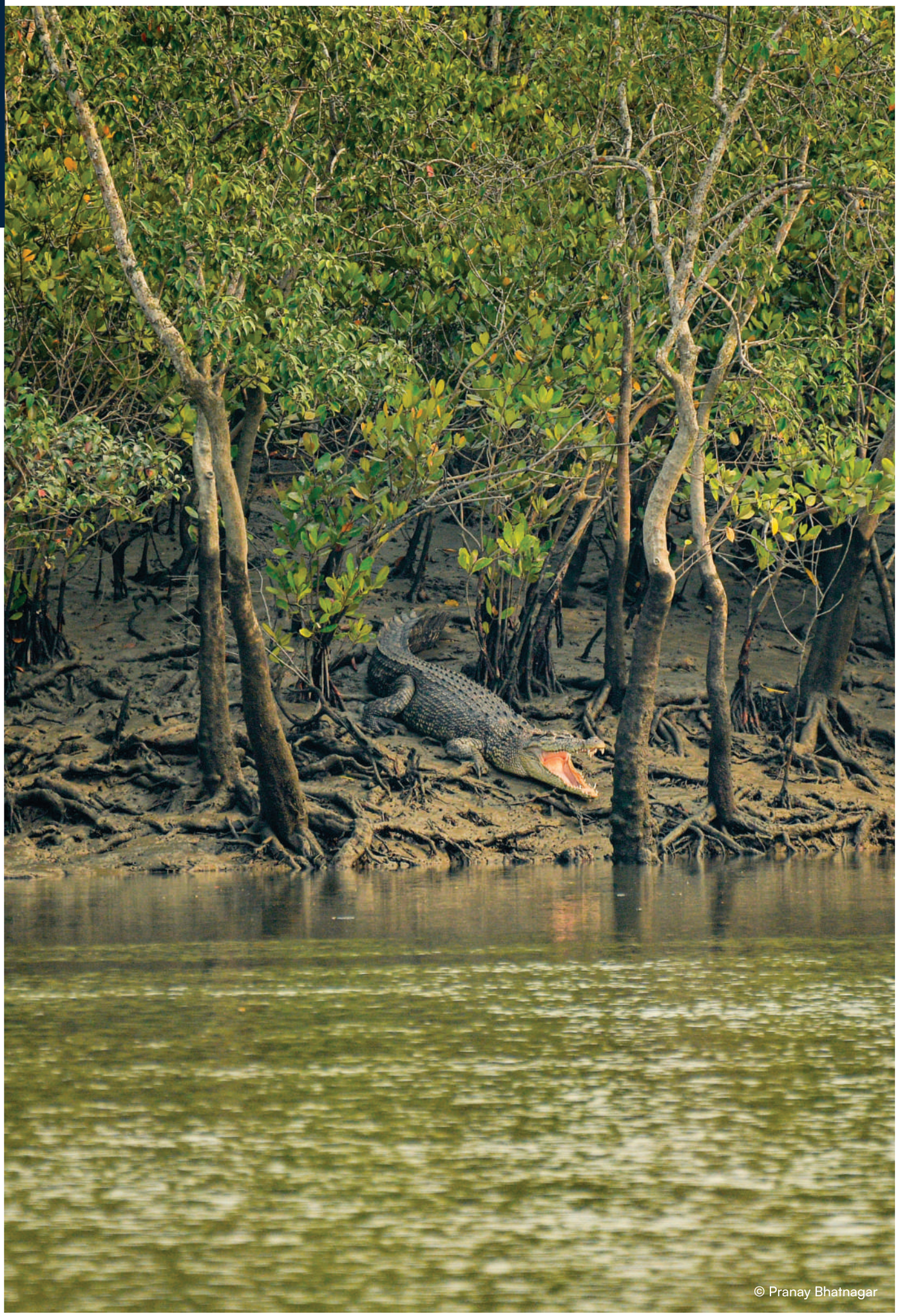
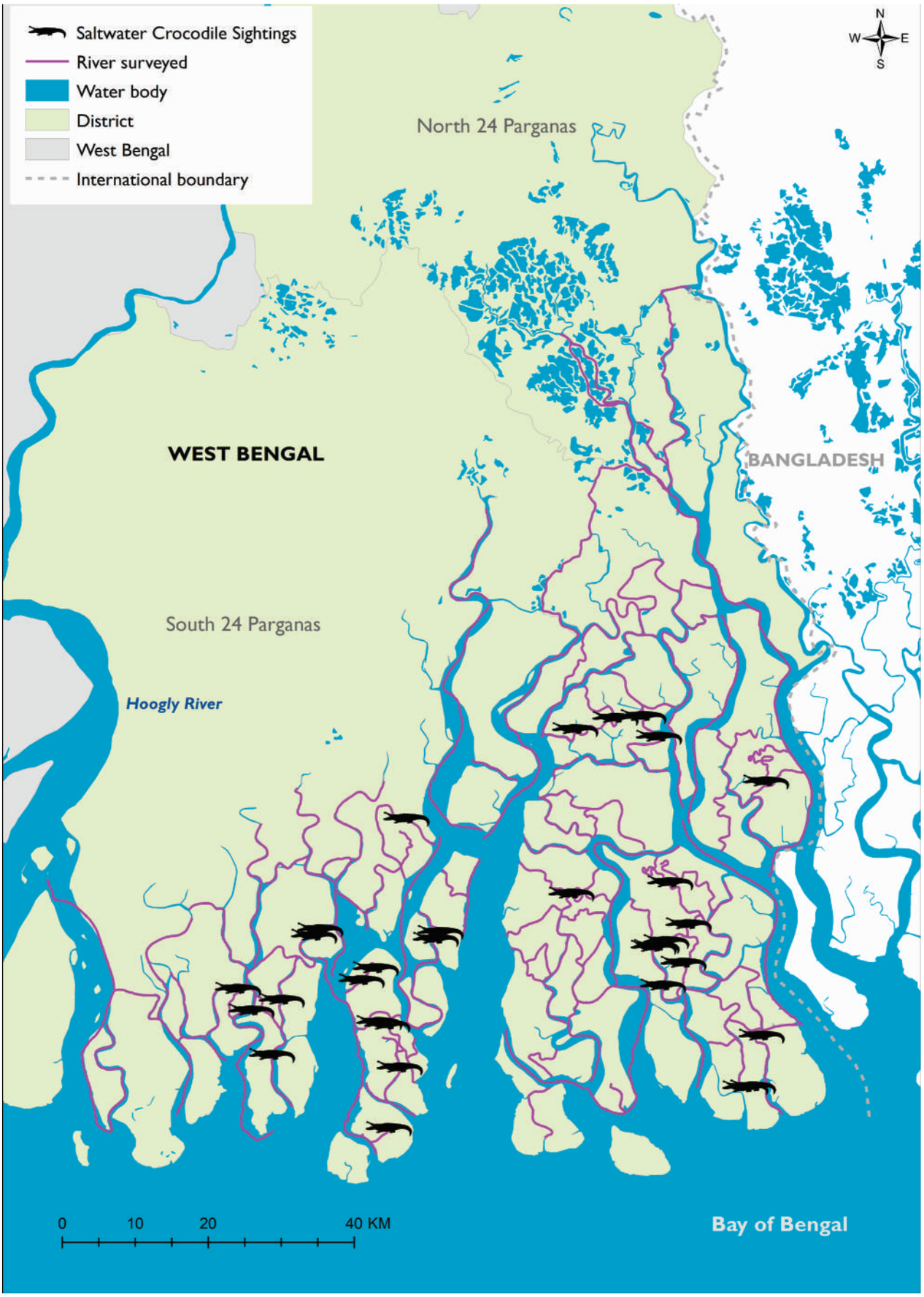

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FIGURE 8.14

Saltwater Crocodile distribution in Sundarbans (Sundarban Tiger Reserve and Sundarban Biosphere Reserve) in West Bengal.



8.5.3.4 Mammals

Sundarbans is the only place where Tigers inhabit the Mangrove forest. In 2022, 101 tigers were estimated from the Sundarbans (Qureshi *et al*., 2023). Mandal & Nandi (1989) have reported 40 species of mammals from the entire Sundarbans region which included one species of shrew, 11 bats, one primate, one species of pangolin (Chinese Pangolin), seven rodents, five cetaceans, 12 carnivores, and two ungulates. Mallick (2012) reported 49 species of mammals from Sundarbans which included one species of shrew, 17 Bats, one Primate, 13 Carnivores, five Cetaceans, two Ungulates, one pangolin (Chinese Pangolin), eight rodents, and one lagomorph. Some notable mammals found in Sundarbans apart from Tigers are Fishing Cat, Leopard Cat, Smooth-coated Otter, Small-clawed Otter, Cheetal, Wild Boar, Indo-Pacific Humpback Dolphin, Irrawaddy Dolphin, and Little Black Finless Porpoises. The ungulate species like Hog Deer, Swamp Deer, Northern Red Muntjac, Wild Buffalo, and Javan Rhino were found in Sundarbans till last century but they are now extinct. The last authentic record of Javan Rhino in Sundarbans was in 1893 (Mandal & Nandi, 1989).

Our survey in Sundarban Tiger Reserve (STR) recorded three mammal species, all categorized as Least Concern on the IUCN Red List. We recorded Cheetal (n=40), Rhesus Macaque (n=32) and Wild Boar (n=6) (Appendix 24.3).

A total of three mammals were recorded in Sundarban Biosphere Reserve (SBR), all categorized as the Least Concern category on the IUCN Red List. We recorded Cheetal (n=3), Rhesus Macaque (n=15) and Indian Flying Fox (n=100) (Appendix 24.6).



8.6 Conclusion

The important areas identified in West Bengal are crucial for dolphin conservation and improving local livelihoods. The dolphin population in West Bengal has significant concentrations in the Rajmahal to Ganga Sagar stretch and the Rupnarayan River. Key areas for conservation include the districts of Hooghly-North 24 Parganas, Malda, Murshidabad-Nadia, Paschim Medinipur-Purba Medinipur, and Cooch Bihar. Notably, the Bakshi Canal, part of the Rupnarayan River System, has a high encounter rate of dolphin 3.6/Km.



ASSAM



Citation: : Merin Jacob, Abdul Wakid, Hiyashri Sarma, Ayan Dutta, Syeda Tabassum Tasfia, Jitul Kalita, Bhawana Pant, Athul A, Atit Rai, Biswajeet Pujari, Dipamoni Taye, Panchali Hazarika, Shyamal Saikia, Sreelekha Suresh PC, Shantam Ojha, Supravat Mahata, Vartika Negi, Pranay Bhatnagar, Nitesh Goswami, Manoj Kumar Das, Shah Alom, Nurjamal Hoque, Abdul Warrish, Sarat Chetia, Sunny Deori, Arun Vignesh, Vishnupriya Kolipakam & Qamar Qureshi. Status of Ganges River Dolphin in Assam (2024).

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ASSAM

NUMBER OF RIVERS SURVEYED

6

NUMBER OF KILOMETERS SURVEYED

1297

NUMBER OF SURVEY DAYS

24





LEAST COUNT

516

POPULATION ESTIMATE

635 (606-664)

9.1 Background

The Brahmaputra originates from the Kailash ranges of the Himalayas at an elevation of 5300 m known as Yarlung Tsangpo. After flowing through Tibet, it enters India through Arunachal Pradesh as Siang and flows through Assam as Brahmaputra and in Bangladesh as Jamuna before it joins the Ganga and drains into the Bay of Bengal. In 2008, the Ganges River Dolphin was declared as the state aquatic animal of Assam. Brahmaputra River holds a good and barrier-free population of the Ganges River Dolphin in its undisturbed natural habitat, making it one of the major conservation areas for the survival of the species (Mohan *et al.*, 1997; Wakid, 2005). Approximately 61 % of the total population of Assam is related to agriculture, and 65 % is irrigable land of gross cropland, which is directly or indirectly related to the Brahmaputra and its tributaries (Nayak & Panda, 2016).

9.2 Study Area

The population estimation of Ganges River Dolphins in Brahmaputra was carried out for a total length of ~1297 Km, covering mainstream Brahmaputra and its tributaries Subansiri, Kulsi, Beki, Kopili, and Barak River (Figure 9.1) between 1st March 2022 - 21st March 2023. 885 Km stretch of the Brahmaputra River (from Dr. Bhupen Hazarika Setu to the Indo-Bangladesh border) was surveyed in 15 days. Likewise, a 91 Km stretch of Subansiri River (from Chauldhuaghat to Jamugurighat) was completed in two days, 61 Km of Kulsi (from Kukurmara to Nagarbera) was surveyed in two days, Beki River was surveyed in two days from Beki River Bridge (Sorbhog) to Sonabari (Beki-Brahmaputra Confluence). The 91 Km stretch of Kopili River was surveyed in two days from Chapormukh (Kolong-Kopili Confluence) to Kajoli Chowki. 124 Km stretch of the Barak River from Sonabari (Assam-Manipur border) to Rajartila (Indo-Bangladesh border) was surveyed in 3 days (Table 9.1 & Figure 9.1).

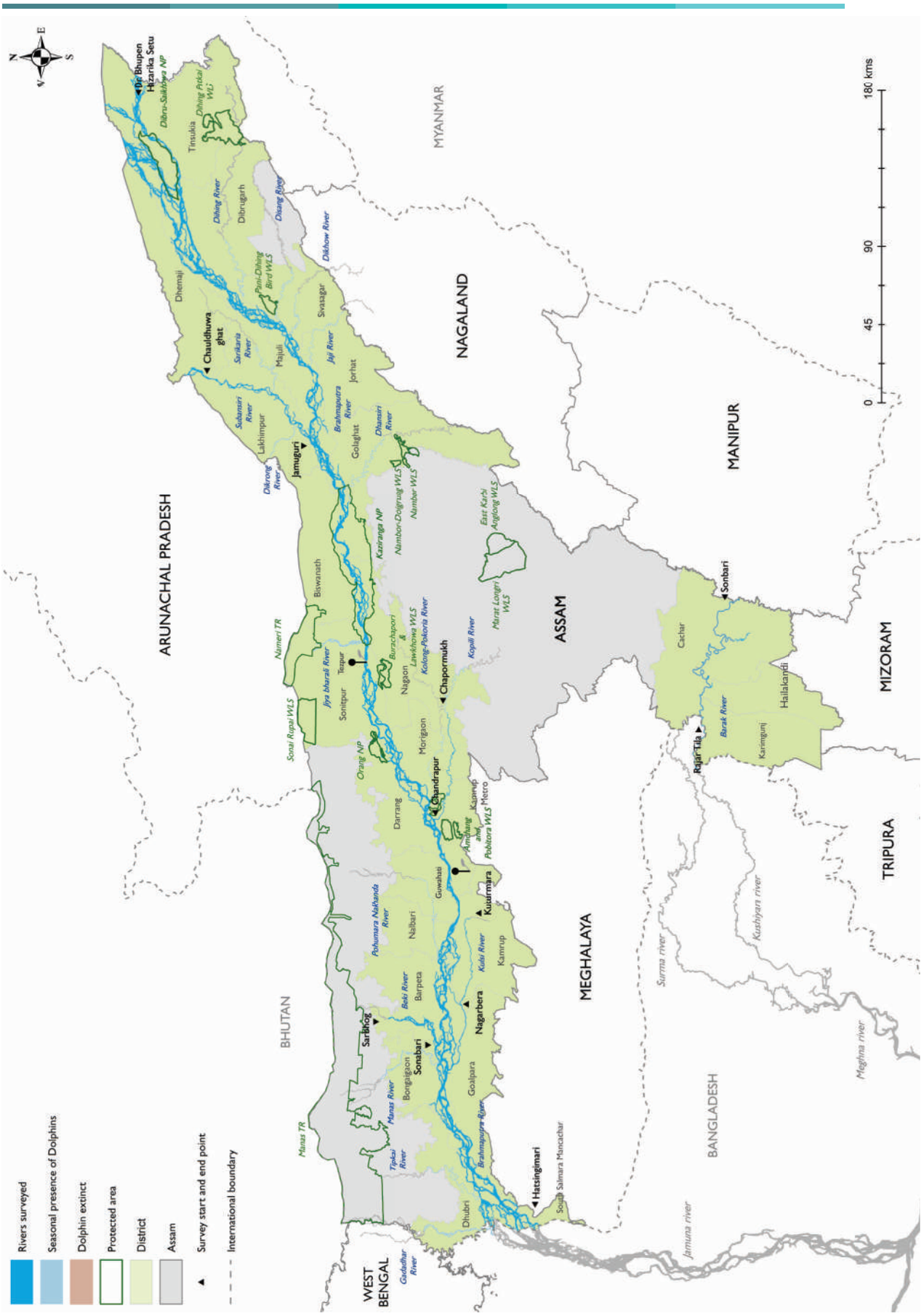
TABLE 9.1

Effort and method used for Ganges River Dolphin survey in Brahmaputra River and its tributaries Subansiri, Kulsi, Beki, Kopili, and Barak River in Assam.

State	River	Stretch	Method	Distance Surveyed (in Km)	Survey dates	Survey days	Total effort (in hrs.)
Assam	Brahmaputra	Dr. Bhupen Hazarika Setu - Hatsingimari (Indo - Bangladesh border)	Double observer	885	1st -17th March, 2022	15	89 hrs.
	Subansiri	Chauldhuwaghat - Jamagurighat	Double observer	91	27th-28th March, 2022	2	7 hrs.
	Kulsi	Kukurmara - Nagarbera	Boat in tandem	61	3rd-4th April, 2022	2	9 hrs.
	Beki	Beki River Bridge (Sorbhog) - Sonabari (Beki - Brahmaputra Confluence)	Double observer	45	20th March, 2023	1	4 hrs. 22 min
	Kopili	Chapormukh (Kolong - Kopili Confluence) - Kajoli Chowki	Double observer	91	17th -18th March, 2023	2	9 hrs. 3 min
	Barak	Sonabari (Assam - Manipur border) - Rajartila (Indo - Bangladesh border	Double observer	124	19th-21st March, 2023	3	15 hrs. 28 min
				1297	1st March-21st March, 2022-23	25	133 hrs. 50 min

FIGURE 9.1

Brahmaputra River and its tributaries Subansiri, Kulsi, Beki, Kopili, and Barak River in Assam.




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FIGURE 9.2

Encounter rate of Ganges River Dolphin in Brahmaputra River and its tributaries Subansiri, Kulsi, Beki, Kopili, and Barak River in Assam.

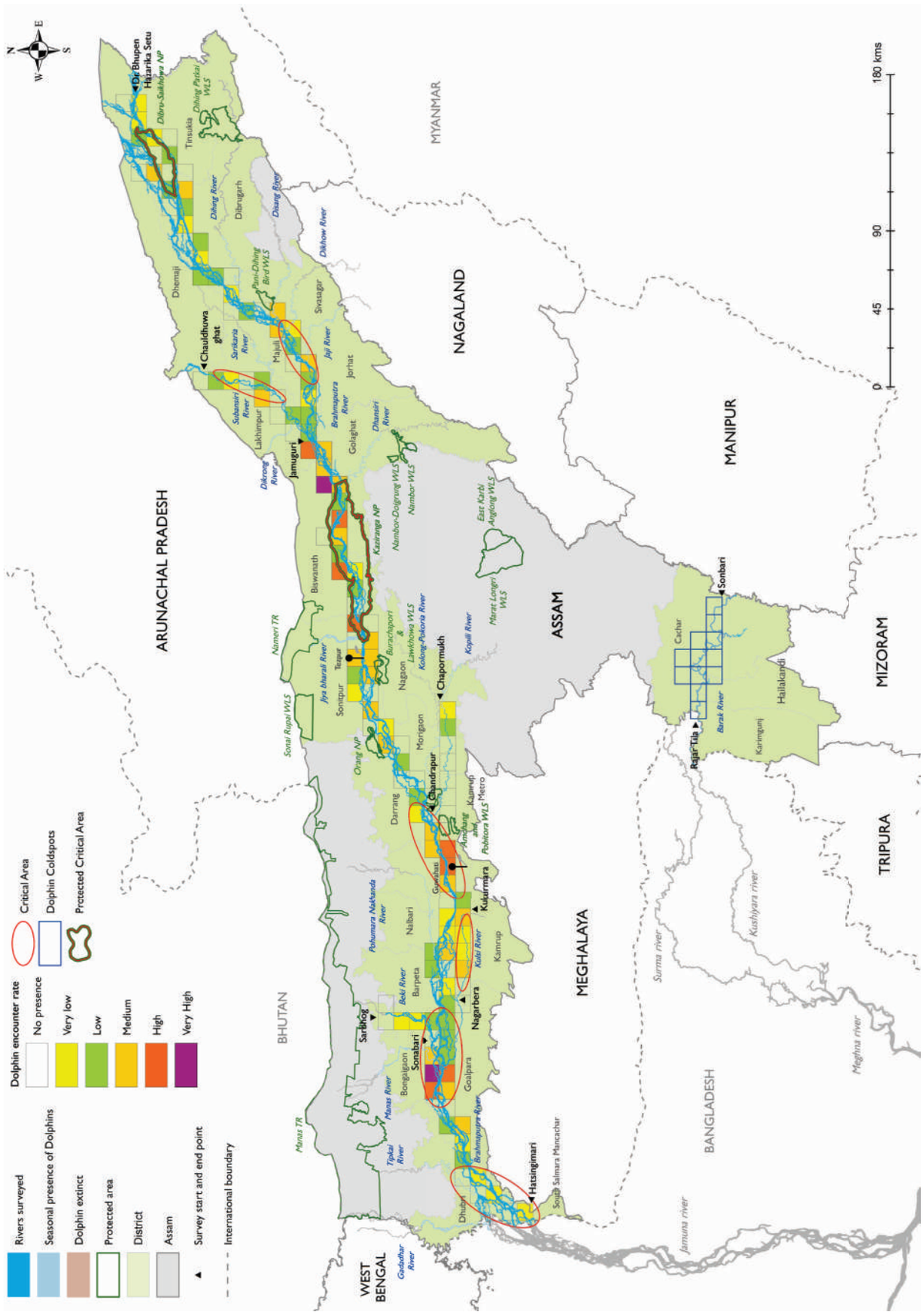


TABLE 9.2

Ganges River Dolphin population estimate in Brahmaputra River and its tributaries Subansiri, Kulsi, Beki and Kopili, and Barak river in Assam.
N_O is the observer corrected population estimate, and ER_O is the observer corrected encounter rate (per Km). N_{OA} is the observer and availability corrected population estimate and ER_{OA} is the observer and availability corrected encounter rate (per Km).

	River Stretch	N_{OA}	ER_{OA}
Brahmaputra	Dr. Bhupen Hazarika Setu - Hatsingimari (Indo - Bangladesh border)	584 (558-610)	0.7
Subansiri	Chauldhuwaghat - Jamagurighat (Subansiri)	22 (20-24)	0.2
Kulsi	Kukurmara - Nagarbera (Kulsi)	20 (19-21)	0.3
Beki	Beki River Bridge (Sorbhog) - Sonabari (Beki - Brahmaputra Confluence)	4	0.1
Kopili	Chapormukh (Kolong - Kopili Confluence) - Kajoli Chowki	5	0.1
Barak	Sonabari (Assam - Manipur border)-Rajartila (Indo - Bangladesh border)	0	0
	Assam	**635 (606-664)**	**0.5**

9.3 Population Estimation

The overall Ganges River Dolphin population in Brahmaputra was estimated at 635 (606-664), with a least count of 516 dolphins and an encounter rate of 0.5/Km (Figure 9.2, Table 9.2). The estimated Ganges River Dolphin population in the Brahmaputra River is similar to the population estimate of 2020 carried out by the Wildlife Institute of India (Qureshi *et al.*, 2020). The survey has helped highlight several important critical areas, which will lead to apt conservation inputs.

9.3.1 Brahmaputra

Brahmaputra River is one of the ranges of the Ganges River Dolphin in India. In an early study conducted in 1997, the population estimate of the Ganges River Dolphin was found to be 268 (Mohan *et al.*,1997). Wakid *et al.*, (2013) recorded 583 dolphins in 2012 and Qureshi *et al.*, (2020) recorded 503 dolphins in 2020. The population has increased since 1997 and seems to be stabilized.

In the Brahmaputra River, a total of 885 Km was covered via the Double observer method between 1st to 17th March 2022. The estimated population of the Ganges River Dolphin in the mainstream Brahmaputra was 584 (558-610), with a least count of 471 dolphins and an encounter rate of 0.7/Km (Figure 9.2, Table 9.2).

9.3.2 Subansiri

The Subansiri River which originates in the Purum peak of Tibet is the largest tributary of Brahmaputra at 443 Km. The river flows through Tibet and Arunachal Pradesh in India before entering Assam near Garukamukh of Lakhimpur district. The river finally discharges into the Brahmaputra at Jamugurighat and the river holds a resident population of Ganges River Dolphins. The population was stable between 2012 (32 dolphins) and 2018 (36 dolphins) (Qureshi *et al.*, 2020).

Over 91 Km were surveyed using the Double observer method in two days, 27th to 28th March 2022. The estimated population was 22 (20-24) dolphins in 91 Km, with a least count of 19 dolphins, and an encounter rate of 0.2/Km (Table 9.2 & Figure 9.3), showing rapid decline, which is a cause of concern.

9.3.3 Kulsi

Kulsi River, which holds a resident population of the Ganges River Dolphin is very narrow. It originates in Meghalaya and enters Assam in the Kamrup district of Western Assam. The river finally discharges into the Brahmaputra at Nagarbera.

In 2012, 17 dolphins were observed and 29 dolphins were seen in 2020 (Qureshi *et al.*, 2021). This population seasonally fluctuates a lot due to the local movement of dolphins. In the last two years, dolphins have been getting stranded in deep pools in the Kukurmara area. Recently, dolphins of the Kulsi River have started to move upstream of the Chayygaon stream.

A total of 61 Km was covered for the dolphin estimation in the Kulsi River from Kukurmara to Nagarbera. The survey was carried out for two days spanning from the 3rd to the 4th of April 2022 (Figure 9.1). In Kulsi, the population estimate was 20(19-21) dolphins with a least count of 17. The encounter rate was 0.3/Km (Table 9.2, Figure 9.2).

9.3.4 Kopili

There was no published report of previous dolphin occurrence in the Kopili River. This survey was carried out using the Double observer method from 17th to 18th March 2023 covering 91 Km. The overall population was 5. The least count of dolphins was 5, with an encounter rate of 0.1/Km (Figure 9.2, Table 9.2). As this survey was conducted during the lean season, the population is suspected to be a resident population rather than a migratory. However, during rainy/flood seasons, dolphins may migrate from the main channel of Brahmaputra to this tributary.

9.3.5 Beki

The river Beki is one of the major north-bank tributaries of Brahmaputra that flows from north to south through the Barpeta district (Kalita *et al.*, 2015). There was no published report of dolphin occurrence in Beki River before our survey.

The survey was carried out using the Double observer method on 17th March 2023 covering 45 Km. The overall population was 4 dolphins, with the least count of 4 dolphins and an encounter rate of 0.1/Km (Table 9.2, Figure 9.2). It is difficult to predict whether it could be a resident population or a migratory.

9.3.6 Barak

The Ganges River Dolphin is suspected to have undergone local extinction in the Barak River. In the 1970s-1980s, dolphins were fairly common in the rivers of the Barak River system (Biswas, 1995). They were recorded up as far as the hilly river courses of the Indian states of Mizoram and Manipur (Choudhury, 2013). However, the population of dolphins has declined gradually since then. During the dry winter season, dolphins in the Barak River are found to congregate in deep riverine pool areas locally called Dahr. Singha *et al.*, (2013) conducted 7 surveys in the 135 Km stretch of the Barak River during the dry winter months of 1999, 2001, 2003, 2005, 2006, 2007, and 2008, which yielded dolphin counts of 14, 12, 10, 9, 9, 8 and 8 respectively. Further surveys conducted in 2013-2014 focusing on the river confluences and traditional dolphin congregation sites, as well as interactions with local fishermen and riparian people, revealed that the dolphin does not occur anymore in the Barak River system in any season (Mazumder *et al.*, 2014). However, they were found to congregate downstream of the Kushiyara River, a tributary of the Barak River (Mazumder *et al.*, 2014). Resident dolphin populations occur currently in almost all the Dahrs of the Kushiyara River at the India-Bangladesh border (Mazumder *et al.*, 2014; Nath & Dhar, 2015).

During our survey, no dolphins were sighted in the 124 Km stretch of Barak River conducted over three days (Table 9.1 & 9.2; Figure 9.2).

9.4 Associated Fauna

9.4.1 Brahmaputra

River Brahmaputra and its tributaries flow through several protected areas in Assam, like Dibru-Saikhowa National Park, Kaziranga Tiger Reserve, Orang Tiger Reserve, Pobitara Wildlife Sanctuary, Laokhowa Wildlife Sanctuary and Manas Tiger Reserve (Figure 9.2). These protected areas, along with the river's vast network of tributaries, islands, grasslands, and other water bodies harbour a rich diversity of aquatic fauna.

Brahmaputra floodplain is home to a large number of migratory and resident bird species, where, ~969 species of birds (Lepage, 2022) were recorded across the river. Out of 29 species of tortoises and fresh-water turtles occurring in India, the Brahmaputra valley has the largest species diversity with 21 species (Ahmed & Das, 2010). Brahmaputra basin is also home to breeding populations of Smooth-coated Otters, especially the Orang Tiger Reserve, Manas Tiger Reserve (Nawab & Hussain, 2012; Sinha *et al.*, 2020) and Kaziranga Tiger Reserve (Qureshi *et al.*, 2020). In another study conducted in 2018, four incidental sightings of Small-clawed Otters were recorded in the Rangamati Beel and Jia-Bhoroli tributaries of the Brahmaputra River (Menzies & Rao, 2021).

9.4.1.1 Birds

In a previous survey conducted by WII in 2018, a total of 46 waterbird species were recorded with 17648 individual sightings (Qureshi *et al.*, 2018). In Brahmaputra, 86 species of birds were recorded in total (Appendix 25.1). The species of conservation concern recorded were the Critically Endangered Slender-billed Vulture (n=3) and White-rumped Vulture (n=1), the Endangered Black-bellied Tern (n=4), Greater Adjutant (n=57), Pallas's Fish-eagle (n=9), Steppe Eagle (n=4) and the Vulnerable Common Pochard (n=138), Lesser Adjutant (n=10), River Tern (n=6), and Swamp Francolin (n=1) were recorded in the River Brahmaputra (Figure 9.3).



migratory shorebirds, gulls and terns, ducks and geese, and other resident water birds like swamp hens, coots, and storks. The steep decline in migratory shorebirds is difficult to distinguish. Also, in the last 5 years, the declining trend in resident water birds has become a cause of concern (SoIB, 2020; SoIB, 2023). Other than this, multiple riverine ground-nesting birds such as Indian Skimmers, Black-bellied Tern, etc. show a 50-80% decline over the long term and some continue to decline even now (SoIB, 2023). Therefore, monitoring of associated aquatic fauna will provide important directions to conserve these species of conservation concern.

9.4.1.2 Herpetofauna

The Brahmaputra River basin is home to 19 species of turtles found in India (Ahmed & Das, 2010). Saikia *et al.*, (2010) recorded more than 31 Gharials between 2004-2007. During our survey, we found only two species of turtles with 13 individuals in the entire Brahmaputra including all the surveyed tributaries. These observations were from the protected stretch of Kaziranga National Park. The survey was not designed for herpetofauna studies, which may be the reason for fewer observations. Additionally, the width of the river is quite large, making visual observations of turtles difficult.

Two species of turtles, with one species being of conservation concern, were observed during the survey. Only 13 individuals were recorded during the survey and one of the species was the Critically Endangered, Assam Roofed Turtle (n=1) and the other was the Least Concern Indian Tent Turtle (n=12) (Appendix 25.2).

9.4.1.3 Mammals

The highest number of mammals from our survey was recorded from the Brahmaputra with a total of 106 individuals belonging to six species namely, the Endangered Asian Elephant (n=12), Wild Water Buffalo (n=74), and Hog Deer (n=14), the Vulnerable One-horned Rhino (n=1) and Smooth-coated Otter (n=5) (Appendix 25.3) (Figure 9.3).



9.4.2 Subansiri

Subansiri is an extremely important habitat for bird life. More than 200 bird species have been identified, some of them are rare (Choudhury pers. comm., 2003) and they support a wide variety of winter migratory birds. In the 91 Km stretch of the river surveyed, we have recorded a total of 43 species of birds. No other associated fauna was recorded from the river.

9.4.2.1 Birds

In Subansiri a total of 43 species of birds were sighted during the survey. Species of conservation concern recorded were the Endangered Steppe Eagle (n=2), the Vulnerable Common Pochard (n=13), the

Lesser Adjutant (n=2), the Near Threatened Ferruginous Pochard (n=30), Eurasian Curlew (n = 5) and Oriental Darter (n=7) (Appendix 26.1).

9.4.3 Kulsi

Very limited to no study was found on the Kulsi River regarding its biodiversity in Assam. Most of the study is focused on the biodiversity of beel connected to the Kulsi River. From our survey, we have recorded 32 species of associated fauna which consist of birds and mammals. No herpetofauna was recorded from this river.

9.4.3.1 Birds

A total of 31 species of birds were recorded from this river stretch. Among these, one Vulnerable species, Lesser Adjutant (n=5), and one Near Threatened species, Oriental Darter (n=1) were recorded in the Kulsi River (Appendix 27.1).

9.4.3.2 Mammals

Only one species of mammal, the Small Indian Mongoose was recorded from this river during the survey (Appendix 27.2).

9.4.4 Kopili River

The Kopili River system is home to a good number of bird species and is also one of the last strongholds of species such as the Endangered Greater Adjutant and Vulnerable Lesser Adjutant. Both species are in serious decline throughout their range and have been reported to flourish and breed well in Assam (Kahl, 1970). The river lacks any significant study on herpetofauna, thus the diversity is yet unknown. While the Kopili River system lies within the historic range of the endemic Assam Roofed Turtle, there have been no sightings of the given species from the river.

In total, 70 unique species of associated fauna were recorded from this river stretch. This included 69 species of birds and one species of mammal.

9.4.4.1 Birds

A total of 69 species of birds were recorded from this stretch. Among these, three species were of conservation importance the Endangered Greater Adjutant (n=7), the Vulnerable Lesser Adjutant (n=9), and the Near Threatened River Lapwing (n=7) (Appendix 28.1).

9.4.4.2 Mammals

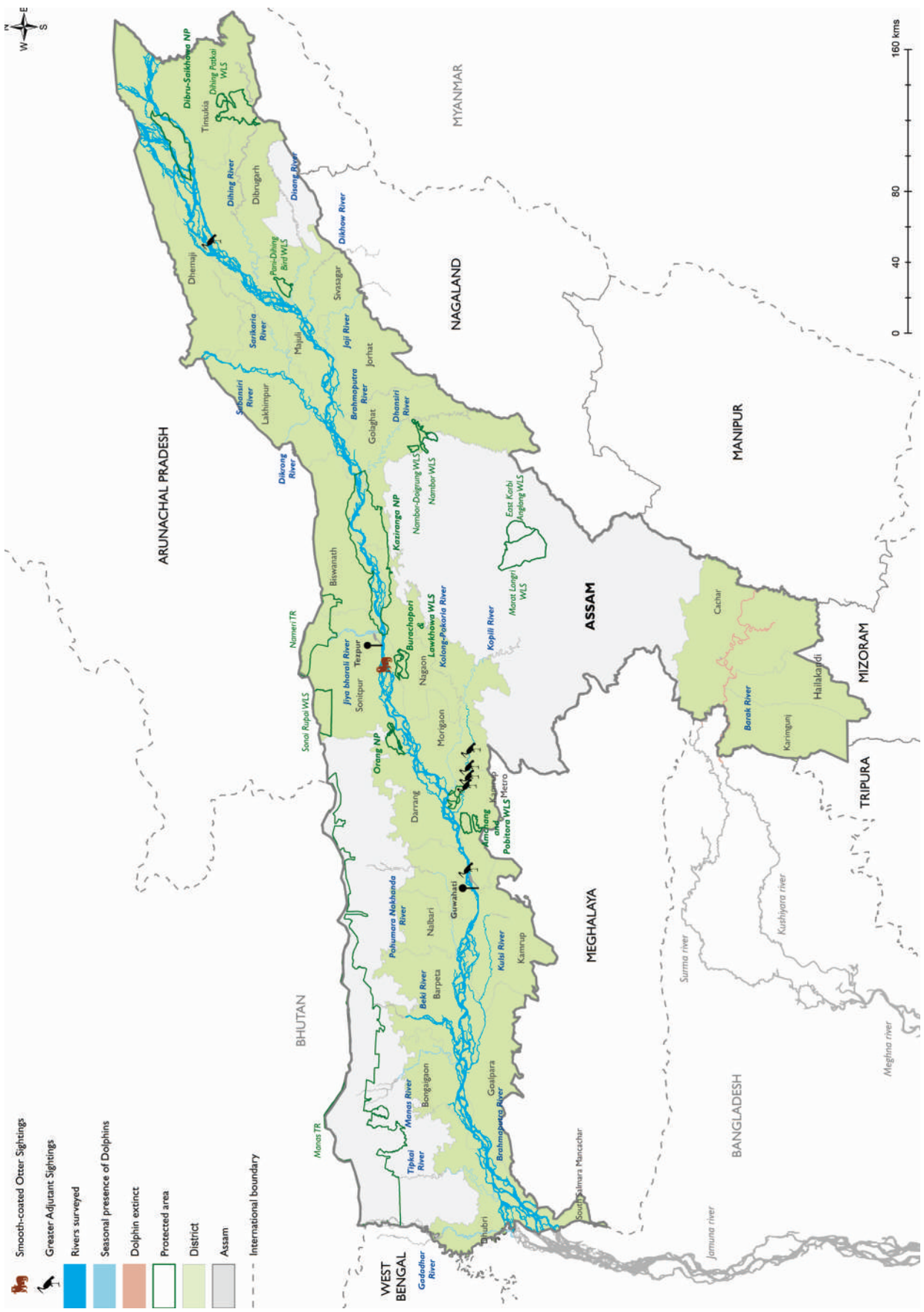
The Indian Flying Fox, also called the Greater Indian Fruit Bat was seen roosting in colonies of hundreds (n=595) during our survey (Appendix 28.2).

9.4.5 Beki River

Beki River, also known as Kurissu River in Bhutan is an important left bank tributary of the Brahmaputra River. It flows from north to south through the Barpeta district. The river passes through some parts of the Manas National Park and sustains a good diversity of flora and fauna. Although there have been reports of many species of birds, herpetofauna, and mammals from the river, no proper study has been done on the biodiversity. While there is no such viable population of Crocodilians in this river system, there have been reports of sightings of Gharials from the Beki and Manas Rivers, especially from the regions near the Manas National Park (Saikia, 2013). The Beki River system also lies within the historic range of the Critically Endangered Black Softshell Turtle. In 2021, a critically endangered Black Softshell Turtle was sighted in the Pahumara River, a tributary of the Beki River, suggesting that the river may be sustaining populations of this species. A survey is needed to evaluate the diversity of reptiles and amphibians in the region (Dutta *et al*., 2022).

FIGURE 9.3

Distribution of Greater Adjutant and Smooth-coated Otter in Brahmaputra River and its tributaries Subansiri, Kulsi, Beki, Kopili, and Barak River in Assam.



A total of 50 species of associated fauna were recorded in the survey.

9.4.5.1 Birds

The birds recorded were the Steppe Eagle (n=6) which is Endangered and the River Lapwing (n=2) which is Near Threatened (Appendix 29.1).

9.5 Conclusion

The important areas identified in Assam within the Brahmaputra River and its tributaries are vital for dolphin conservation and local livelihoods. The estimated dolphin population in Assam is 635 individuals, with critical areas in the Kulsi River (Kamrup district), Subansiri River (Lakhimpur), Brahmaputra River in Majuli, Dibru-Saikhowa National Park (Tinsukia), Kaziranga National Park (Biswanath district), Guwahati (Darang-Kamrup metro), Goalpara-Bongaigaon, and Dhubri. The Barak River has been identified as a coldspot with no dolphin population. Conservation efforts in these critical areas are necessary to maintain dolphin populations and support other species of conservation concern, including the Otter and Greater Adjutant Stork.


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X : PUNJAB



Citation: : Gargi Roy Chowdhury, Gitanjali Kanwar, Aaranya Gayathri, Abdul Wakid, Abhishek Bettaswamy, Ranjana Negi, Syeda Tabassum Tasfia, Bhawana Pant, Gursewak, Sunny Deori, Vineet Singh, Nalin Yadav, Suresh Babu, Vishnupriya Kolipakam & Qamar Qureshi. Status of Indus River Dolphins in India (2024).

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PUNJAB

NUMBER OF RIVERS SURVEYED

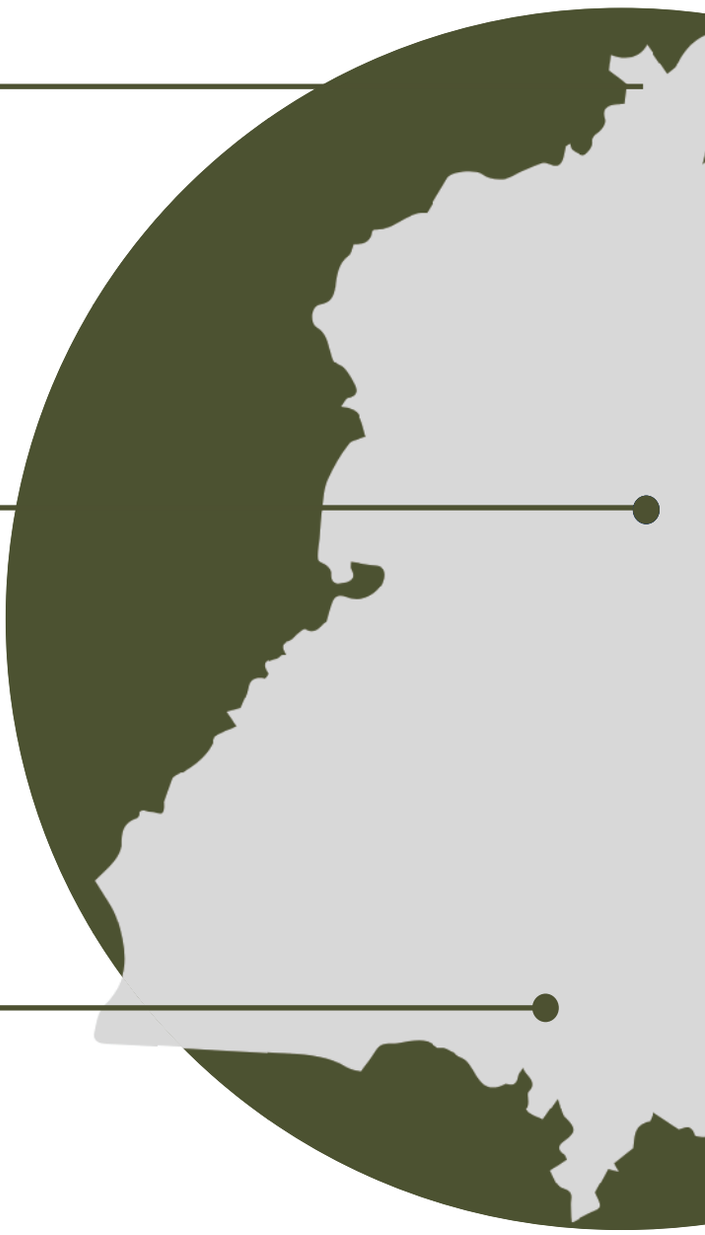
1

NUMBER OF KILOMETERS SURVEYED

101

NUMBER OF SURVEY DAYS

3





LEAST COUNT

3

POPULATION ESTIMATE

3

10.1 Background

Indus River Dolphin is one of the two surviving species of the family Platinistadae and was r*egarded* as a subspecies *of the* South Asian River dolphin, along with Ganges River Dolphins (Hamilton *et al.,* 2001). New information from mitochondrial genomics led to its taxonomic status being revised to a separate species from that of the Ganges River Dolphin to Indus River Dolphin (Braulik *et al*., 2022). The Beas River harbors the only remaining population of Indus River Dolphins in India. In British India, the Indus River Dolphin was found in approximately 3400 Km length of Indus River and its tributaries, from the foothills of the Himalayas to the limits of the tidal zone in Pakistan (Anderson, 1878). The Indus River Dolphin now occupies only one-fifth of its former range (Reeves *et al*., 1991), with 1816 individuals in Pakistan (WWF-Pakistan, 2017). In India, Indus River Dolphin was thought to be locally extinct around 1960s, during the 1980s there were only occasional reports of dolphin sightings. In 2007, Basanta Rajkumar, DFO, Harike Wildlife Sanctuary, sighted a dolphin during his routine visit. The discovery raised the possibility that overlooked dolphin populations may persist in areas from which they were previously believed to have been extirpated (Behera *et al*., 2008), prompting the forest department to collaborate with WWF-India for monitoring and conservation.

10.2 Study Area

The Beas River in India flows from the Western Himalayas near Rohtang Pass to the plains of Punjab and joins the Sutlej River, a tributary of the Indus River. The Indus River had approximately four times the annual discharge of the Jhelum or Chenab, six times that of the Sutlej, and thirteen times that of the Ravi before large-scale water diversion (IUCN, 2011). The Jhelum and Chenab may have had greater dolphin abundance in the past, than the smaller Ravi, Sutlej, and Beas.

The population estimation survey started from Terkiana (Shri Hargobindpur) and ended at Harike from 28th to 30th November 2021 (Table 10.1), covering a total stretch of 101 Km (Figure 10.1).


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FIGURE 10.1

Beas River from Shri Hargobindpur (Terkiana) to Harike in Punjab.



TABLE 10.1

Effort and method used for Indus River Dolphin estimation in Beas River from Shri Hargobindpur (Terkiana) to Harike in Punjab.

State	River	Stretch	Method	Distance surveyed (Km)	Survey dates	Survey days	Total effort (hrs.)
Punjab	Beas	Sri Hargobindpur (Terkiana) - Harike	Boat in tandem	101	28th — 30th November, 2021	3	12 hrs.

TABLE 10.2

Indus River Dolphin population estimate in Beas River from Shri Hargobindpur (Terkiana) to Harike in Punjab.

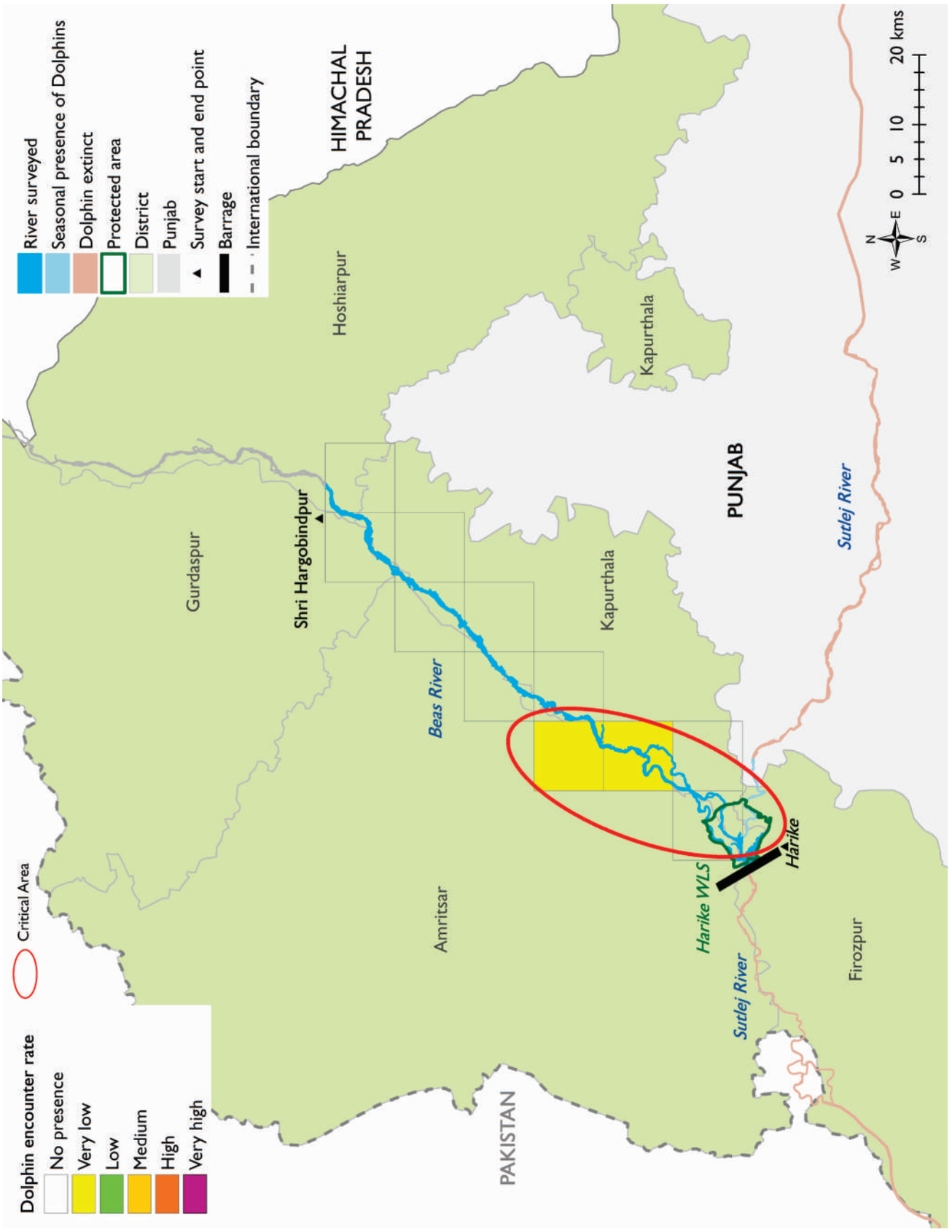
River Stretch	N_o	ER_o (Km)
Sri Hargobindpur- (Terkiana) Harike	3	0.03



© Paolo Manzi

FIGURE 10.2

Encounter rate of Indus River Dolphin distribution in Beas River from Shri Hargobindpur (Terkiana) to Harike in Punjab.



10.3 Population Estimation

In 1874, Indus River Dolphins were most abundant in the middle or lower third of their range (Jerdon, 1874), which is consistent with the present relatively high-density area on the Indus in northern Sindh. Five dolphins were reported by WWF-India (2018).

During the current survey, only three Indus River Dolphins (two adults and one neonate), with an encounter rate of 0.03/Km were detected (Table 10.2, Figure 10.2).

In early 2024, the death of a pregnant female was recorded, reducing the population to two individuals.

10.4 Associated Fauna

River Beas, flowing through Himachal Pradesh and the agrarian state of Punjab had been designated as a “Conservation Reserve” in 2017 and a “Ramsar site” in 2019 (Kumar & Kler, 2021). The Beas River is a vital habitat for over 500 bird species, attracting resident and migratory water birds during different seasons (Kumar & Kler, 2021). The Beas River supports the Ganges Soft-shelled Turtle, Indian Flap-shelled Turtle, Narrow-headed soft-shelled Turtle, Spotted Pond Turtle, Crowned River Turtle, and Brown Roofed Turtle (PCCF Punjab, 2020).

Gharials were extinct in Punjab for over half a century. In 2017-18, the Punjab Forest Department and WWF released 47 Gharials in the Beas River near Amritsar from the Morena breeding center and 23 Gharials were released in the Beas River near Hoshiarpur district in 2021 (Singh, 2021). Smooth-coated Otters were found along some portions of the Beas, Sutlej, and Ravi Rivers, as well as the Harike Wetlands, in India’s Punjab plains (Khan, 2015).

Our assessment recorded a total of 86 species including 78 species of birds, two species of mammals, and six species of herpetofauna.

10.4.1 Birds

A total of 78 bird species were recorded of which the species of conservation concern recorded were the Vulnerable Common Pochard (n= 25), River Tern (n=15), the Near Threatened Oriental Darter (n=28), Black-headed Ibis (n=5), Great Thick-knee (n=38), Indian Spotted Eagle (n=6) and Asian Woolly-necked Stork (n=3) (Appendix 30.1)..

10.4.2 Herpetofauna

Six species of herpetofauna were recorded of which 16 individuals of the Critically Endangered Gharials were sighted (Figure 10.3). Also, the Endangered Ganges Soft-shelled Turtle (n=1) was sighted, and the Near Threatened Brown Roofed Turtle (n=120) (Appendix 30.2).

10.4.3 Mammals

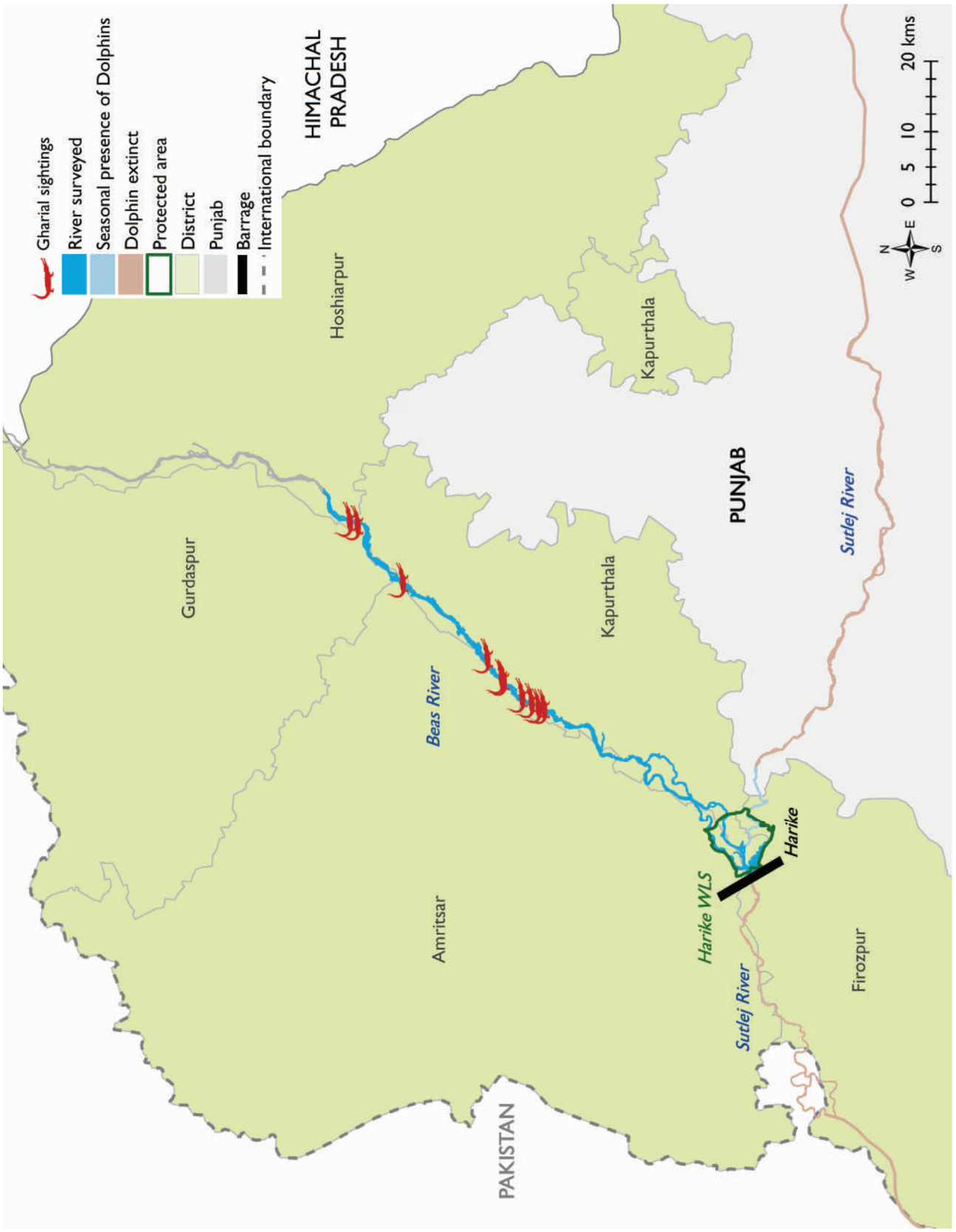
Two species of mammals, the Wild Boar and Indian Grey Mongoose were recorded, both falling under the Least Concern category (Appendix 30.3).


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FIGURE 10.3

Distribution of Gharial in Beas River from Shri Hargobindpur (Terkiana) to Harike in Punjab.



10.5 Conclusion

The important areas identified in Punjab are essential for conserving the last remnant population of Indus River Dolphin in India. The stretch from Mundapind to Harike Barrage is a critical area, currently home to two known dolphins. The Beas Conservation Reserve in the river's lower stretch is crucial for survival, as the population is concentrated here. Conservation efforts in the form of adequate stringent protection and augmentation are needed to prevent the extinction of Indus River Dolphins in India.



XI : PROTECTED AREAS



Citation: Sunny Deori, Dipamoni Taye, Atit Rai, Vijay Pratap Singh, Sajeer P., Vineet Singh, Saswati Mahanta, Swasti Joshi, Abhikrishan G, Santosh HR, Hiyashri Sarma, Biswajeet Pujari, Ayan Dutta, Madhusree Das, Gunjan Chawla, Panchali Hazarika, Merin Jacob, Gargi Roy Chowdhury, Taslima Ahmed Hazarika, Preeti Jhakwal, Kiran Rawat, Prateek Sai, Athul A., Pranay Bhatnagar, Pranav Kulkarni, Shantam Ojha, Vartika Negi, Abdul Wakid, Vishnupriya Kolipakam & Qamar Qureshi.
Status of River Dolphins in Protected Areas (2024).



Protected Areas play a very crucial role in the conservation of species throughout India. Protected Areas have largely been designated considering terrestrial ecosystem needs. The Brahmaputra and Ganga Rivers course through several protected areas, making those areas important for the conservation of not only terrestrial but also aquatic habitats, fauna, and flora. In India, there is only one protected area declared with the Ganges River Dolphin as the focal species: the Vikramshila Gangetic Dolphin Sanctuary (76 km), which encompasses one of the major hotspots for this species in the Ganga. In Brahmaputra, Kaziranga National Park supports India's big five terrestrial species and protects the Ganges River Dolphins (Qureshi *et al*., 2018). Relatively greater presence of dolphins in these protected areas could be due to minimal disturbance and anthropogenic activity (fishing, sand mining, etc.), coupled with additional protection by the Forest Department.

During the Rangewide River Dolphin Estimation survey, the Ganges River Dolphin population was estimated in these protected areas, i.e., Hastinapur Wildlife Sanctuary, Kachhua Wildlife Sanctuary, Katerniaghat Wildlife Sanctuary, Dudhwa Tiger Reserve, Pilibhit Tiger Reserve and Kishanpur Wildlife Sanctuary in Uttar Pradesh, Vikramshila Gangetic Dolphin Sanctuary, Valmiki Tiger Reserve and Sohagibarwa Wildlife Sanctuary in Bihar, Sundarban Tiger Reserve and Biosphere Reserve in West Bengal, Dibru Saikhowa National Park, Kaziranga Tiger Reserve, Laokhowa Wildlife Sanctuary, Orang National Park and Pobitora Wildlife Sanctuary in Assam, and National Chambal Sanctuary in the tri-states of Uttar Pradesh, Madhya Pradesh, and Rajasthan. The Indus River Dolphin was estimated in the Beas Conservation Reserve in Punjab. The Ganges and Indus River Dolphin populations and the encounter rate are estimated inside each of these Protected Areas, with an additional 10 Km buffer upstream and downstream of the river to account for dolphin movement.

A total of 2,788 km of the Ganga-Brahmaputra and Beas River systems was surveyed within these protected areas. The protected areas contain 21% of the river dolphins estimated across their entire range.

11.1 Uttar Pradesh

11.1.1 Hastinapur Wildlife Sanctuary

The Hastinapur Wildlife Sanctuary is a notable conservation area in western Uttar Pradesh, located along the Ganga River. It was founded in 1986 to preserve the unique and rapidly deteriorating Ganga River grassland-wetland complex. The drainage system of the sanctuary is formed by the river Ganga and its former bed, known locally as the Budhi Ganga (Khan & Abbasi, 2015). The sanctuary covers an area of approximately 2,073 Km^2, comprising the Uttar Pradesh districts of Muzaffarnagar, Meerut, Ghaziabad, Bijnor, and Amroha. It is part of the Upper Gangetic Plains biogeographic area and is home to the Gangetic grassland biome (Rodgers & Panwar, 1988). The sanctuary is distinguished by four distinct microhabitats: the Khola, which consists of elevated alluvial deposition parallel to the Ganga River on the western bank; the Khadar, which encompasses the river's low-lying sandy bed on either side; the Budhi Ganga, a belt of swamps and marshes located between the Khola and Khadar; and the ever-changing Ganga River habitats. Hastinapur contains wetlands (swamps and marshes), different types of grasslands (tall wet grasslands, short wet grasslands, and dry scrub grasslands), and tropical dry deciduous woods. It also includes extensive riverine alluvial habitats offered by the Ganga and Budhi-Ganga Rivers, which run through the sanctuary's center. Notably, the sanctuary is also home to the Ramsar-listed Haidarpur Wetland, which is located on the western side of the Bijnor Barrage (Joshi *et al*., 2021). The sanctuary, which includes a unique riparian environment along the Ganga, is an important ecosystem for a diverse assemblage of endangered and declining species that rely on it. Many threatened species have found refuge in the sanctuary, including our national aquatic animal, the Ganges River Dolphin, the Critically Endangered Gharial, which was released in the sanctuary by the State Forest Department in 1991-92 (Yadav *et al*., 2013), the Vulnerable Smooth-coated Otter, and many species of turtles. This sanctuary's wetlands and grasslands also serve as a last refuge for the Vulnerable Western Swamp Deer, or Barasingha, a viable population that thrives in the sanctuary. Furthermore, the sanctuary's diversified riverine and alluvial habitat supports a diverse array of bird species that rely on the river directly or indirectly. Notable examples include the Near Threatened Oriental Darter, the Endangered Egyptian Vulture, the Vulnerable Sarus Crane, and other non-threatened birds as well as migratory birds coming from the

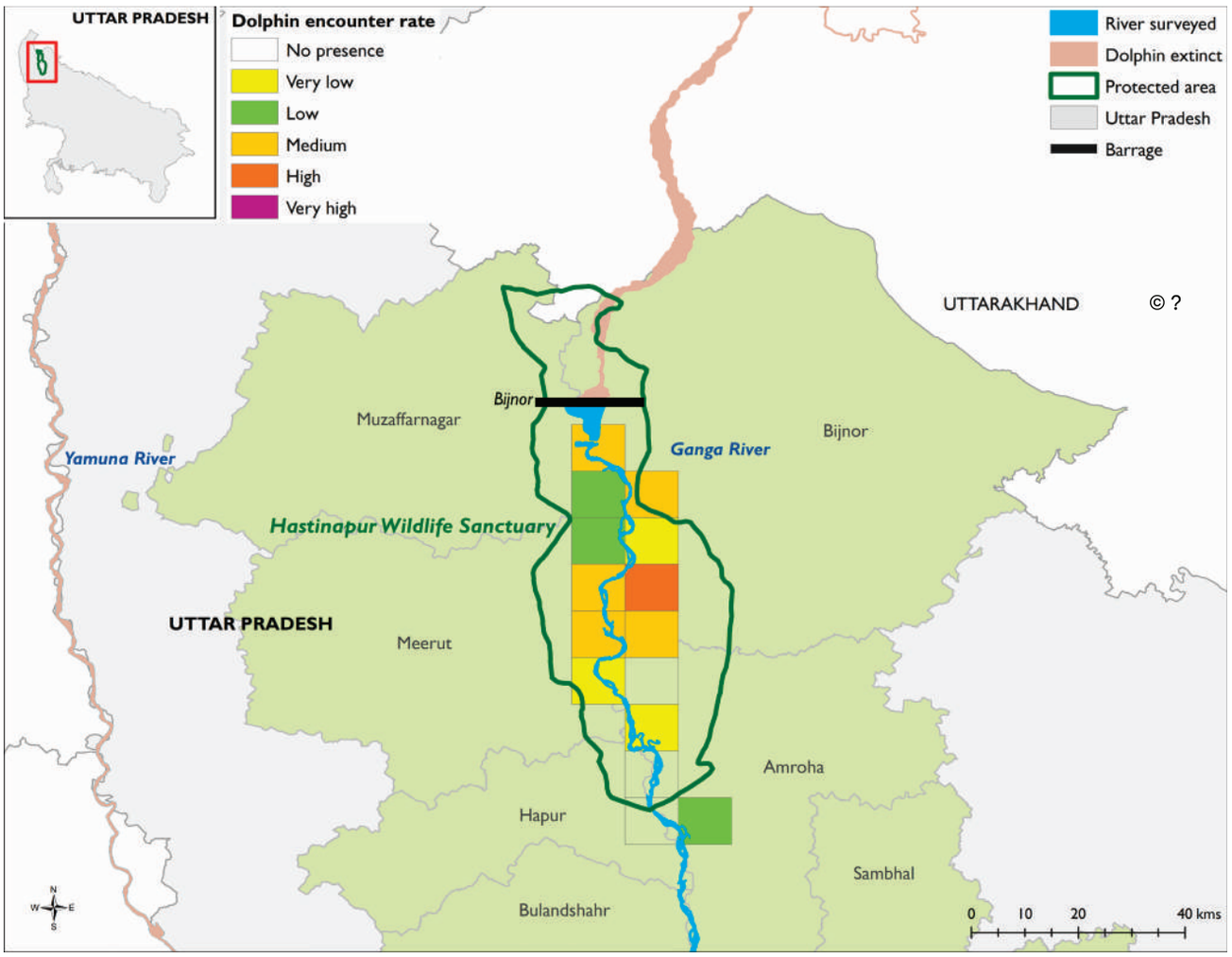
central Asian flyway to this sanctuary to find a haven, such as the Bar-headed Goose, Mallard, Ruddy Shelduck, Common Pochard, etc. (Khan *et al.*, 2013).

The Ganges River Dolphin population estimate in this protected area was 67(61-73), in a 109 Km stretch, which was surveyed over 3 days. The least count of dolphins in this area was 53, with an encounter rate of 0.6/Km (Figure 11.1, Table 11.1). We recorded 32 bird species and four reptiles of conservation concern. Out of these were the Endangered Black-bellied Tern (n=18), the Vulnerable River Tern (n=4) and Sarus Crane (n=3), the Near Threatened, Black-necked Stork (n=4), Great Thick-knee (n=30), Oriental Darter (n=12), River Lapwing (n=179) and Asian Woolly-necked Stork (n=6). We also encountered the Critically Endangered Gharial (n=22), the Vulnerable Indian Roofed Turtle (n=55), and the Near Threatened Brown Roofed Turtle (n=121).



FIGURE 11.1

Encounter rate of Ganges River Dolphin in Hastinapur Wildlife Sanctuary.



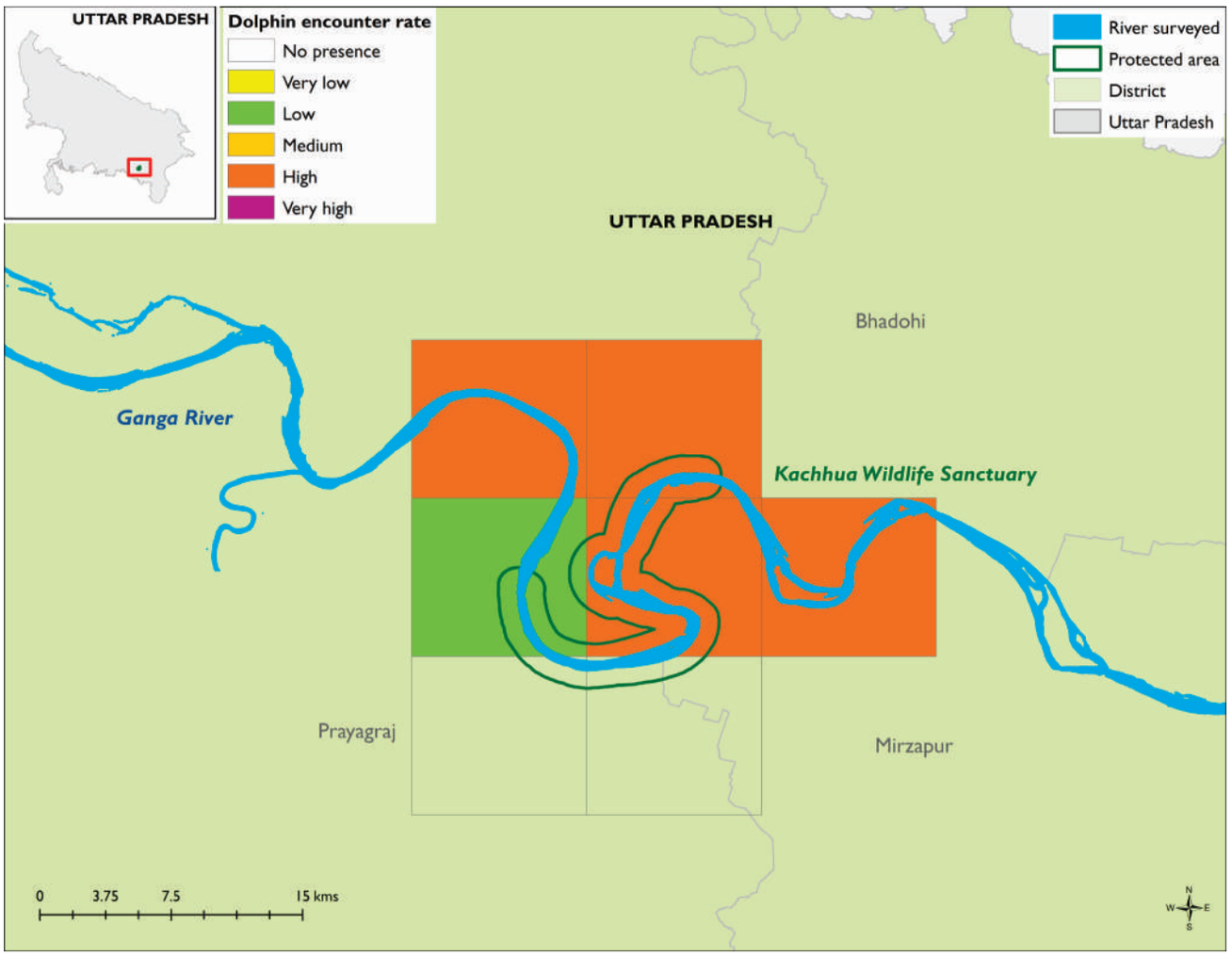
11.1.2 Kachhua Wildlife Sanctuary

The Kachhua Wildlife Sanctuary, which spans a 30 Km stretch of the Ganga River between the Uttar Pradesh districts of Bhaddodhi, Prayagraj, and Mirzapur, is critical for river biodiversity protection.

In our study, we have estimated 175 (166-184) dolphins, across a 49 Km stretch of the sanctuary. The least count was 144 dolphins with an encounter rate of 3.6/Km (Figure 11.2, Table 11.1). We have also recorded 25 birds and one mammal. Among the birds recorded were the Endangered Indian Skimmer (n=2), Egyptian Vulture (n=2), the Vulnerable River Tern (n=4), the Near Threatened Painted Stork (n=6), River Lapwing (n=27) and Asian Woolly-necked Stork (n=9).

FIGURE 11.2

Encounter rate of Ganges River Dolphin in Kachhua Wildlife Sanctuary.



11.1.3 Katerniaghat Wildlife Sanctuary

The Katerniaghat Wildlife Sanctuary covers 400 Km^2 in Uttar Pradesh and is located inside the core area of the Dudhwa Tiger Reserve. The sanctuary was established in 1975 and borders Nepal's Bardia National Park to the north and Dudhwa National Park to the west (Pandey *et al.*, 2008). The Katerniaghat's primary rivers are the Geruwa and Kauriala, which are also known as the Ghaghara in their lower portions. These rivers begin as the Karnali in Nepal's lower Himalayas and branch into the Kauriala and Geruwa before entering India, meandering along the sanctuary's northwest edge. The Kauriala and Geruwa rivers meet at the Girijapuri Barrage before merging to form the Ghaghara River, which flows into the Ganga. The sanctuary is home to major terrestrial fauna such as the tiger, rhinoceros, Swamp Deer, and the Critically Endangered Hispid Hare (Butool & Singh, 2021).

Katerniaghat is known for its rich biodiversity and is home to the Endangered Ganges River Dolphin. In 1994, the estimated population of the Ganges River Dolphin in the Geruwa River was 30 (25-31) (Smith *et al.*, 1994). However, a major flooding event in 2010 led the Karnali River's active mainstream to fully shift from the east Geruwa channel, to the west Kauriala channel, resulting in changes in river depth and flow from the east to the west channel. As a result of this natural channel shift, the relict Ganges River Dolphin population shifted from the east to the west channel, but it also shifted from a protected stretch to one where fishing and irrigation operations predominated (Khanal *et al.*, 2016). Population estimates from 2012 revealed 39 (29-45) dolphins (Behera *et al.*, 2014). Following that, in 2013, the estimated

population of dolphins across the same river portions was 35 (27-41) (Singh & Behera, 2018).

The protected area has also been home to otters, a variety of migrating bird species, and a resident population of freshwater turtles (Singh & Behera, 2018). A previous study in Geruwa and Kauriala Rivers done by Singh & Behera (2018) found 65 Gharials and 20 muggers in the area. Another study estimated 50 mature adult Gharials throughout the Geruwa River and the reservoir's 20 Km shoreline, with nesting occurring at four sites and a dramatic drop in hatchling survival rates in recent years (Lang, 2019). This breeding population in Katerniaghat was second only to the bigger Chambal population (Lang, 2019). Additionally, other associated fauna from the stretch included the Endangered birds like the Black-bellied Tern and Egyptian Vulture, and the vulnerable Mugger Crocodile (Singh & Behera, 2018).

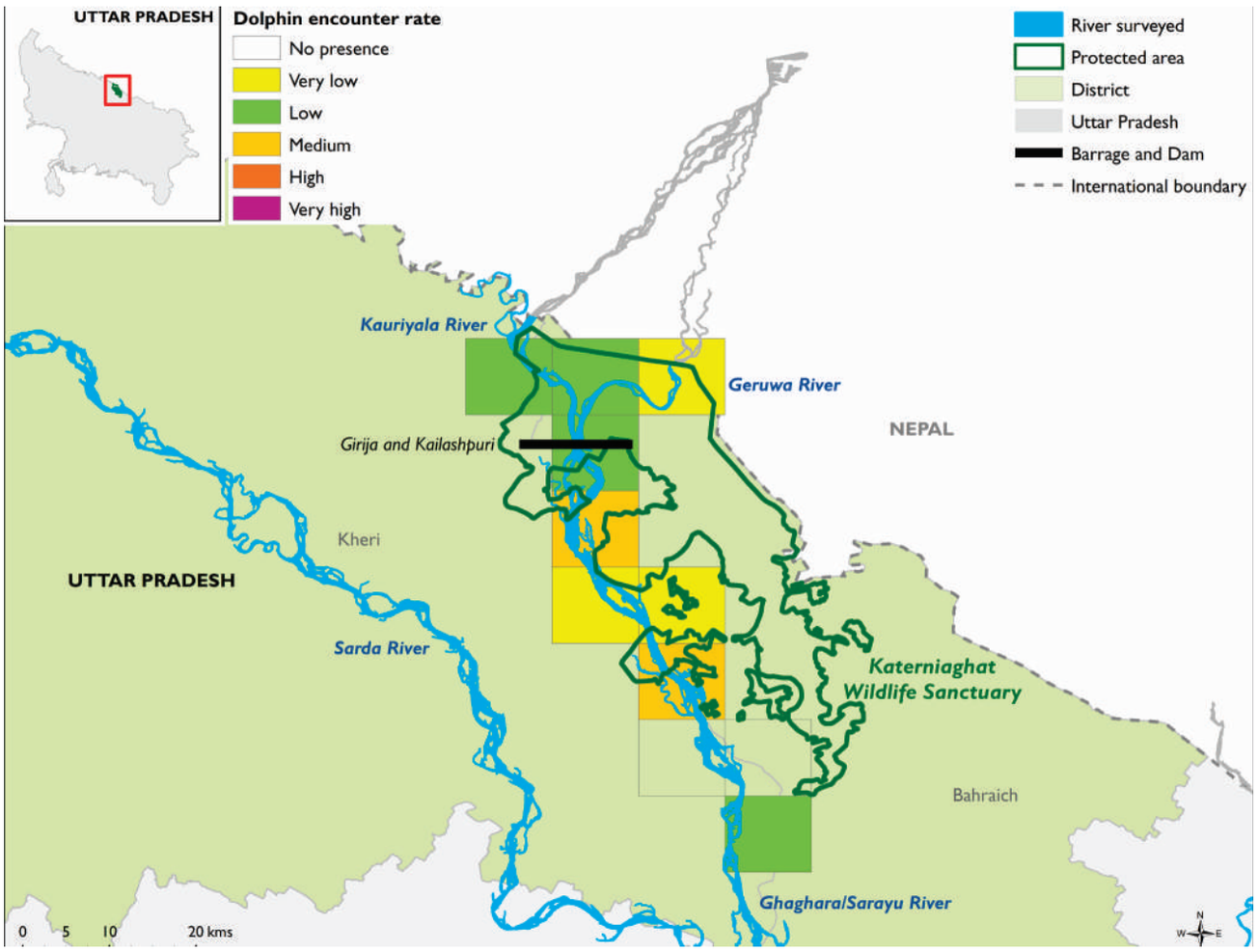
During our survey, we estimated 72 (64-80) dolphins in a 95 Km stretch of Katerniaghat Wildlife Sanctuary, with a minimum count of 56 dolphins and an encounter rate of 0.8/Km (Figure 11.3, Table 11.1). We recorded 45 bird species and four reptiles of conservation concern. The Endangered Egyptian Vulture (n=3), the Vulnerable Common Pochard (n=32), the Near Threatened: Black-necked Stork (n=1), Eurasian Curlew (n=6), Grey-headed Fish-Eagle (n=1), Painted Stork (n=15), Oriental Darter (n=2), River Lapwing (n=47), Asian Woolly-necked Stork (n=13), were amongst those species recorded. We also encountered the Critically Endangered Gharial (n=116), the Endangered Ganges Soft-shelled Turtle (n=1), the Vulnerable Mugger (n=47), and the Near Threatened Brown Roofed Turtle (n=299).



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FIGURE 11.3

Encounter rate of Ganges River Dolphin in Katerniaghat Wildlife Sanctuary.



11.1.4 Pilibhit Tiger Reserve, Kishanpur Wildlife Sanctuary and Dudhwa National Park

For the Pilibhit Tiger Reserve, Kishanpur Wildlife Sanctuary, and Dudhwa National Park combined Ganges River Dolphin population estimate was 20 (12-30), with a minimum count of 12 dolphins. For a 94 Km span, the encounter rate was 0.2/Km (Figure 11.4, Table 11.1). During the survey, we also recorded 42 bird species and six reptiles. Out of these were the Endangered Egyptian Vulture (n=2), the Near Threatened Black-necked Stork (n=9), Oriental Darter (n=6), Painted Stork (n=3), River Lapwing (n=25) and Asian Woolly-necked Stork (n=9). Among reptiles, we recorded the Critically Endangered Gharial (n=9), the Endangered Ganges Soft-shelled Turtle (n=1), Vulnerable Mugger (n=1), Indian Roofed Turtle (n=7), and the Near Threatened Brown Roofed Turtle (n=20).

11.1.4.1 Pilibhit Tiger Reserve

The Pilibhit Tiger Reserve, located in the Terai region of Uttar Pradesh, is a significant conservation area known for its rich biodiversity and unique ecological features. Established in 2008, the reserve spans approximately 730 Km^2, encompassing diverse habitats that support a wide range of fauna (NTCA). The Pilibhit Forest Division, consisting of five forest ranges (Barahi, Haripur, Deoria, Mala, and Mahof) and comprising 52 forest beats, holds significant importance in the conservation of wildlife in the Terai Arc Landscape (TAL) due to its proximity to the terai-Babar forests of Surai range in the Terai East Forest Division to the northwest and the Kishanpur Wildlife Sanctuary to the southeast. It serves as a crucial

link connecting the Shukla Phanta Wildlife Reserve, Nepal to the Kishanpur Wildlife Sanctuary in India through the Lagga-Bagga Forest block, Tatargailj area of the North Kheri Forest Division, and the Haripur range of the Pilibhit Forest Division (NTCA). Notably, the Terai region is characterized by unique features, including a lower water table and swampy areas (Kumar *et al*., 2018). Gomati River originates from the reserve, which is also the catchment of several other rivers like Sharda, Chuka, and Mala Khannot. Sharda Sagar Dam, which extends up to a length of 22 Km, borders the reserve on the east side (NTCA). The habitat is characterized by Sal forests, tall grasslands, and swamps, maintained by periodic flooding from rivers, which harbour a diverse range of fauna including Royal Bengal Tiger, Leopard, Fishing Cat, Leopard Cat, Swamp Deer, Hog Deer, Northern Red Muntjac, Blackbuck, Sambar, Sloth Bear, and Giant Flying Squirrel. Furthermore, it is also home to two Critically Endangered species, including the Bengal Florican and Hispid Hare. Among the wildlife inhabiting the reserve, a total of 13 mammal species, 9 bird species, and 11 herpetofauna species are endangered and are listed in Schedule I of the Wildlife (Protection) Amendment Act, 2022. Thus, the reserve serves a significant role in maintaining the population dynamics of the species.

11.1.4.2 Kishanpur Wildlife Sanctuary

Kishanpur Wildlife Sanctuary, established in 1973, covers approximately 227 Km^2 and spans the South Kheri Forest Division in Gola Tehsil of Lakhimpur district and a small reserve forest region in Powayan Tehsil of Shahjahanpur district in Uttar Pradesh (Agnihotri *et al*., 2016). It is a constituent area of Dudhwa Tiger Reserve, connected with the South Kheri Forest Division, and is located in the southern portion of Dudhwa National Park on the southern side of the Sharda River, about 15 Km from Dudhwa National Park, separated by an agricultural landscape (Agnihotri *et al*., 2016).

Kishanpur Wildlife Sanctuary represents a typical Terai ecosystem, characterized by extensive alluvial plains, wetlands, hygrophilous grasslands, woodlands, and moist forests. The vegetation of the area can be categorized into riverine forests, mixed sal forests, teak plantations, woodlands, and alluvial grasslands (Agnihotri *et al*., 2016). The sanctuary is home to a range of animals, including tigers, leopards, Muggers, Gharial, Ganges Soft-shelled Turtle and Ganges River Dolphin (Agnihotri *et al.,* 2016). Land use and land cover analysis revealed that the sanctuary was represented by sal forests - 58.4%, other forests - 7.7%, plantations - 5.5%, grasslands - 22.9%, wetlands - 4.1%, and a small extent (0.9%) of habitation and agriculture under two villages located within the sanctuary (Mathur & Midha, 2008).

Kishanpur Wildlife Sanctuary is linked to two significant and huge rivers: Sharda and Ull. The Sharda River rises in the Greater Himalayas in Kalapaani at an elevation of 3,600 m in Uttarakhand's Pithoragarh district, forms part of the Kishanpur Wildlife Sanctuary's northeast boundary, and eventually joins the Ghaghara (Mathur & Midha, 2008). The Ull River traverses from northwest to southeast through the core of Kheri district and sanctuary, rising in wetlands in the Pilibhit district's Puranpur area. It runs across much of the sanctuary before joining the Sharda River. During the monsoon season, both rivers swell to a high volume, causing flooding and damage to the district's agriculture (Mathur & Midha, 2008). The western side of Kishanpur Wildlife Sanctuary is bounded by the Kheri Branch Canal of the Sharda Canal System, and the other sides are bounded by forests of the South Kheri Forest Division (SKFD) and the Shahjahanpur Forest Division.

11.1.4.3 Dudhwa National Park

Dudhwa National Park is situated in the Terai region of Uttar Pradesh, covering an area of 500 Km^2 along the Indo-Nepal border in the Kheri district (Singh & Tandon, 2009). The Mohana and Suheli Rivers run along the Dudhwa National Park's northern and southern limits, respectively. The park's river system is supplemented by several streams known as 'nallah.' In addition, the park contains a substantial quantity of permanent or seasonal 'taal' (Midha, 2008). In 1965, this region was designated as a Wildlife Sanctuary, and in 1977, it was designated as a national park (Singh & Tandon, 2009). The park's core area is surrounded by 190 Km^2 of buffer on both the northern and southern sides (Midha, 2008). There are no major settlements in the park, except for 5.78 square kilometers of forest area encroached upon, the most notable being Surma village, home to 69 families (Midha, 2008). The park is home to more than 38 species of mammals, 90 species of fish, 400 species of birds, and 16 species of reptiles (Areen-

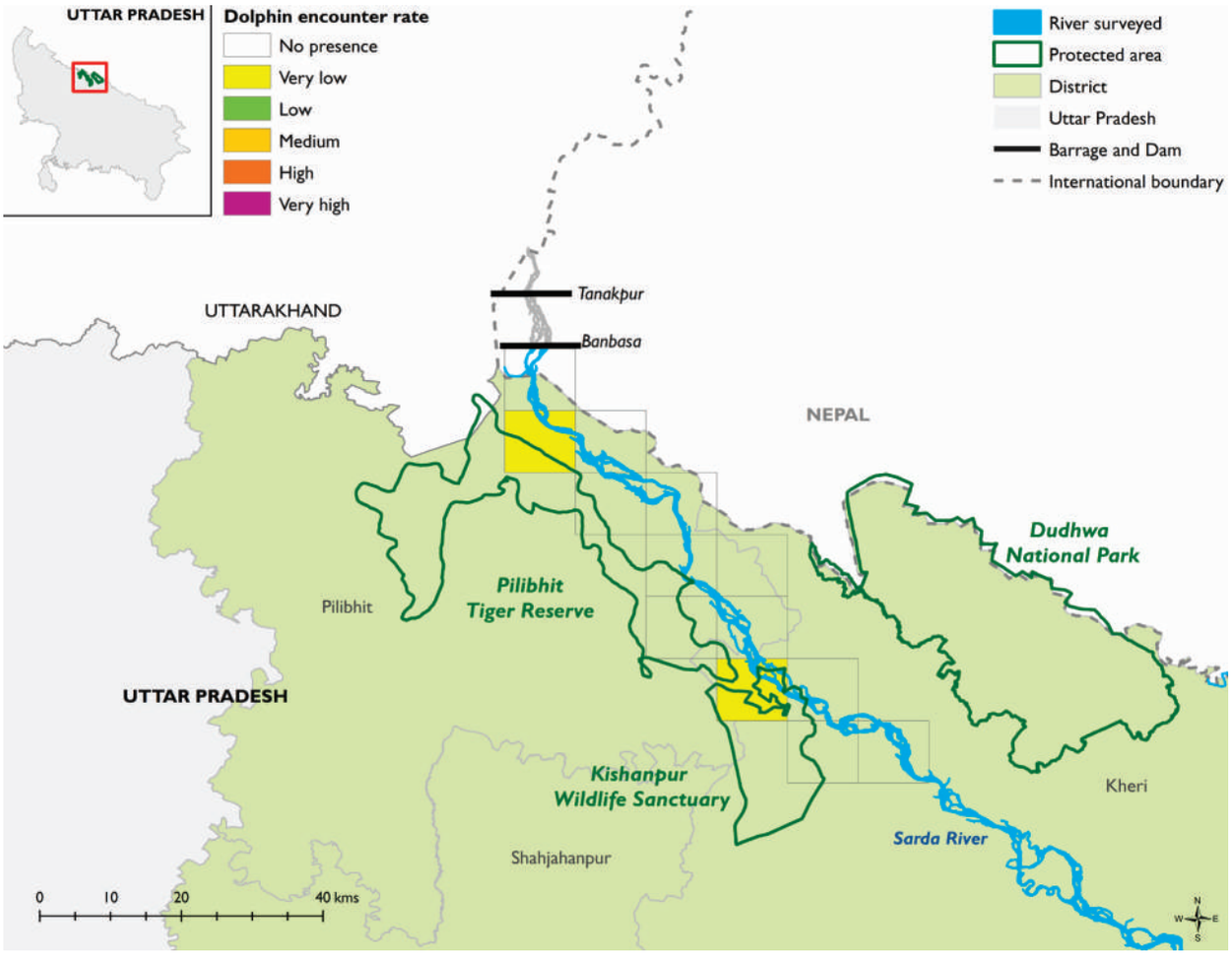
dran *et al.*, 2018). The water bodies in the park also support a wide variety of wildlife, including turtles, crocodiles, and Ganges River Dolphins (Areendran *et al.*, 2018). Wetlands comprise a third of the major habitat with marshes, rivers, lakes, and streams that are either perennial or dry up during the summer months and fill up after the monsoons (Areendran *et al.*, 2018).

Based on surveys conducted during March-April (summer season) and July-August (monsoon season) of 1989-1993, it was estimated that the Suheli and Mohana tributaries of the Sharda River supported approximately 10 dolphins during the monsoon season, and these animals moved into the Sharda during the dry season (Reeves et al., 2000). It was also estimated that the segment of the Sharda River within the Dudhwa Tiger Reserve, approximately 80 Km in length, supported 10-20 dolphins during both monsoon and summer seasons.



FIGURE 11.4

Encounter rate of Ganges River Dolphin in Pilibhit Tiger Reserve, Kishanpur Wildlife Sanctuary and Dudhwa National Park.



11.2 Bihar

11.2.1 Vikramshila Gangetic Dolphin Sanctuary

The Vikramshila Gangetic Dolphin Sanctuary is located in the Bhagalpur district and is a riverine-protected area in the River Ganga. It was established in August 1991 exclusively for the conservation of the Ganges River Dolphin. It stretches for around 60-70 Km, beginning in Sultanganj and ending in Kahalgaon. The water depth in the sanctuary ranges from 0.2 to 40 m, and the usual width of the main channel is 150 m to 3 Km, though it can spread to 5 or 6 Km during the monsoon season (Choudhary *et al.*, 2006). This stretch also receives water from the Burhi Gandak River, which meets the Ganga just 20 Km upstream of Sultanganj at Munger (the upstream boundary of the Vikramshila Gangetic Dolphin Sanctuary).

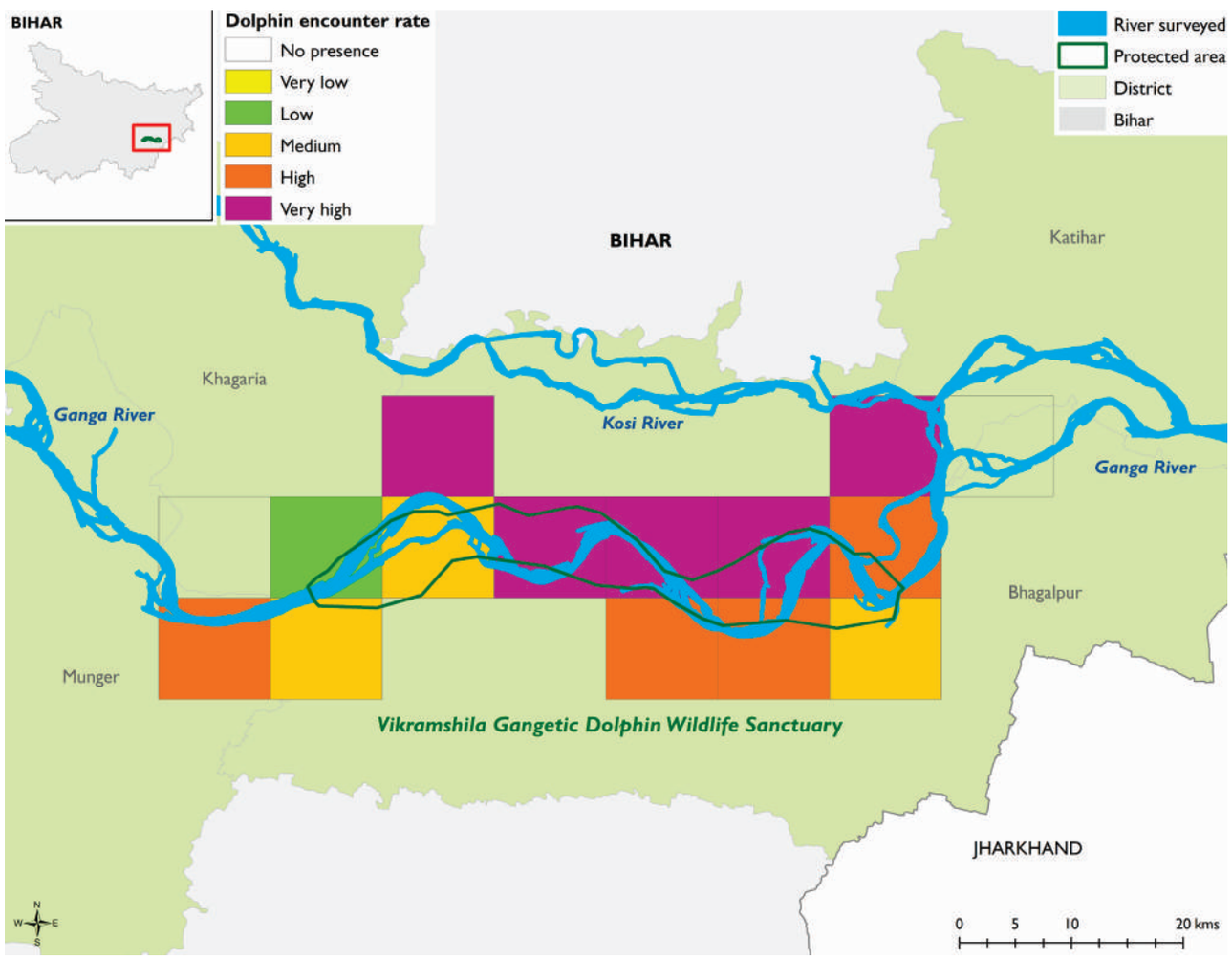
The sanctuary is critical in protecting the habitat of Ganges River Dolphins and other associated fauna. During the low-water seasons of 1996 and 1998, boat-based visual surveys were done to estimate the dolphin population within the Sanctuary, and a minimum of 92 and 81 dolphins were counted, respectively (Sinha et al., *2000)*. From 2001 to 2003, eight boat-based visual dolphin surveys were done, yielding a mean number of 119 dolphins (the highest count of 174 dolphins) with an encounter rate of 1.8/Km (Choudhary *et al.*, 2006). In March and April, the surveys yielded a total of 180 and 270 dolphins respectively (Kelkar, 2008). The sanctuary not only provides a haven for Ganges River Dolphins, but also for a variety of fish, turtles, and aquatic bird species. Other threatened aquatic fauna found in

the sanctuary include the Indian Smooth-coated Otter, Gharial, numerous freshwater turtle species, and 135 water bird species (Choudhary *et al.*, 2006). Additionally, the sanctuary serves as a crucial breeding ground for numerous riverine bird species, such as the Endangered Black-bellied Tern and Indian Skimmer, the Vulnerable River Tern, the Near Threatened River Lapwing, and the Great Thick-knee. These birds reproduce largely on exposed sandbars along numerous big, sandy, and slow-flowing lowland rivers (WII-GACMC, 2017). The Vikramshila Gangetic Dolphin Sanctuary has also become one of the most important refuges for the highly endangered Greater Adjutant (Choudhary *et al.*, 2006).

In our survey, in a stretch of 105 Km, we have estimated 325 (310-340) dolphins, with an encounter rate of 3.1/Km and least count of 267 dolphins (Figure 11.5, Table 11.1). The Greater Adjutant was recorded only from the Vikramshila Gangetic Dolphin Sanctuary in the mainstream Ganga in Bihar. Other than that, we recorded 54 bird species and one mammal. Out of these were the Endangered Greater Adjutant (n=14), the Vulnerable River Tern (n=2) and Lesser Adjutant (n=26), the Near Threatened, Black-necked Stork (n=10), Black-headed Ibis (n=283), Painted Stork (n=26), River Lapwing (n=49) and Asian Woolly-necked Stork (n=66).

FIGURE 11.5

Encounter rate of Ganges River Dolphin in Vikramshila Gangetic Dolphin Sanctuary.





11.2.2 Valmiki Tiger Reserve and Sohagibarwa Wildlife Sanctuary

Our study found a Ganges River Dolphin population of 88 (79-97) with a least count of 68 dolphins in a 72 Km stretch of the Gandak River passing through Valmiki Tiger Reserve and Sohagibarwa Wildlife Sanctuary. The encounter rate was 1.2/Km (Figure 11.6, Table 11.1). For associated fauna, we recorded 33 birds, four reptiles, and two mammals. Recorded were the Near Threatened Eurasian Curlew (n=4), Oriental Darter (n=1), Painted Stork (n=1), and the Asian Woolly-necked Stork (n=17). In reptiles, we found the Critically Endangered Gharial (n=12), Vulnerable Mugger (n=8), and the Near Threatened Brown Roofed Turtle (n=33).

11.2.2.1 Valmiki Tiger Reserve

Valmiki Tiger Reserve is located in the West Champaran district of Bihar and is the only tiger reserve in Bihar. It was initially declared as a Wildlife Sanctuary in 1978 and subsequently declared as a Tiger reserve in 1990 (Chakraborty *et al.*, 1998). Valmiki Tiger Reserve is located in the Terai arc landscape which is considered one of the important tiger habitats. It covers an area of 901 Km^2 and its northern boundary is shared with Chitwan National Park of Nepal (Jhala *et al.*, 2020). Around 40 Km stretch of Gandak River (known as Narayani River in Nepal) downstream of Valmiki Nagar Barrage flows along this tiger reserve and forms its western boundary. The Sohagibarwa Wildlife Sanctuary is located on the western side of Valmiki Tiger Reserve and the right bank of the Gandak River in Uttar Pradesh. The water in the Gandak River is regulated by the Valmiki Nagar Barrage. The average depth and width of 1.93±0.88 m and 256±102 m respectively are reported in the 50 Km stretch that passes along both Valmiki Tiger Reserve and Sohagibarwa Wildlife Sanctuary between Valmiki Nagar Barrage and Paniahwa. Between this river stretch, the river substrate comprises sand and boulders and both banks are covered with patches of forests and grasslands (WTI, 2020).

The topography of Valmiki Tiger Reserve is characterized by rocky hills and valleys drained by numerous rivers and streams which gradually merge with flat alluvial plains in the south. The annual rainfall received is around 1106 mm. Valmiki Tiger Reserve represents one of the last patches of forest having terai-bhabhar vegetation. The vegetation types comprise of Bhabar Dun Sal forest, dry Siwalik Sal forest, west gangetic moist mixed deciduous forest, khair-sissoo forest, cane brakes, eastern wet alluvial grassland and barringtonia swamp forest. Most of the grassland patches are found in and around rivers and

streams (Maurya & Borah, 2013).

Chakraborty *et al.*, (1998) have reported 53 species of mammals, 145 species of birds, 26 species of reptiles, 7 species of amphibians, and 13 species of fishes from Valmiki Tiger Reserve. Choudhury (2016) mentioned about the occurrence of 246 species of birds and suggested the presence of more than 300 species of birds in this reserve. Threatened birds like Lesser Adjutant, Swamp Francolin, Sarus Crane, etc. have been reported from this reserve. Due to the diversity and presence of threatened species of birds, Valmiki Tiger Reserve is also listed as an important bird and biodiversity area (Rahmani *et al.*, 2016). Among reptiles, Critically Endangered Gharial and Vulnerable Mugger are also reported from the Gandak River flowing along Valmiki Tiger Reserve. Bihar Forest Department and WTI released 30 captive-raised Gharials from Patna Zoo into the Gandak River in Valmiki Tiger Reserve in 2014-15 to enhance their population in this river. In a survey conducted along Gandak River in 2020, 53 Gharials (1 sub-adult, 10 juveniles, and 42 yearlings) were recorded in a 50 Km river stretch along Valmiki Tiger Reserve (WTI, 2020). Mammals like the Bengal Tiger, Fishing Cat, Dhole, Hog Deer, Gaur, Ganges River Dolphin, etc. are found in Valmiki Tiger Reserve.

In a survey of Gandak River conducted in 2010, 17 river dolphins were reported from the 47 Km stretch of river flowing along Valmiki Tiger Reserve downstream of Valmiki Barrage (Choudhary, 2010). During a survey conducted in 2017, 9-10 dolphins were reported in a 50 Km stretch of Gandak River flowing along Valmiki Tiger Reserve between Valmikinagar to Paniahwa (WTI, 2017).

Since 2010, regular surveys for riverine species such as the Gharial and Ganges River Dolphin have been conducted.

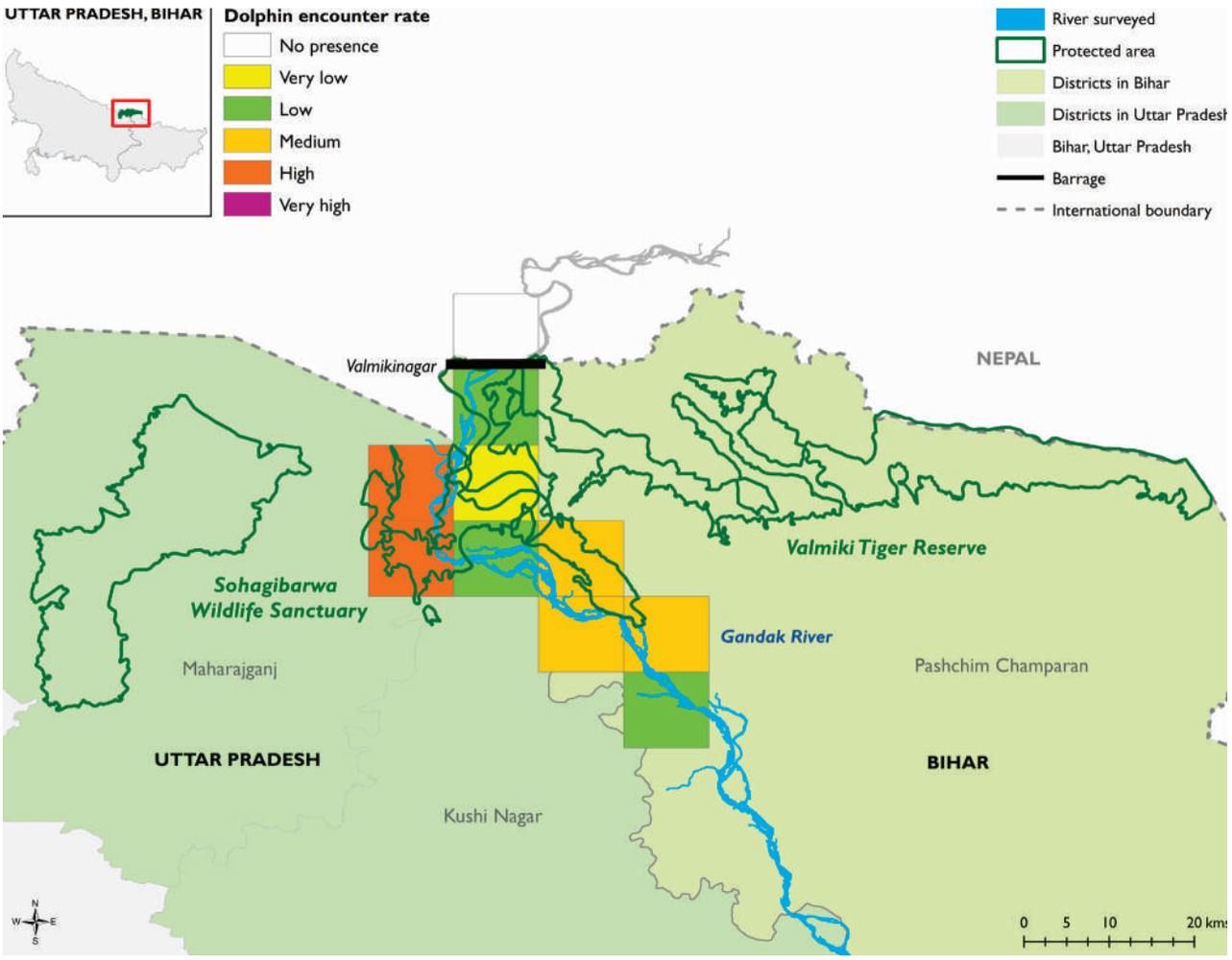
11.2.2.2 Sohagibarwa Wildlife Sanctuary

Sohagibarwa Wildlife Sanctuary is located in the Maharajganj and Kushinagar districts in Uttar Pradesh and is part of the Terai arc landscape. This sanctuary was declared in 1987 and covers an area of 428 Km^2. The India-Nepal border lies towards the north of this sanctuary and the eastern part of this sanctuary borders Valmiki Tiger Reserve in Bihar (Jhala *et al.*, 2020). The Gandak River passes along the eastern boundary of this sanctuary for around 8 Km downstream of the Valmiki Nagar Barrage (Sinha *et al.*, 2020). This sanctuary receives annual rainfall of around 1500 mm (Rahmani *et al.*, 2016). The vegetation of this sanctuary comprises tropical moist deciduous forest dominated by Sal. The forest also has various patches of grasslands which are characterized by seasonal flooding and waterlogging (Jhala *et al.*, 2020).

This sanctuary is also identified as an important bird and biodiversity area as per the A1 criteria of identifying IBA due to the presence of threatened and near threatened species of birds (Islam & Rahmani, 2004). Around 200 species of birds have been reported from this sanctuary including the Endangered Egyptian Vulture, Vulnerable Sarus Crane, Lesser Adjutant, Asian Woolly-necked Stork, and Greater Spotted Eagle. In 2014, 60-65 Sarus Cranes were estimated to be present in the wetlands of this sanctuary. The grasslands of this sanctuary are also considered suitable for Bengal florican, but there are no recent sightings (Rahmani *et al.*, 2016). Reptiles like Critically Endangered Gharial, Vulnerable Mugger, and Near Threatened Brown Roofed Turtles are reported from the Gandak River flowing along the border of this sanctuary (Choudhary, 2010; WTI, 2020). Mammals reported from this sanctuary include the Bengal Tiger, Leopard, Hog Deer, Chital, Jungle Cat, etc. (Jhala *et al.*, 2020). Fishes like rohu, saur, singhi, and barari are also reported.

FIGURE 11.6

Encounter rate of Ganges River Dolphin in Valmiki Tiger Reserve and Sohagibarwa Wildlife Sanctuary.



11.3 Assam

11.3.1 Dibru Saikhowa National Park

The Dibru Saikhowa National Park, surrounded by the Siang River in the north, Brahmaputra in the west, Dibang River in the northeast, and Lohit, Dangori, and Dibru River in the south, is an island formed at the confluence of Siang and Lohit River with an area of 340 km^2, which is the core part of the larger area (765 km^2) of Dibru Saikhowa Biosphere Reserve.

The area is characterized by its extensive riverine and wetland ecosystems, making it an exceptional representative of river biodiversity. The ecosystem of Dibru Saikhowa exhibits the presence of numerous perennial and seasonal channels. Multiple oxbow lakes and wetlands are interspersed within the park (Choudhury, 2006). Many water channels and waterbodies are also formed due to seasonal flooding in the area. The park's complex network of rivers, lakes, marshes, grasslands, and swamps provides diverse habitats and supports a wide range of plant and animal species adapted to these unique environments including several species of fishes, amphibians, reptiles, and birds. The park is an important bird area (IBA), and a home to over 500 species of birds including winter migrants. It is known as a major habitat for the globally threatened White-winged Duck, Black-breasted Parrotbill, and Marsh Babbler (Nongmaithem *et. al.*, 2016). Nongmaithem *et al.*, 2016 also recorded 42 species of reptiles, 17 species of amphibians, and 104 species of fish from Dibru Saikhowa Biosphere Reserve which highlights the ecological importance of the aquatic environment in and around the park area.

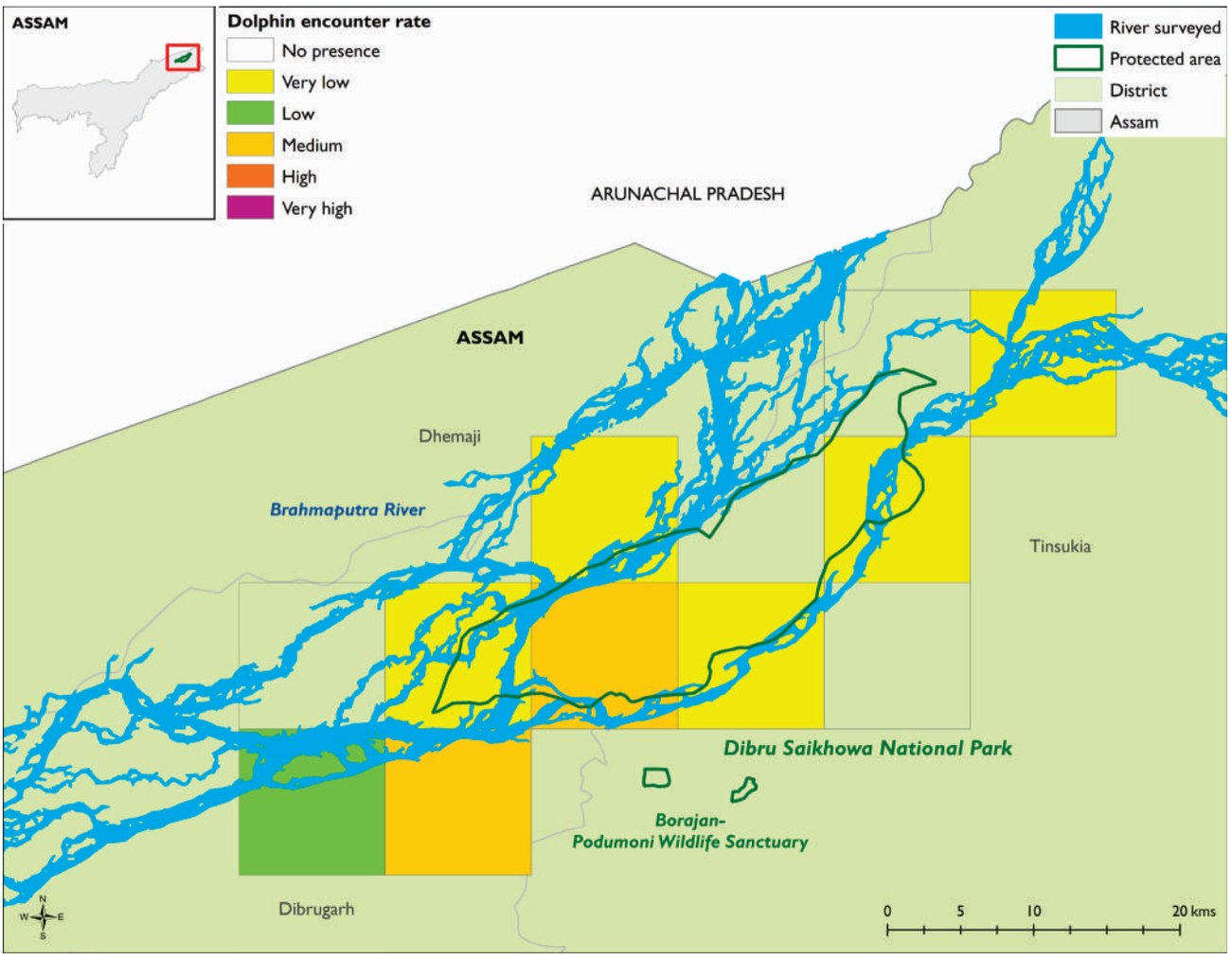
The riverine system of Dibru Saikhowa National Park supports the Endangered Ganges River Dolphin. Surveys conducted by the Wildlife Institute of India, in 2020 have reported 28 Ganges River Dolphins in the river stretch surrounding this park (Qureshi *et al.*, 2020; Qureshi *et al.*, 2021). The Dibru River on the park's southern edge also acts as a home for this endangered species, with a record of 5 dolphins in a 4 Km stretch of the river (Qureshi *et al.,* 2020). During the Baghjan blowout, the Wildlife Institute of India (WII) conducted two surveys in the Lohit-Dibru River (Qureshi *et al.,* 2020). The first survey took place in May 2020 after the oil spill and before the oil well explosion, and the second survey was carried out in June 2020. In the June 2020 survey, a significantly lower encounter rate (0.48/10 Km stretch) was estimated in the Lohit River (from Dr. Bhupen Hazarika Setu to Siang-Lohit confluence at Balijan), indicating an 89% reduction in dolphin habitat utilization compared to the early dolphin estimate of the same area during the Baghjan blowout (Qureshi *et al.*, 2020).

The Ganges River Dolphin population inside the Dibru Saikhowa National Park within 105 Km was found to be 42 (40-44), with an encounter rate of 0.4/Km and least count of 36 dolphins (Figure 11.7, Table 11.1). During the survey, we recorded 54 birds, of which were the Critically Endangered Slender-billed Vulture (n=2) and White-rumped Vulture (n=1), the Endangered Black-bellied Tern (n=4), the Vulnerable Common Pochard (n=2) and River Tern (n=6), and the Near Threatened Falcated Duck (n=2), Ferruginous Pochard (n=10), Northern Lapwing (n=2), Oriental Darter (n=13), River Lapwing (n=1) and Spot-billed Pelican (n=11).



FIGURE 11.7

Encounter rate of Ganges River Dolphin in Dibru Saikhowa National Park.



11.3.2 Kaziranga Tiger Reserve and Laokhowa Wildlife Sanctuary

A total of 153 Km was covered within the Kaziranga Tiger Reserve and its buffer Laokhowa Wildlife Sanctuary. The total Ganges River Dolphin population for this stretch was 174 (163-185) with an encounter rate of 1.1/Km and a least count of 139 dolphins (Figure 11.8, Table 11.1). Other than dolphins, we also recorded 48 birds, six mammals, and two reptiles. Among birds were the Critically Endangered Slender-billed Vulture (n=1), the Endangered Pallas's Fish-Eagle (n=8), the Vulnerable Lesser Adjutant (n=1) and Swamp Francolin (n=1), the Near Threatened Black-necked Stork (n=11), Great Thick-knee (n=10), Grey-headed Fish-Eagle (n=4), Northern Lapwing (n=41), Oriental Darter (n=31), River Lapwing (n=1), Spotted-billed Pelican (n=34) and Asian Woolly-necked Stork (n=8). In reptiles, we found the Critically Endangered Assam Roofed Turtle (n=1), and in mammals were the Endangered Asian Elephant (n=12), Hog Deer (n=14), Wild Water Buffalo (n=74), the Vulnerable Smooth-coated Otter (n=5) and Greater One-horned Rhinoceros (n=1).

11.3.2.1 Kaziranga Tiger Reserve

The Kaziranga Tiger Reserve, covering an area of 1055 Km^2 in Assam, is situated along the floodplains of the Brahmaputra River. Renowned for its high conservation value and rich biodiversity, this reserve has made significant contributions to Tiger and One-horned Rhinoceros conservation. It was officially designated as a Tiger Reserve in 2006 and has also earned the status of a UNESCO World Heritage Site

due to its unique ecosystem and diverse wildlife.

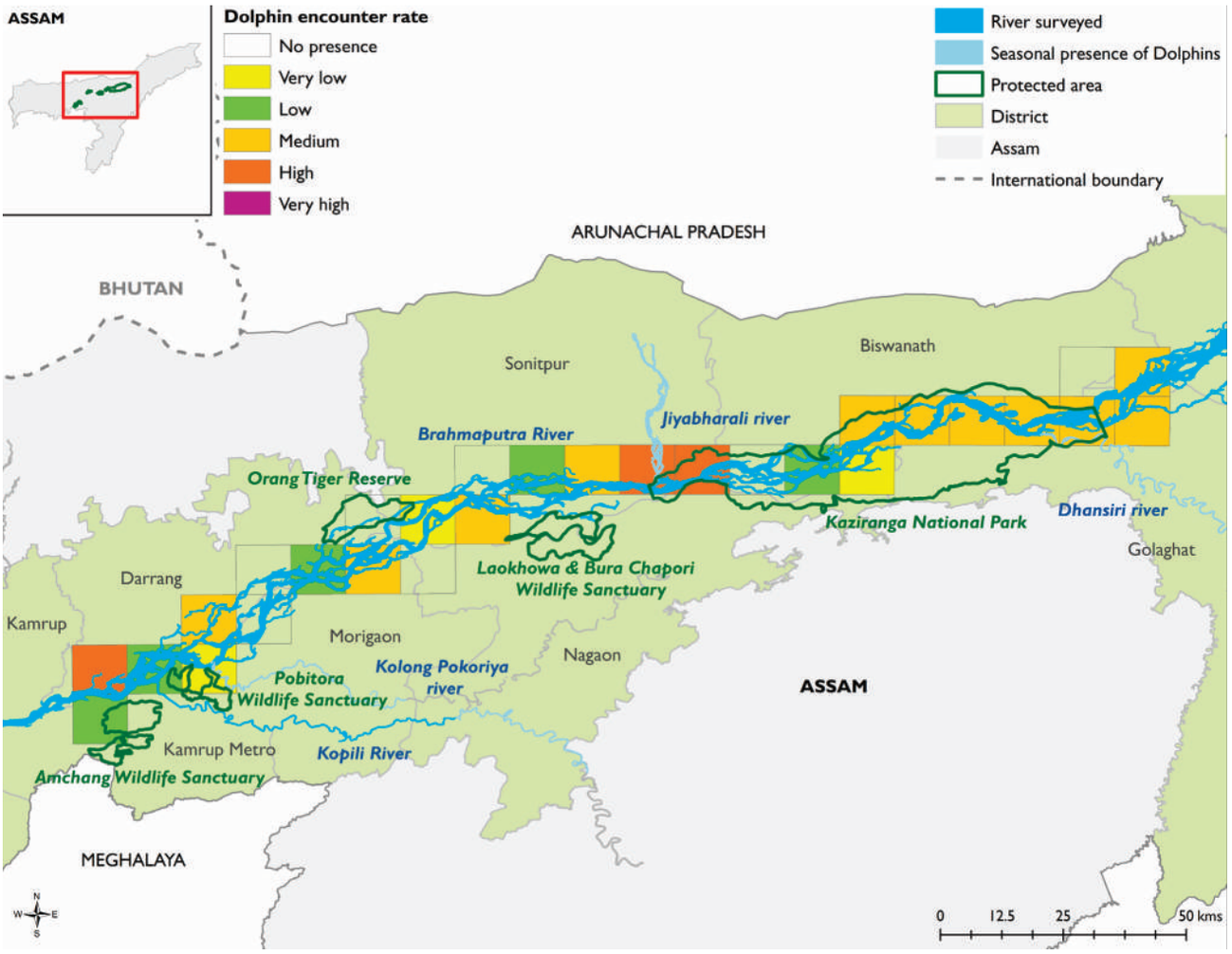
The Kaziranga Tiger Reserve encompasses a wide range of habitats, including tall grasslands, marshes, wetlands, and tropical moist forests. This mosaic of ecosystems provides a conducive environment for numerous plant and animal species to thrive. Notably, the reserve is home to charismatic and threatened species such as the Indian Rhinoceros, Asian Elephant, and Swamp Deer (Sharma, 2018). In addition to its terrestrial ecosystem, the Kaziranga Tiger Reserve plays a vital role in the conservation of river biodiversity. The reserve's riverine habitats, influenced by the Brahmaputra River and its tributaries, serve as crucial ecological niches for various aquatic species. These habitats include different river channels, floodplains, wetlands, and riparian vegetation, all of which contribute to the overall biodiversity of the reserve.

One of the flagship species in this aquatic ecosystem is the Endangered Ganges River Dolphin, which finds a safe refuge within the reserve. The presence of the Ganges River Dolphin signifies the conservation significance of the reserve's riverine habitats. Tributaries of Brahmaputra like Dhansiri and Jiabharali confluences with the mainstream in this particular stretch, which creates one of the most critical and preferred habitats for this endangered species. The park is home to a stable population of Ganges River Dolphins and is considered a hotspot in the state (Qureshi *et al.*, 2018 & 2019). The reserve also supports numerous other ecologically significant aquatic fauna, including various species of fishes, turtles, otters, amphibians, and reptiles. Two species of otters, the Smooth-coated Otter and the Eurasian Otter are reported to be present in the rivers and wetlands of the protected area (Sharma, 2018). Ahmed and Das (2009) reported a total of 17 species of turtles and tortoises from the area which includes IUCN-threatened category species like Black Softshell Turtle, Narrow-headed soft-shelled Turtle, and Assam Roofed Turtle. 35 species of fish were recorded from a 92.5 Km stretch of Brahmaputra River traversing through the Kaziranga National Park area (Qureshi *et al.*, 2019).

The population estimate of Ganges River Dolphins in the 130 Km stretch of Brahmaputra River that flows through the park was 143 (133-153), with an encounter rate of 1.1/Km and a least count of 114 dolphins (Figure 11.8, Table 11.1.8). This stretch of the Kaziranga River also has a greater calf-to-adult ratio, with a calf encounter rate of 1.32/Km when compared to the other sectors of the river (Qureshi *et al.*, 2018), indicating that it may be operating as a source population. We also recorded 47 birds, four mammals, and two reptiles. Among birds were the Critically Endangered Slender-billed Vulture (n=1), the Endangered Pallas's Fish-Eagle (n=8), the Vulnerable Lesser Adjutant (n=1) and Swamp Francolin (n=1), the Near Threatened Black-necked Stork (n=11), Great Thick-knee (n=10), Grey-headed Fish-Eagle (n=4), Northern Lapwing (n=41), Oriental Darter (n=30), River Lapwing (n=1), Spotted-billed Pelican (n=34) and Asian Woolly-necked Stork (n=8). In reptiles, we found the Critically Endangered Assam Roofed Turtle (n=1), and in mammals were the Endangered Asian Elephant (n=12), Hog Deer (n=14), Wild Water Buffalo (n=74), and Greater One-horned Rhinoceros (n=1).

FIGURE 11.8

Encounter rate of Ganges River Dolphin in Kaziranga Tiger Reserve, Orang Tiger Reserve, Pobitora and Laokhowa Wildlife Sanctuaries.





11.3.2.2 Laokhowa Wildlife Sanctuary

The Laokhowa and Burhachapori Wildlife Sanctuaries are two significant protected areas in Central Assam (Ojah *et al*., 2012). Laokhowa Wildlife Sanctuary has a total size of 71.1 Km^2 in the Nagaon district of Central Assam, whereas Burhachapori Wildlife Sanctuary has a total area of 44.06 Km^2 in the Sonitpur district (Ojah, 2014; Yadava, 2014). The two reserves are located between the Kaziranga National Park to the east and the Orang National Park to the west. Both Laokhowa and Burhachapori were designated as buffer areas of the Kaziranga Tiger Reserve in 2007. These protected areas are linked by the Brahmaputra River and its numerous islands, known locally as chars (Bhagabati & Lahkar, 1998). This riverine area serves as an important wildlife migration route, where tigers and rhinos have been documented to use the corridor, along with the Laokhowa-Burhachapori area, for migration between the National Parks (Ojah e*t al*., 2011).

The Laokhowa-Burhachapori landscape is a floodplain area on the Brahmaputra's bank with a unique mix of grasslands, woods, marshes, and various types of riparian forests. It is subject to the subtropical monsoon climatic regime. Most low-lying areas are vulnerable to monsoon-induced floods, which inundate 50 to 70% of the total land mass each year (Ojah *et al*., 2012; Phukan & Sharma 2003).

The protected areas are home to large mammals like Asiatic Wild Buffaloes, tigers, and elephants. Besides, the alluvial grasslands also sustain a large number of herbivores like Sambar, Northern Red Muntjac, and Hog Deer, along with many rare and endangered species of small cats, reptiles, turtles, butterflies, and nocturnal species like Binturong and Slow Loris. The perennial and seasonal wetlands function as breeding grounds for numerous local fish species and important bird species. A large number of migratory birds, including waterfowls, visit the rich wetlands of these two protected areas every winter. About 290 bird species have been documented within Laokhowa and Burhachapori complex (NWLD-LBCS, 2014), including the Critically Endangered Bengal Florican (Birdlife International, 2015). Ganges River Dolphin is a common sight in the Brahmaputra River stretch flowing through and adjacent to Burhachapori Wildlife Sanctuary (Bora, 2003; Ojah *et al*., 2012).

During this survey, the estimate for the Ganges River Dolphin was 30 (27-33), with an encounter rate of 1.3/Km, and least count of 25 dolphins in a stretch of 23 Km of Brahmaputra inside Laokhowa Wildlife Sanctuary (Figure 11.8, Table 11.1). We also recorded 16 birds and one mammal. Among the species of conservation concern were the Near Threatened Oriental Darter (n=1) and the Vulnerable Smooth-coated Otter (n=5).

11.3.3 Pobitora Wildlife Sanctuary

The Pobitora Wildlife Sanctuary is a protected area in the Brahmaputra and South Bank floodplains. Located in the Morigaon district of Assam, it has an area of 38.81 km^2. Along its northern boundary, the Brahmaputra is a prevailing landmark along with the North Mayang hills (Borah & Prasad 2016).

Northern damp mixed deciduous forest (Burha Mayong hillock), Eastern west alluvial grassland, Barringtonia swamp forest, low alluvial swamp (Albizia saman), and woodland are the four distinguished forest types found in the Wildlife Sanctuary (Borah & Prasad 2016). Pobitora Wildlife Sanctuary has high biodiversity that is important for conservation. It is the home of the One-horned Rhinoceros, harbouring the second biggest population after Kaziranga National Park. Leopards, Wild Boar, Barking Deer, Wild Buffalo, and different reptiles are other important species found in the protected area (Borah & Prasad 2016). Several water bodies known as 'beels' (for example, Garanga Beel and Haduk Beel) serve as breeding habitats for various fish species. This wildlife refuge attracts about 2000 migrating birds (Borah & Prasad 2016). The rivers Brahmaputra and Kolong flood the whole Pobitora Wildlife Sanctuary region, filling beels and marshes. Before 1971, the land was not inhabited by any significant wildlife, so the area was regarded as a 'grazing reserve' for domestic cattle. During 1961-62, the Nagaon Forest Division recorded the presence of a few One-horned Rhinoceros. With the locals' active participation and support, the Indian Government upgraded Pobitora to a 'Reserved Forest', and finally, in 1987, Pobitora Wildlife Sanctuary came into existence. At this time, it was a meager area of 16 km^2 (Konwar *et al*., 2009), but by 1998, the area was expanded up to 38.8 km^2 (Choudhury, 2005).

During the Rangewide River Dolphin Estimation survey, the Pobitora Wildlife Sanctuary and Amchang Wildlife Sanctuary river sections totaled 93 Km, and the Ganges River Dolphin population estimate was 30 (28-32), with an encounter rate of 0.3/Km and a minimum count of 26 dolphins (Figure 11.8, Table 11.1). We also recorded 74 birds and one mammal. Among the birds recorded were the Endangered Greater Adjutant (n=3), Pallas's Fish Eagle (n=1), Steppe Eagle (n=2), the Vulnerable Common Pochard (n=2), Lesser Adjutant (n=1), the Near Threatened Alexandrine Parakeet (n=1), Black-headed Ibis (n=2), Oriental Darter (n=7) and River Lapwing (n=2) (Figure 11.8).



11.3.4 Orang Tiger Reserve

The Orang National Park, which covers an area of 78.80 Km^2, is located on the north bank of the Brahmaputra River in the Assam districts of Darrang and Sonitpur (Borthakur *et al.*, 2011). The forest was recognised as a Wildlife Sanctuary in 1985 and then as a National Park in 1999. Three rivers, Panchnoi, Belsiri, and Dhansiri, border the park and join the Brahmaputra in the south (Borthakur *et al.*, 2011). During the monsoon season, the park becomes a veritable flood plain with many streams overlapping each other, forming an integral part of this Indo-Burma biodiversity hotspot. The topography of Orang is classified by the following types of terrains: eastern Himalayan moist deciduous forest, eastern seasonal swamp forest, eastern wet alluvial grasslands, savannah grassland, degraded grassland, water bodies, moist sandy area, and dry sandy area. It has a fairly flat terrain tending north to south with a gentle slope. The whole park is encircled by inhabited villages thus subjecting it to biotic and anthropogenic pressure.

Orang is well-known for its stronghold Indian One-horned Rhino and Bengal Tiger populations on the northern bank of the Brahmaputra River. Apart from this, the park contains significant breeding populations of several mammalian species which include Asiatic Elephant, Pygmy Hog, Hog Deer Wild Boar, and Ganges River Dolphin. Orang is one of the few habitats of the Critically Endangered Pygmy Hog. The population was re-introduced in 2011-2015 from the captive-bred population taken from Manas National Park. About 222 species of birds reside in Orang National Park, which includes the Critically Endangered Bengal Florican. Thus, the park is listed as one of BirdLife International's (2016) "Important Bird and Biodiversity Areas" (IBAs).

In our survey, the total estimate of Ganges River Dolphins was 24 (22-26), across the 46 Km river stretch, with an encounter rate of 0.5/Km, with a least count of 21 dolphins (Figure 11.8, Table 11.1). In this stretch, only 24 bird species were recorded, of which were the Vulnerable Common Pochard (n=6), Near Threatened Ferruginous Pochard (n=1), and Oriental Darter (n=5).

11.4 Rajasthan, Madhya Pradesh and Uttar Pradesh

11.4.1 National Chambal Sanctuary

Chambal River was declared as a Protected area in 1978, known as National Chambal Sanctuary, with an area of 5400 Km^2. This is the first and only tri-state (Madhya Pradesh, Rajasthan, and Uttar Pradesh) managed Protected Area in India. Around 600 Km of the river stretch, between Jawahar Sagar Dam and Pachnada, along with a stretch of 2-6 Km wide ravines on both banks are part of the sanctuary. The basin's climate is impacted by its proximity to the Tropic of Cancer and the presence of the Vindhya ranges in the upper reaches. The region is semiarid, with temperatures ranging from 2°C to 48°C in winter and summer, respectively. The Chambal River is 400 m wide and 1-26 m deep (Hussain & Choudhury, 1990). The riverbanks are stony in the upstream portions and muddy and sandy further downstream, with forest, shrubs, and grasses as major riparian vegetation (Singh, 2010; Taigor & Rao, 2010). The Chambal River is fed mostly by two large tributaries, the Parbati, and the Kali Sindh. It joins the Yamuna and three additional rivers, Sindh, Kuanri, and Pahuj, in Pachhnada before joining the Ganga mainstream at Prayagraj.

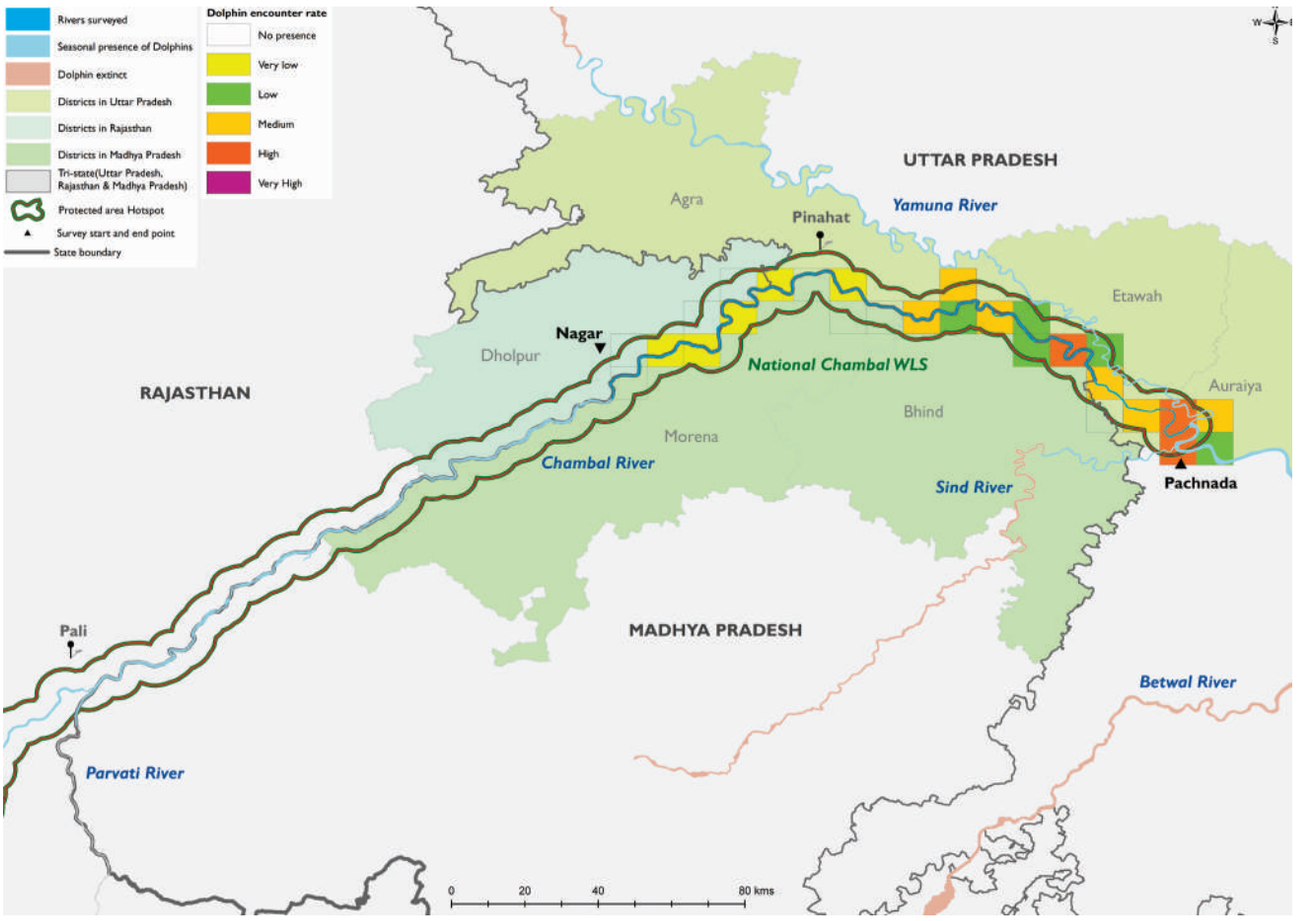
The Chambal River system is home to the world's biggest population of Critically Endangered Gharial, which is native to the Indian subcontinent, as well as Endangered Ganges River Dolphins. The most recent study has estimated 1545 Gharials in Chambal River which is about 80- 90% of the global population (Lang, 2021). The Chambal River sanctuary's significant fauna includes the Vulnerable Mugger Crocodile, seven freshwater turtle species, and 78 wetland bird species, including the Endangered Indian Skimmers (Singh, 2008). Singh and Rao (2012) recorded a total of about 91 and 66 dolphins in 2007 and 86 and 55 dolphins in 2008 in dry and wet seasons respectively. The mean encounter rates of dolphins were 0.21/Km±0.013 individuals/Km in the dry season and 0.15/Km±0.37 individuals/Km in the wet seasons of each year. In 2014-15 in 356 Km of Chambal Sanctuary, 90-120 dolphins were recorded (Behera *et al.*, 2014; WWF-UPFD 2015; Singh *et al.*, 2014) while Sharma and Singh (2014) reported counts of 59 and 66 dolphins in 2013 and 2014 respectively.

The current estimate in a stretch of 242 Km of the sanctuary was 298 (278-320) individuals with an encounter rate of 1.2/Km and least count of 243 dolphins (Figure 11.9, Table 11.1). Other than the Ganges River Dolphin, we have recorded various species of conservation concern from this river including the Endangered Indian Skimmer (n=202), Black-bellied Tern (n=23), the Critically Endangered Gharial (n=348), and the Vulnerable Mugger (n= 341).



FIGURE 11.9

Encounter rate of Ganges River Dolphin in National Chambal Sanctuary.



11.5 West Bengal

11.5.1 Sundarban Tiger Reserve and Sundarban Biosphere Reserve

Sundarbans is the largest contiguous estuarine mangrove forest formed at the mouth of the Ganga-Brahmaputra River system which spreads across India and Bangladesh covering an area of approximately 10,000 Km^2 of which 38% lies in India (Chaudhuri & Choudhury, 1994) and the rest 62% lies in Bangladesh (Khan, 2004; Barlow, 2009; Danda *et al*., 2011). The Indian Sundarbans, at the tip of the Bay of Bengal, is located on the southern fringe of the state of West Bengal, straddling a major portion of the North and South 24 Parganas districts. The region is bordered by Bangladesh in the east, the Hooghly River in the west, the Dampier and Hodges line in the north, and the Bay of Bengal in the south.

The saline intertidal hydrological system supports diverse plant and wildlife assemblages and economically significant fisheries. The name 'Sundarban' literally translates to "beautiful forest" and in all likelihood is named after the 'Sundari' trees found in these mangroves (Das, 2015). Sundarbans comprises about 55% forest land and 45% water spread area, in the forms of tidal rivers, creeks, canals, and vast estuarine mouths of the rivers Hooghly, Saptamukhi, Thakuran, Matla, Gosaba, and Harinbhanga (Herobhanga), as encountered from west to east (Naskar & Guha Bakshi, 1987). It is bound on the west by river Muriganga and on the east by rivers Harinbhanga and Raimangal. River Matla divides Sundarban Reserve Forest into Sundarban Tiger Reserve (STR) on the east and Sundarban Biosphere Reserve (SBR) on the west.

The Sundarbans mangroves are important with respect to species diversity, richness in mangrove flora and fauna, mangrove abundance, and unique succession features. The Sundarbans provide a 'home' for globally threatened species like tiger, Fishing Cat, Saltwater Crocodile, Horseshoe Crabs, Water Monitor, and river terrapins. Mangrove forests provide a large amount of fish catch (up to 80%), thereby supporting the livelihood and ensuring the food security of coastal people (Khan, 2013). Records for most faunal groups are partial and incomplete, with different estimates for species numbers.

Sundarbans is the only mangrove-Critical Tiger Habitat in the world. Jhala *et al*. (2015) documented that dolphin signs and sightings in Indian Sundarbans were in general lower, with higher presence recorded on the Bangladesh side, especially within the declared Protected areas for the species. Mitra & Chowdhury (2018), indicated a possible decline in the range of Ganges River Dolphin in the Indian Sundarbans, attributing the extirpation to the combined effect of elevated sedimentation, reduced freshwater discharge, and increasing salinity. On the other hand, there is continued occurrence of Irrawaddy dolphin in the Indian part of the estuary. Wakid *et al*. (2015) recorded the occurrence of Irrawaddy dolphins and Indo-Pacific Humpback Dolphins but no Ganges River Dolphins in the surveyed stretches of the Indian Sundarbans. The Indo-Pacific Finless Porpoise and Indo-Pacific Humpback Dolphin can be encountered rarely but there are no recent records of sighting any Pantropical Spotted Dolphin in the Sundarbans (Mallick, 2012).

The Ganges River Dolphin population was found only in the Sundarban Tiger Reserve. It was recorded in a 26 Km stretch of Chayakapura - Khatuajhuri River, where two dolphins were recorded (Figure 11.10). On the other hand, the overall population of Irrawaddy Dolphins in Sundarbans was found to be 108 (83-134), with an encounter rate of 0.07/Km. In Sundarban Biosphere Reserve, it was 14 (8-25) dolphins with a least count of 8 and an encounter rate of 0.02/Km. In Sundarban Tiger Reserve, it was 94 (75- 109) dolphins with a least count of 74 and an encounter rate of 0.1/Km (Figure 11.11, Table 11.1).

FIGURE 11.10

Encounter rate of Ganges River Dolphin in Sundarban Tiger Reserve.

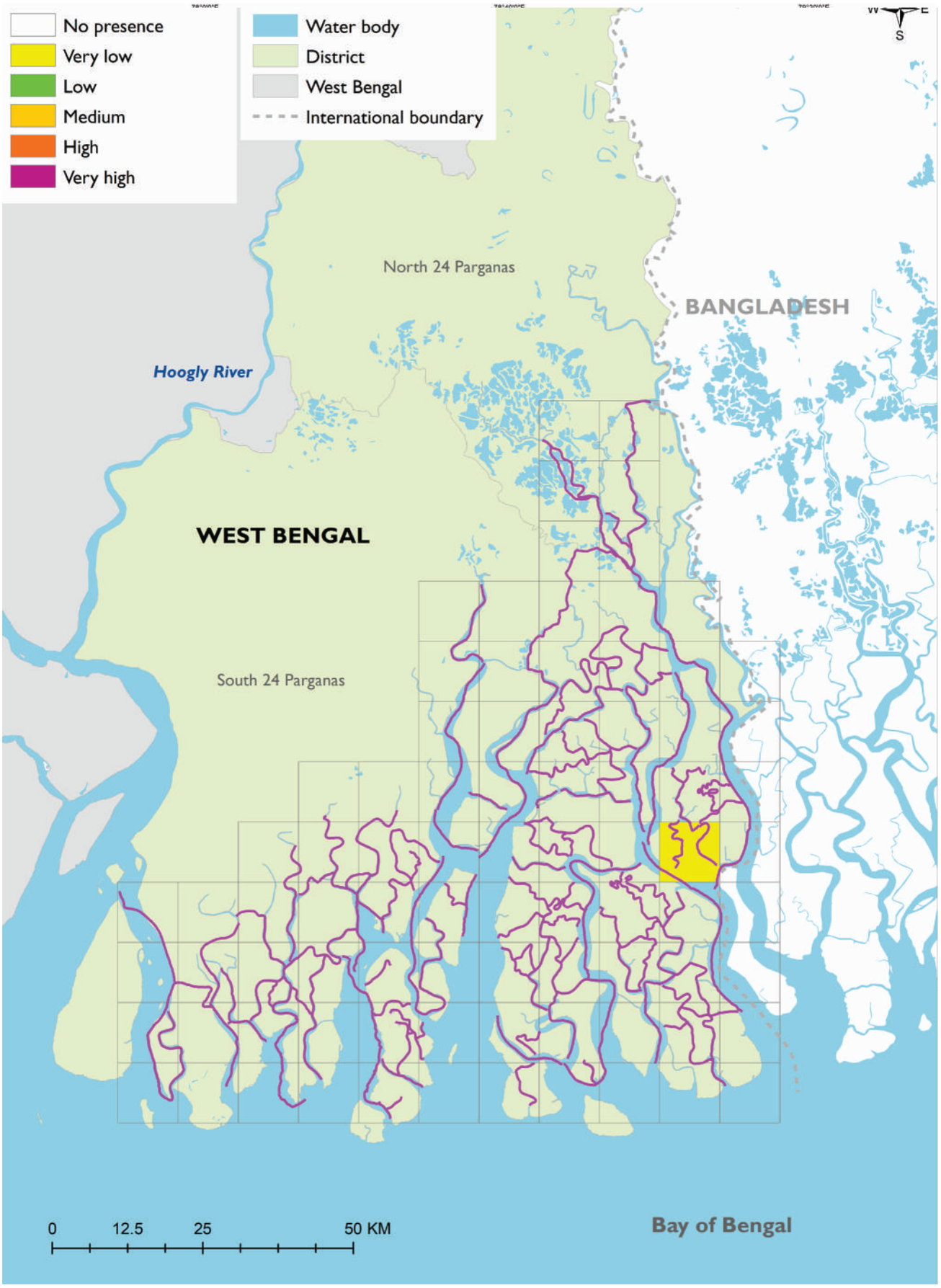
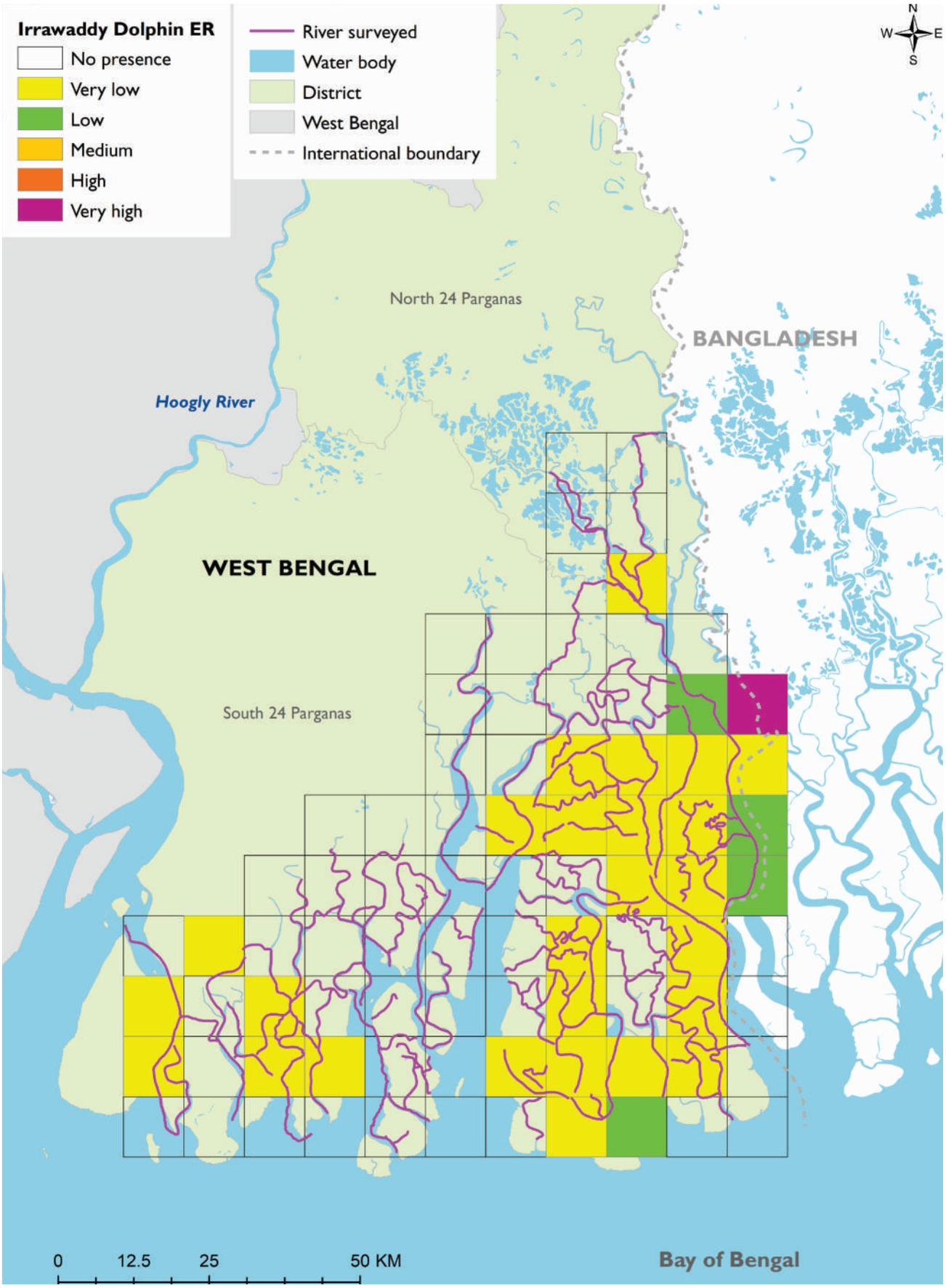


FIGURE 11.11

Encounter rate of Irrawaddy Dolphin in Sundarban Tiger Reserve and Sundarban Biosphere Reserve.



11.6 Punjab

11.6.1 Beas Conservation Reserve and Harike Wetlands

The Beas Conservation Reserve, spanning 185 Km along the Beas River, was established in 2017 to safeguard the river's ecosystem and promote conservation efforts (WWF-India, 2018). The Beas River is a vital habitat for over 500 bird species, attracting resident and migratory water birds during different seasons (Kumar & Kler, 2021). These birds rely on the diverse habitats provided by the river, including wetlands, marshes, and riverine forests. The river acts as a congregation ground, serving as a summer habitat for some species and a wintering site for others. The Beas River's designation as a Ramsar site in 2019 highlights its global significance as an essential wetland ecosystem (PCCF Punjab, 2020).

Besides its importance for bird conservation, the Beas River also supports a diverse assemblage of freshwater turtles. Species such as the Indian Flap-shelled Turtle, Ganges Soft-shelled Turtle, Narrow-headed Softshell Turtle, Crowned River Turtle, Spotted Pond Turtle, and Brown Roofed Turtle find their home in the river's waters (Kumar & Kler, 2021). These turtles contribute to the Beas Conservation Reserve's overall biodiversity and ecological balance. The conservation of the Beas River is not limited to avian and turtle species alone. Harike and the Beas Conservation Reserve support over 90 fish species (PCCF Punjab, 2020). These fish species play a crucial role in maintaining the river's ecological integrity and serve as an essential food source for various predators within the ecosystem.

The protection and conservation of the Beas River contribute to the overall health and sustainability of its aquatic fauna. In recent years, efforts have been made to reintroduce endangered species into the Beas Conservation Reserve. WWF-India and the Punjab Forest Department, recognizing the importance of conserving biodiversity, have reintroduced the Critically Endangered Gharial into the reserve (WWF-India, 2018). This initiative aims to enhance the Gharial population's long-term survival and restore the Beas River's ecological balance.

The population estimation survey was conducted from Shri Hargobind Sahib (Terkiana) to Harike in Punjab from 28th to 30th November 2021, covering a total of 101 Km. The Indus River Dolphin popu- lation estimate was 3, with an encounter rate of 0.03/Km (Figure 11.11, Table 11.1). Unfortunately, in March, 2024 an adult gravid female was found dead, bringing the current population estimate to 2 individuals.

For associated fauna, we recorded a total of 78 birds, six reptiles, and two mammals during the survey. Among these were the Vulnerable Common Pochard (n=25), River Tern (n=15), the Near Threatened Oriental Darter (n=28), the Black-headed Ibis (n=5), Great Thick-knee (n=38), Indian Spotted Eagle (n=6) and Asian Woolly-necked Stork (n=3). In reptiles, we found the Critically Endangered Gharial (n=16), the Endangered Ganges Soft-shelled Turtle (n=1), and the Near Threatened Brown Roofed Turtle (n=120).

FIGURE 11.12

Encounter rate of Indus River Dolphin in Beas Conservation Reserve and Harike Wetlands.

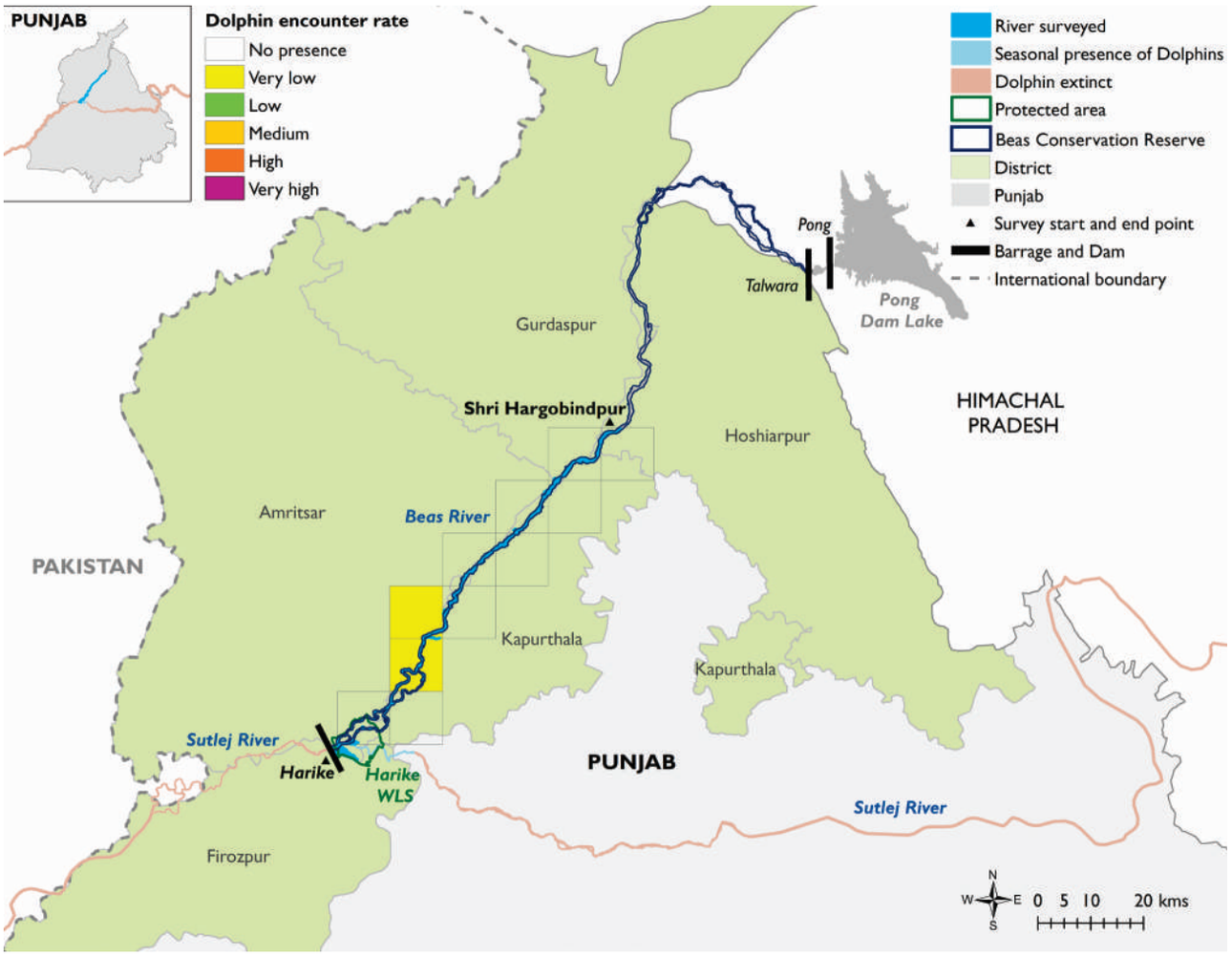




TABLE 11.1

River Dolphin population estimate in Protected Areas

State	Name of Protected Area	N_{OA}	ER_{OA}
Uttar Pradesh	Hastinapur Wildlife Sanctuary	67 (61-73)	0.6
Uttar Pradesh	Kachhua Wildlife Sanctuary	175 (166-184)	3.6
Uttar Pradesh	Katerniaghat Wildlife Sanctuary	72 (64-80)	0.8
Uttar Pradesh	Pilibhit Tiger Reserve, Kishanpur Wildlife Sanctuary and Dudhwa National Park	20 (12-30)	0.2
Bihar	Vikramshila Gangetic Dolphin Sanctuary	325 (310-340)	3.1
Bihar	Valmiki Tiger Reserve and Sohagibarwa Wildlife Sanctuary	88 (79-97)	1.2
Assam	Dibru Saikhowa National Park	42 (40-44)	0.4
Assam	Kaziranga Tiger Reserve	143 (133-153)	1.1
Assam	Laokhowa Wildlife Sanctuary	30 (27-33)	1.3
Assam	Pobitora Wildlife Sanctuary	30 (28-32)	0.3
Assam	Orang Tiger Reserve	24 (22-26)	0.5
Rajasthan, Madhya Pradesh, and Uttar Pradesh	National Chambal Sanctuary	298 (278-320)	1.3
Punjab	Beas Conservation Reserve and Harike Wetlands	3	0.03
West Bengal	Sundarban Tiger Reserve and Sundarban Biosphere Reserve	2	0.001
		1319 (1225-1417)	**0.5**

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APPENDICES

APPENDIX A
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APPENDIX B
ABBREVIATIONS

°C: degree Celsius

ACF: Assistant Conservator of Forests

AIC: Akaike's Information Criterion

asl: above sea level

A-tag: Acoustic tag

BRC: Braided Channel

BRCF: Braiding Confluence

BSF: Border Security Force

CAF: Central Asian Flyway

CAMPA: Compensatory Afforestation Fund Management and Planning Authority

CF: Confluence

CWC: Central Water Commission

DCF: Deputy Conservator of Forests

DFO: Divisional Forest Officer

DIG: Deputy Inspector General

DO: Dissolved Oxygen

EAAF: East Asian-Australasian Flyway

ER_{OA}: observer and availability corrected encounter rate (per Km).

ER_{O}: Observer corrected encounter rate (per Km)

GPS: Global Positioning System

Hrs: Hours

IBAs: Important Bird and Biodiversity Areas

IUCN/SSC: International Union for Conservation of Nature/ Species Survival Commission

IUCN: International Union for Conservation of Nature

IWAI: Inland Waterways Authority of India

Km/h: Kilometre per hour

Km: Kilometre

Km^2: Square Kilometre

M: Meander

m: Metre

MCI: Mid-Channel Island

mps: Number of animals observed by both teams (matches or recaptures)

$\hat{N}$: Population size estimate

NC: Narrow Channel

NMCG: National Mission for Clean Ganga

N_{O}: observer corrected population estimate

N_{OA}: observer and availability corrected population estimate

np: Number of animals sighted by primary observer team

ns: Number of animals sighted by secondary observer team

NTCA: National tiger conservation Authority

NW: National Waterway

Pa: Pascal

PCCF: Principal Chief Conservator of Forest

per Km: per Kilometre

PWD: Public Works Department

SBR: Sundarban Biosphere Reserve

SD: Standard Deviation

SE: Standard Error

SKFD: South Kheri Forest Division

SP: Stagnant Pool

STR: Sundarban Tiger Reserve

TAL: Terai Arc Landscape

TSA: Turtle Survival Alliance

UNESCO: United Nations Educational, Scientific and Cultural Organization

UPFD: Uttar Pradesh Forest Department

WC: Wide Channel

WII: Wildlife Institute of India

WTI: Wildlife Trust of India

WWF: World Wildlife Fund

APPENDIX C

LIST OF SPECIES MENTIONED IN THE REPORT

DOLPHINS

Sl. No.	Common Name	Scientific name
1	Finless Porpoise	*Neomeris phocoenoides*
2	Ganges River Dolphin	*Platanista gangetica*
3	Indo-Pacific Humpback Dolphin	*Sousa chinensis*
4	Indus River Dolphin	*Platanista minor*
5	Irrawaddy Dolphin	*Orcaella brevirostris*
6	Pantropical Spotted Dolphin	*Stenella attenuata*

BIRDS

Sl. No.	Common Name	Scientific name
1	Alexandrine Parakeet	*Psittacula eupatria*
2	Asian Woolly-necked Stork	*Ciconia episcopus*
3	Bar-headed Goose	*Anser indicus*
4	Bar-tailed Godwit	*Limosa lapponica*
5	Bengal Florican	*Houbaropsis bengalensis*
6	Black-bellied Tern	*Sterna acuticauda*
7	Black-breasted Parrotbill	*Paradoxornis flavirostris*
8	Black-headed Ibis	*Threskiornis melanocephalus*
9	Black-necked Stork	*Ephippiorhynchus asiaticus*
10	Black-tailed Godwit	*Limosa limosa*
11	Brown-winged Kingfisher	*Pelargopsis amauroptera*
12	Caspian Tern	*Hydroprogne caspia*
13	Citrine Wagtail	*Motacilla citreola*
14	Common Kingfisher	*Alcedo atthis*
15	Common Pochard	*Aythya ferina*
16	Dalmatian Pelican	*Pelecanus crispus*
17	Egyptian Vulture	*Neophron percnopterus*
18	Eurasian Coot	*Fulica atra*
19	Eurasian Curlew	*Numenius arquata*
20	Eurasian Spoonbill	*Platalea leucorodia*
21	Falcated Duck	*Mareca falcata*
22	Ferruginous Pochard	*Aythya nyroca*
23	Great Crested Grebe	*Podiceps cristatus*
24	Great Hornbill	*Buceros bicornis*
25	Great Thick-knee	*Esacus recurvirostris*

26	Greater Adjutant	*Leptoptilos dubius*
27	Greater Spotted Eagle	*Clanga clanga*
28	Grey-headed Fish-Eagle	*Icthyophaga ichthyaetus*
29	Himalayan Griffon	*Gyps himalayensis*
30	Indian Eagle-Owl	*Bubo bengalensis*
31	Indian Skimmer	*Rynchops albicollis*
32	Indian Spotted Eagle	*Clanga hastata*
33	Indian Thick-knee	*Burhinus indicus*
34	Kentish Plover	*Antigone alexandrinus*
35	Lesser Adjutant	*Leptoptilos javanicus*
36	Mallard	*Anas platyrhynchos*
37	Marbled Teal	*Marmaronetta angustirostris*
38	Marsh Babbler	*Pellorneum palustre*
39	Northern Lapwing	*Vanellus vanellus*
40	Northern Pintail	*Anas acuta*
41	Oriental Darter	*Anhinga melanogaster*
42	Painted Stork	*Mycteria leucocephala*
43	Pallas's Fish-Eagle	*Haliaeetus leucoryphus*
44	Pallas's Gull	*Ichthyaetus ichthyaetus*
45	Pied Kingfisher	*Ceryle rudis*
46	Purple Heron	*Ardea purpurea*
47	River Lapwing	*Vanellus duvaucelii*
48	River Tern	*Sterna aurantia*
49	Ruddy Shelduck	*Tadorna ferruginea*
50	Sarus Crane	*Antigone antigone*
51	Slender-billed Vulture	*Gyps tenuirostris*
52	Spot billed Pelican	*Pelecanus philippensis*
53	Steppe Eagle	*Aquila nipalensis*
54	Swamp Francolin	*Ortygornis gularis*
55	Tufted duck	*Aythya fuligula*
56	White-rumped Vulture	*Gyps bengalensis*
57	White-throated Kingfisher	*Halcyon smyrnensis*
58	White-winged Duck	*Acercornis scutulata*

REPTILES

Sl. No.	Common Name	Scientific name
1	Assam Roofed Turtle	*Pangshura sylhetensis*

2	Bengal Monitor	*Varanus bengalensis*
3	Black Soft-shelled Turtle	*Nilssonia nigricans*
4	Brown Roofed Turtle	*Pangshura smithii*
5	Crowned River Turtle	*Hardella thurjii*
6	Dog-faced Water Snake	*Cerberus rynchops*
7	Gharial	*Gavialis gangeticus*
8	Indian Flap-shelled Turtle	*Lissemys punctata*
9	Narrow-headed soft-shelled Turtle	*Chitra indica*
10	Peacock Soft-shelled Turtle	*Nilssonia hurum*
11	Indian Ratsnake	*Ptyas mucosa*
12	Indian Roofed Turtle	*Pangshura tecta*
13	Ganges Soft-shelled Turtle	*Nilssonia gangetica*
14	Indian Tent Turtle	*Pangshura tentoria*
15	Mugger	*Crocodylus palustris*
16	Northen river Terrapin	*Batagur baska*
17	Red Sand Boa	*Eryx johnii*
18	Red-crowned Roofed Turtle	*Batagur kachuga*
19	Saltwater Crocodile	*Crocodylus porosus*
20	Spectacled Cobra	*Naja naja*
21	Spotted Pond Turtle	*Geoclemys hamiltonii*
22	Three-striped Roofed Turtle	*Batagur dhongoka*
23	Water Monitor	*Varanus salvator*
24	Indian Rock Python	*Python molurus*

MAMMALS

Sl. No.	Common Name	Scientific name
1	Asian Elephant	*Elephas maximus*
2	Northern Red Muntjac	*Muntiacus vaginalis*
3	Binturong	*Arctictis binturong*
4	Blackbuck	*Antilope cervicapra*
5	Cheetal	*Axis axis*
6	Dhole	*Cuon alpinus*
7	Eurasian otter	*Lutra lutra*
8	Fishing cat	*Prionailurus viverrinus*
9	Gaur	*Bos gaurus*
10	Giant flying Squirrel	*Petaurista sp.*
11	Golden Jackal	*Canis aureus*

12	Greater One-horned Rhinoceros	*Rhinoceros unicornis*
13	Northern Plains Gray Langur	*Semnopithecus entellus*
14	Hispid Hare	*Caprolagus hispidus*
15	Hog Deer	*Axis porcinus*
16	Indian Flying Fox	*Pteropus medius*
17	Indian Grey Mongoose	*Herpestes edwardsii*
18	Javan rhinoceros	*Rhinoceros sondaicus*
19	Jungle cat	*Felis chaus*
20	Leopard	*Panthera pardus*
21	Leopard cat	*Prionailurus bengalensis*
22	Nilgai	*Boselaphus tragocamelus*
23	Indian Pangolin	*Manis crassisaudata*
24	Chinese Pangolin	*Manis pentadactyla*
25	Pygmy Hog	*Porcula salvania*
26	Rhesus Macaque	*Macaca mulatta*
27	Sambar	*Rusa unicolor*
28	Sloth bear	*Melursus ursinus*
29	Slow loris	*Nycticebus sp.*
30	Small Indian Mongoose	*Herpestes auropunctatus*
31	Small-clawed otter	*Aonyx cinereus*
32	Smooth-coated Otter	*Lutrogale perspicillata*
33	Striped Hyena	*Hyaena hyaena*
34	Swamp deer	*Rucervus duvaucelli*
35	Tiger	*Panthera tigris*
36	Wild Boar	*Sus scrofa*
37	Wild Water Buffalo	*Bubalus arnee*

PISCES

Sl. No	Common Name	Scientific Name
1	Barari	*Wallago attu*
2	Catfish	*Clarias sp.*
3	Rohu	*Labeo rohita*
4	Saur	*Channa marulius*
5	Singhi	*Heteropneustes fossilis*
6	Mahseer	*Tor sp.*

OTHERS

Sl. No.	Common Name	Scientific name
1	Barringtonia	*Barringtonia sp.*
2	Horseshoe crabs	*Carcinoscorpius rotundicauda*
3	Khair	*Acacia catechu*
4	Sal	*Shorea robusta*
5	Sissoo	*Dalbergia sissoo*
6	Sundari trees	*Heritiera fomes*
7	Teak	*Tectona grandis*

UTTAR PRADESH



GANGA
Bird Species - 1.1

Sl. No.	Common Name	Scientific Name	IUCN Status
1	Asian Openbill	*Anastomus oscitans*	Least Concerned
2	Bank Myna	*Acridotheres ginginianus*	Least Concerned
3	Bar-headed Goose	*Anser indicus*	Least Concerned
4	Black-bellied Tern	*Sterna acuticauda*	Endangered
5	Black Drongo	*Dicrurus macrocercus*	Least Concerned
6	Black-headed Gull	*Chroicocephalus ridibundus*	Least Concerned
7	Black-headed Ibis	*Threskiornis melanocephalus*	Near Threatened
8	Black Kite	*Milvus migrans*	Least Concerned
9	Black-necked Stork	*Ephippiorhynchus asiaticus*	Near Threatened
10	Black Stork	*Ciconia nigra*	Least Concerned
11	Black-winged Kite	*Elanus caeruleus*	Least Concerned
12	Black-winged Stilt	*Himantopus himantopus*	Least Concerned
13	Brown Fish-Owl	*Ketupa zeylonensis*	Least Concerned
14	Cattle Egret	*Bubulcus ibis*	Least Concerned
15	Cinnamon Bittern	*Ixobrychus cinnamomeus*	Least Concerned
16	Citrine Wagtail	*Motacilla citreola*	Least Concerned
17	Common Crane	*Grus grus*	Least Concerned
18	Common Greenshank	*Tringa nebularia*	Least Concerned
19	Common Hawk-Cuckoo	*Hierococcyx varius*	Least concerned
20	Common Kingfisher	*Alcedo atthis*	Least Concerned
21	Common Pochard	*Aythya ferina*	Vulnerable
22	Common Redshank	*Tringa totanus*	Least Concerned
23	Common Sandpiper	*Actitis hypoleucos*	Least Concerned
24	Common Shelduck	*Tadorna tadorna*	Least Concerned
25	Common Teal	*Anas crecca*	Least Concerned
26	Demoiselle Crane	*Anthropoides virgo*	Least Concerned
27	Egyptian Vulture	*Neophron percnopterus*	Endangered
28	Eurasian Coot	*Fulica atra*	Least Concerned
29	Eurasian Curlew	*Numenius arquata*	Near threatened
30	Eurasian Marsh-Harrier	*Circus aeruginosus*	Least Concerned
31	Eurasian Spoonbill	*Platalea leucorodia*	Least Concerned
32	Eurasian Wigeon	*Mareca penelope*	Least Concerned
33	Gadwall	*Mareca strepera*	Least Concerned

34	Garganey	*Spatula querquedula*	Least Concerned
35	Glossy Ibis	*Plegadis falcinellus*	Least Concerned
36	Great Cormorant	*Phalacrocorax carbo*	Least Concerned
37	Great Crested Grebe	*Podiceps cristatus*	Least Concerned
38	Great Egret	*Ardea alba*	Least Concerned
39	Greater Coucal	*Centropus sinensis*	Least Concerned
40	Greater Spotted Eagle	*Clanga clanga*	Vulnerable
41	Great Thick-knee	*Esacus recurvirostris*	Near Threatened
42	Green Sandpiper	*Tringa ochropus*	Least Concerned
43	Grey Heron	*Ardea cinerea*	Least Concerned
44	Greylag Goose	*Anser anser*	Least Concerned
45	House Crow	*Corvus splendens*	Least Concerned
46	Indian Cormorant	*Phalacrocorax fuscicollis*	Least Concerned
47	Indian Grey Hornbill	*Ocyceros birostris*	Least Concerned
48	Indian Peafowl	*Pavo cristatus*	Least Concerned
49	Indian Pond-Heron	*Ardeola grayii*	Least Concerned
50	Indian Robin	*Copsychus fulicatus*	Least Concerned
51	Indian Skimmer	*Rynchops albicollis*	Endangered
52	Indian Spot-billed Duck	*Anas poecilorhyncha*	Least Concerned
53	Indian Thick-Knee	*Burhinus indicus*	Least Concerned
54	Intermediate Egret	*Ardea intermedia*	Least Concerned
55	Kentish Plover	*Charadrius alexandrinus*	Least Concerned
56	Knob-billed Duck	*Sarkidiornis melanotos*	Least Concerned
57	Large-billed Crow	*Corvus macrorhynchos*	Least Concerned
58	Lesser Whistling-Duck	*Dendrocygna javanica*	Least Concerned
59	Little Cormorant	*Microcarbo niger*	Least Concerned
60	Little Egret	*Egretta garzetta*	Least Concerned
61	Little Grebe	*Tachybaptus ruficollis*	Least Concerned
62	Little Ringed Plover	*Charadrius dubius*	Least Concerned
63	Little Stint	*Calidris minuta*	Least Concerned
64	Little Tern	*Sternula albifrons*	Least Concerned
65	Mallard	*Anas platyrhynchos*	Least Concerned
66	Marsh Sandpiper	*Tringa stagnatilis*	Least Concerned
67	Northern Pintail	*Anas acuta*	Least Concerned
68	Oriental Honey-buzzard	*Pernis ptilorhynchus*	Least Concerned
69	Oriental Darter	*Anhinga melanogaster*	Near Threatened
70	Osprey	*Pandion haliaetus*	Least Concerned

71	Painted Stork	*Mycteria leucocephala*	Near Threatened
72	Pallas's Gull	*Ichthyaetus ichthyaetus*	Least Concerned
73	Peregrine Falcon	*Falco peregrinus*	Least Concerned
74	Pied Avocet	*Recurvirostra avosetta*	Least Concerned
75	Pied Kingfisher	*Ceryle rudis*	Least Concerned
76	Plain Martin	*Prinia inornata*	Least Concerned
77	Purple Heron	*Ardea purpurea*	Least Concerned
78	Red-Crested Pochard	*Netta rufina*	Least Concerned
79	Red-wattled Lapwing	*Vanellus indicus*	Least Concerned
80	Red-naped Ibis	*Pseudibis papillosa*	Least Concerned
81	River Lapwing	*Vanellus duvaucelii*	Near Threatened
82	River Tern	*Sterna aurantia*	Vulnerable
83	Blue Rock Pigeon	*Columba livia*	Least Concerned
84	Ruddy Shelduck	*Tadorna ferruginea*	Least Concerned
85	Pale Martin	*Riparia diluta*	Least Concerned
86	Sarus Crane	*Grus antigone*	Vulnerable
87	Shikra	*Accipiter badius*	Least Concerned
88	Small Pratincole	*Glareola lactea*	Least Concerned
89	Tufted Duck	*Aythya fuligula*	Least Concerned
90	White-breasted Waterhen	*Amaurornis phoenicurus*	Least Concerned
91	White-browed Wagtail	*Motacilla maderaspatensis*	Least Concerned
92	White-throated Kingfisher	*Halcyon smyrnensis*	Least Concerned
93	White Wagtail	*Motacilla alba*	Least Concerned
94	Wire-tailed Swallow	*Hirundo smithii*	Least Concerned
95	Wood Sandpiper	*Tringa glareola*	Least Concerned
96	Asian Woolly-necked Stork	*Ciconia episcopus*	Near Threatened

Reptile Species - 1.2



Sl. No.	Common Name	Scientific Name	IUCN Status
1	Brown Roofed Turtle	*Pangshura smithii*	Near Threatened
2	Checkered Keelback	*Fowlea piscator*	Least Concerned
3	Gharial	*Gavialis gangeticus*	Critically Endangered
4	Indian Tent Turtle	*Pangshura tentoria*	Least Concerned
5	Indian Flap-shelled Turtle	*Lissemys punctata*	Least Concerned
6	Indian Peacock Soft-shelled Turtle	*Nilssonia hurum*	Endangered
7	Indian Roofed Turtle	*Pangshura tecta*	Vulnerable

8	Ganges Soft-shelled Turtle	*Nilssonia gangetica*	Endangered
9	Three-striped Roofed Turtle	*Batagur dhongoka*	Critically Endangered

Mammal Species - 1.3



Sl. No.	Common Name	Scientific Name	IUCN Status
1	Golden Jackal	*Canis aureus*	Least Concerned
2	Nilgai	*Boselaphus tragocamelus*	Least Concerned

CHAMBAL
Bird Species - 2.1



Sl. No.	Common Name	Scientific Name	IUCN Status
1	Asian Openbill	*Anastomus oscitans*	Least Concerned
2	Bar-headed Goose	*Anser indicus*	Least Concerned
3	Black Drongo	*Dicrurus macrocercus*	Least Concerned
4	Black Kite	*Milvus migrans*	Least Concerned
5	Black-bellied Tern	*Sterna acuticauda*	Endangered
6	Black-headed Gull	*Chroicocephalus ridibundus*	Least Concerned
7	Black-necked Stork	*Ephippiorhynchus asiaticus*	Near Threatened
8	Black-winged Stilt	*Himantopus himantopus*	Least Concerned
9	Blue Rock-Thrush	*Monticola solitarius*	Least Concerned
10	Brahminy Kite	*Haliastur indus*	Least Concerned
11	Brown-headed Gull	*Chroicocephalus brunnicephalus*	Least Concerned
12	Cattle Egret	*Bubulcus ibis*	Least Concerned
13	Common Greenshank	*Tringa nebularia*	Least Concerned
14	Common Pochard	*Aythya ferina*	Vulnerable
15	Common Redshank	*Tringa totanus*	Least Concerned
16	Common Sandpiper	*Actitis hypoleucos*	Least Concerned
17	Common Shelduck	*Tadorna tadorna*	Least concerned
18	Dalmatian Pelican	*Pelecanus crispus*	Near Threatened
19	Egyptian Vulture	*Neophron percnopterus*	Endangered
20	Eurasian Marsh-Harrier	*Circus aeruginosus*	Least Concerned
21	Eurasian Spoonbill	*Platalea leucorodia*	Least Concerned
22	Common Teal	*Anas crecca*	Least Concerned
23	Gadwall	*Mareca strepera*	Least Concerned
24	Grey Wagtail	*Motacilla cinerea*	Least concerned

25	Great Cormorant	*Phalacrocorax carbo*	Least Concerned
26	Great Egret	*Ardea alba*	Least Concerned
27	Great Thick-knee	*Esacus recurvirostris*	Near Threatened
28	Great White Pelican	*Pelecanus onocrotalus*	Least Concerned
29	Great Crested Grebe	*Podiceps cristatus*	Least Concerned
30	Greater Coucal	*Centropus sinensis*	Least Concerned
31	Greater Flamingo	*Phoenicopterus roseus*	Least Concerned
32	Greater Spotted Eagle	*Clanga clanga*	Vulnerable
33	Grey Heron	*Ardea cinerea*	Least Concerned
34	Greylag Goose	*Anser anser*	Least Concerned
35	Plain Martin	*Riperia chinensis*	Least Concerned
36	Indian Cormorant	*Phalacrocorax fuscicollis*	Least Concerned
37	Indian Peafowl	*Pavo cristatus*	Least Concerned
38	Indian Skimmer	*Rynchops albicollis*	Endangered
39	Indian Spot-billed Duck	*Anas poecilorhyncha*	Least Concerned
40	Indian Spotted Eagle	*Clanga hastata*	Vulnerable
41	Intermediate Egret	*Ardea intermedia*	Least Concerned
42	Kentish Plover	*Charadrius alexandrinus*	Least Concerned
43	Knob-billed Duck	*Sarkidiornis melanotos*	Least Concerned
44	Lesser Whistling-Duck	*Dendrocygna javanica*	Least Concerned
45	Little Cormorant	*Microcarbo niger*	Least Concerned
46	Little Egret	*Egretta garzetta*	Least Concerned
47	Little Ringed Plover	*Charadrius dubius*	Least Concerned
48	Little Stint	*Calidris minuta*	Least Concerned
49	Marsh Sandpiper	*Tringa stagnatilis*	Least Concerned
50	Northern Pintail	*Anas acuta*	Least Concerned
51	Northern Shoveler	*Spatula clypeata*	Least Concerned
52	Oriental Darter	*Anhinga melanogaster*	Least Concerned
53	Osprey	*Pandion haliaetus*	Least Concerned
54	Painted Stork	*Mycteria leucocephala*	Least Concerned
55	Pallas's Gull	*Ichthyaetus ichthyaetus*	Least Concerned
56	Pied Avocet	*Recurvirostra avosetta*	Least Concerned
57	Pied Kingfisher	*Ceryle rudis*	Least Concerned
58	Indian Pond-Heron	*Ardeola grayii*	Least Concerned
59	Red-crested Pochard	*Netta rufina*	Least Concerned
60	Red-naped Ibis	*Pseudibis papillosa*	Least Concerned
61	Red-wattled Lapwing	*Vanellus indicus*	Least Concerned
62	River Lapwing	*Vanellus duvaucelii*	Near Threatened
63	River Tern	*Sterna aurantia*	Vulnerable
64	Blue Rock Pigeon	*Columba livia*	Least Concerned

65	Rose-ringed Parakeet	*Psittacula krameri*	Least Concerned
66	Ruddy Shelduck	*Tadorna ferruginea*	Least Concerned
67	Pale Martin	*Riparia diluta*	Least Concerned
68	Small Pratincole	*Glareola lactea*	Least Concerned
69	White Wagtail	*Motacilla alba*	Least Concerned
70	White-browed Wagtail	*Motacilla maderaspatensis*	Least Concerned
71	White-throated Kingfisher	*Halcyon smyrnensis*	Least Concerned
72	Wire-tailed Swallow	*Hirundo smithii*	Least Concerned
73	Asian Woolly-necked Stork	*Ciconia episcopus*	Near Threatened

Reptile Species - 2.2



Sl. No.	Common Name	Scientific Name	IUCN Status
1	Gharial	*Gavialis gangeticus*	Critically Endangered
2	Indian Roofed Turtle	*Pangshura tecta*	Vulnerable
3	Ganges Soft-shelled Turtle	*Nilssonia gangetica*	Endangered
4	Indian Tent Turtle	*Pangshura tentoria*	Least Concerned
5	Mugger	*Crocodylus palustris*	Vulnerable
6	Narrow-headed soft-shelled Turtle	*Chitra indica*	Endangered

Mammal Species - 2.3



Sl. No.	Common Name	Scientific Name	IUCN Status
1	Golden Jackal	*Canis aureus*	Least Concerned
2	Nilgai	*Boselaphus tragocamelus*	Least Concerned
3	Striped Hyaena	*Hyaena hyaena*	Near Threatened

Yamuna
Bird Species - 3.1



Sl. No.	Common Name	Scientific Name	IUCN Status
1	Asian Openbill	*Anastomus oscitans*	Least Concerned
2	Bank Myna	*Acridotheres ginginianus*	Least Concerned
3	Bar-headed Goose	*Anser indicus*	Least Concerned
4	Black-bellied Tern	*Sterna acuticauda*	Endangered
5	Barn Swallow	*Hirundo rustica*	Least Concerned
6	Black Drongo	*Dicrurus macrocercus*	Least Concerned
7	Black-headed Gull	*Chroicocephalus ridibundus*	Least Concerned
8	Black-tailed Godwit	*Limosa limosa*	Near Threatened
9	Black Kite	*Milvus migrans*	Least Concerned
10	Black-necked Stork	*Ephippiorhynchus asiaticus*	Near Threatened
11	Black Stork	*Ciconia nigra*	Least Concerned
12	Blue Blue Rock Pigeon	*Columba livia*	Least Concerned
13	Black-winged Stilt	*Himantopus himantopus*	Least Concerned
14	Blue Rock-Thrush	*Monticola solitarius*	Least Concerned
15	Brown-headed Gull	*Chroicocephalus brunnicephalus*	Least Concerned
16	Cattle Egret	*Bubulcus ibis*	Least Concerned
17	Common Crane	*Grus grus*	Least Concerned
18	Common Greenshank	*Tringa nebularia*	Least Concerned
19	Common Kingfisher	*Alcedo atthis*	Least Concerned
20	Common Pochard	*Aythya ferina*	Vulnerable
21	Common Redshank	*Tringa totanus*	Least Concerned
22	Common Sandpiper	*Actitis hypoleucos*	Least Concerned
23	Common Shelduck	*Tadorna tadorna*	Least Concerned
24	Crested Serpent-Eagle	*Spilornis cheela*	Least Concerned
25	Egyptian Vulture	*Neophron percnopterus*	Endangered
26	Eurasian Coot	*Fulica atra*	Least Concerned
27	Eurasian Curlew	*Numenius arquata*	Near threatened
28	Eurasian Collared-Dove	*Streptopelia decaocto*	Least Concerned
29	Eurasian Spoonbill	*Platalea leucorodia*	Least Concerned
30	Gadwall	*Mareca strepera*	Least Concerned
31	Great Cormorant	*Phalacrocorax carbo*	Least Concerned
32	Great Crested Grebe	*Podiceps cristatus*	Least Concerned
33	Great Egret	*Ardea alba*	Least Concerned
34	Great White Pelican	*Pelecanus onocrotalus*	Least Concerned
35	Plain Martin	*Riperia chinensis*	Least Concerned
36	Great Thick-knee	*Esacus recurvirostris*	Near Threatened
37	Grey Heron	*Ardea cinerea*	Least Concerned
38	Greylag Goose	*Anser anser*	Least Concerned
39	House Crow	*Corvus splendens*	Least Concerned
40	House Sparrow	*Passer domesticus*	Least Concerned
41	Indian Peafowl	*Pavo cristatus*	Least Concerned
42	Indian Pond-Heron	*Ardeola grayii*	Least Concerned
43	Indian Spot-billed Duck	*Anas poecilorhyncha*	Least Concerned
44	Intermediate Egret	*Ardea intermedia*	Least Concerned
45	Kentish Plover	*Charadrius alexandrinus*	Least Concerned
46	Knob-billed Duck	*Sarkidiornis melanotos*	Least Concerned
47	Large-billed Crow	*Corvus macrorhynchos*	Least Concerned
48	Lesser Whistling-Duck	*Dendrocygna javanica*	Least Concerned
49	Little Cormorant	*Microcarbo niger*	Least Concerned

50	Little Egret	*Egretta garzetta*	Least Concerned
51	Little Ringed Plover	*Charadrius dubius*	Least Concerned
52	Little Stint	*Calidris minuta*	Least Concerned
53	Marbled Teal	*Marmaronetta angustirostris*	Near Threatened
54	Northern Pintail	*Anas acuta*	Least Concerned
55	Oriental Honey-buzzard	*Pernis ptilorhynchus*	Least Concerned
56	Oriental Darter	*Anhinga melanogaster*	Near Threatened
57	Osprey	*Pandion haliaetus*	Least Concerned
58	Painted Stork	*Mycteria leucocephala*	Near Threatened
59	Pale Martin	*Prinia inornata*	Least Concerned
60	Pallas's Gull	*Ichthyaetus ichthyaetus*	Least Concerned
61	Pied Avocet	*Recurvirostra avosetta*	Least Concerned
62	Pied Kingfisher	*Ceryle rudis*	Least Concerned
63	Purple Heron	*Ardea purpurea*	Least Concerned
64	Red-crested Pochard	*Netta rufina*	Least Concerned
65	Red-wattled Lapwing	*Vanellus indicus*	Least Concerned
66	Red-naped Ibis	*Pseudibis papillosa*	Least Concerned
67	River Lapwing	*Vanellus duvaucelii*	Near Threatened
68	River Tern	*Sterna aurantia*	Vulnerable
69	Rose-ringed Parakeet	*Psittacula krameri*	Least Concerned
70	Ruddy Shelduck	*Tadorna ferruginea*	Least Concerned
71	Ruff	*Calidris pugnax*	Least Concerned
72	Pale Martin	*Riparia diluta*	Least Concerned
73	Sarus Crane	*Grus antigone*	Vulnerable
74	Small Pratincole	*Glareola lactea*	Least Concerned
75	White-browed Wagtail	*Motacilla maderaspatensis*	Least Concerned
76	White-throated Kingfisher	*Halcyon smyrnensis*	Least Concerned
77	White Wagtail	*Motacilla alba*	Least Concerned
78	Wire-tailed Swallow	*Hirundo smithii*	Least Concerned
79	Asian Woolly-necked Stork	*Ciconia episcopus*	Near Threatened
80	Yellow-Wattled Lapwing	*Vanellus malabaricus*	Least Concerned

Reptile Species - 3.2



Sl. No.	Common Name	Scientific Name	IUCN Status
1	Gharial	*Gavialis gangeticus*	Critically Endangered
2	Indian Flap-shelled Turtle	*Lissemys punctata*	Vulnerable
3	Narrow-headed soft-shelled Turtle	*Chitra indica*	Endangered
4	Ganges Soft-shelled Turtle	*Nilssonia gangetica*	Endangered
5	Indian Tent Turtle	*Pangshura tentoria*	Least Concerned
6	Red-Crowned Roofed Turtle	*Batagur kachuga*	Critically Endangered
7	Red Sand Boa	*Eryx johnii*	Near Threatened

Mammal Species - 3.3



Sl. No.	Common Name	Scientific Name	IUCN Status
1	Golden Jackal	*Canis aureus*	Least Concerned
2	Nilgai	*Boselaphus tragocamelus*	Least Concerned
3	Northern Plains Grey Langur	*Semnopithecus entellus*	Least Concerned

Rapti
Bird Species - 4.1



Sl. No.	Common Name	Scientific Name	IUCN Status
1	Ashy Prinia	*Prinia socialis*	Least Concerned
2	Asian Openbill	*Anastomus oscitans*	Least Concerned
3	Black-crowned Night-Heron	*Nycticorax nycticorax*	Least Concerned
4	Black-winged Kite	*Elanus caeruleus*	Least Concerned
5	Bar-headed Goose	*Anser indicus*	Least Concerned
6	Barn Swallow	*Hirundo rustica*	Least Concerned
7	Black-tailed Godwit	*Limosa limosa*	Near Threatened
8	Black Kite	*Milvus migrans*	Least Concerned
9	Black-necked Stork	*Ephippiorhynchus asiaticus*	Near Threatened
10	Blue Blue Rock Pigeon	*Columba livia*	Least Concerned
11	Black-winged Stilt	*Himantopus himantopus*	Least Concerned
12	Brown-headed Gull	*Chroicocephalus brunnicephalus*	Least Concerned
13	Cattle Egret	*Bubulcus ibis*	Least Concerned
14	Common Greenshank	*Tringa nebularia*	Least Concerned
15	Common Pochard	*Aythya ferina*	Vulnerable
16	Common Redshank	*Tringa totanus*	Least Concerned
17	Common Sandpiper	*Actitis hypoleucos*	Least Concerned
18	Common Shelduck	*Tadorna tadorna*	Least Concerned
19	Common Kestrel	*Falco tinnunculus*	Least Concerned
20	Common Teal	*Anas crecca*	Least Concerned
21	Dunlin	*Calidris alpina*	Least Concerned
22	Egyptian Vulture	*Neophron percnopterus*	Endangered
23	Eurasian Curlew	*Numenius arquata*	Near threatened
24	Eurasian Collared-Dove	*Streptopelia decaocto*	Least Concerned
25	Eurasian Wigeon	*Mareca penelope*	Least Concerned
26	Gadwall	*Mareca strepera*	Least Concerned
27	Great Cormorant	*Phalacrocorax carbo*	Least Concerned

28	Great Crested Grebe	*Podiceps cristatus*	Least Concerned
29	Great Egret	*Ardea alba*	Least Concerned
30	Greater Coucal	*Centropus sinensis*	Least Concerned
31	Green Sandpiper	*Tringa ochropus*	Least Concerned
32	Grey Francolin	*Francolinus pondicerianus*	Least Concerned
33	Plain Martin	*Riperia chinensis*	Least Concerned
34	Great Thick-knee	*Esacus recurvirostris*	Near Threatened
35	Grey Heron	*Ardea cinerea*	Least Concerned
36	Himalayan Griffon	*Gyps himalayensis*	Near Threatened
37	Indian Cormorant	*Phalacrocorax fuscicollis*	Least Concerned
38	Indian Eagle-Owl	*Bubo bengalensis*	Least Concerned
39	Indian Spotted Eagle	*Clanga hastata*	Vulnerable
40	Indian Thick-Knee	*Burhinus indicus*	Least Concerned
41	Indian Peafowl	*Pavo cristatus*	Least Concerned
42	Indian Pond-Heron	*Ardeola grayii*	Least Concerned
43	Indian Spot-billed Duck	*Anas poecilorhyncha*	Least Concerned
44	Intermediate Egret	*Ardea intermedia*	Least Concerned
45	Kentish Plover	*Charadrius alexandrinus*	Least Concerned
46	Knob-billed Duck	*Sarkidiornis melanotos*	Least Concerned
47	Large-billed Crow	*Corvus macrorhynchos*	Least Concerned
48	Large Cuckooshrike	*Coracina javensis*	Least Concerned
49	Little Cormorant	*Microcarbo niger*	Least Concerned
50	Little Egret	*Egretta garzetta*	Least Concerned
51	Little Ringed Plover	*Charadrius dubius*	Least Concerned
52	Little Stint	*Calidris minuta*	Least Concerned
53	Long-legged Buzzard	*Buteo rufinus*	Least Concerned
54	Mallard	*Anas platyrhynchos*	Least Concerned
55	Marsh Sandpiper	*Tringa stagnatilis*	Least Concerned
56	Northern Pintail	*Anas acuta*	Least Concerned
57	Northern Shoveler	*Spatula clypeata*	Least Concerned
58	Oriental Honey-buzzard	*Pernis ptilorhynchus*	Least Concerned
59	Osprey	*Pandion haliaetus*	Least Concerned
60	Painted Stork	*Mycteria leucocephala*	Near Threatened
61	Pied Avocet	*Recurvirostra avosetta*	Least Concerned
62	Pied Kingfisher	*Ceryle rudis*	Least Concerned
63	Plain Prinia	*Prinia inornata*	Least Concerned
64	Red-Crested Pochard	*Netta rufina*	Least Concerned
65	Red-wattled Lapwing	*Vanellus indicus*	Least Concerned
66	Red-naped Ibis	*Pseudibis papillosa*	Least Concerned
67	River Lapwing	*Vanellus duvaucelii*	Near Threatened

68	River Tern	*Sterna aurantia*	Vulnerable
69	Ruddy Shelduck	*Tadorna ferruginea*	Least Concerned
70	Ruff	*Calidris pugnax*	Least Concerned
71	Pale Martin	*Riparia diluta*	Least Concerned
72	Sarus Crane	*Grus antigone*	Vulnerable
73	Shikra	*Accipiter badius*	Least Concerned
74	Short-eared Owl	*Asio flammeus*	Least Concerned
75	Siberian Stonechat	*Saxicola maurus*	Least Concerned
76	Spotted Redshank	*Tringa erythropus*	Least Concerned
77	Striated Heron	*Butorides striata*	Least Concerned
78	Small Pratincole	*Glareola lactea*	Least Concerned
79	Temminck's Stint	*Calidris temminckii*	Least Concerned
80	White-browed Wagtail	*Motacilla maderaspatensis*	Least Concerned
81	White-throated Kingfisher	*Halcyon smyrnensis*	Least Concerned
82	White Wagtail	*Motacilla alba*	Least Concerned
83	White-breasted Waterhen	*Amaurornis phoenicurus*	Least Concerned
84	Asian Woolly-necked Stork	*Ciconia episcopus*	Near Threatened
85	Yellow Bittern	*Ixobrychus sinensis*	Least Concerned

Reptile Species - 4.2



Sl. No.	Common Name	Scientific Name	IUCN Status
1	Brown Roofed Turtle	*Pangshura smithii*	Near Threatened
2	Checkered Keelback	*Fowlea piscator*	Least Concerned
3	Gharial	*Gavialis gangeticus*	Critically Endangered
4	Indian Flap-shelled Turtle	*Lissemys punctata*	Vulnerable
5	Indian Ratsnake	*Ptyas mucosa*	Least Concerned
6	Indian Roofed Turtle	*Pangshura tecta*	Vulnerable
7	Ganges Soft-shelled Turtle	*Nilssonia gangetica*	Endangered
8	Indian Tent Turtle	*Pangshura tentoria*	Least Concerned
9	Red Sand Boa	*Eryx johnii*	Near Threatened

Mammal Species - 4.3



Sl. No.	Common Name	Scientific Name	IUCN Status
1	Golden Jackal	*Canis aureus*	Least Concerned
2	Indian Grey Mongoose	*Urva edwardsii*	Least Concerned
3	Nilgai	*Boselaphus tragocamelus*	Least Concerned
4	Northern Plains Grey Langur	*Semnopithecus entellus*	Least Concerned

Sharda
Bird Species - 5.1

Sl. No.	Common Name	Scientific Name	IUCN Status
1	Asian Openbill	*Anastomus oscitans*	Least Concerned
2	Bar-headed Goose	*Anser indicus*	Least Concerned
3	Black-bellied Tern	*Sterna acuticauda*	Endangered
4	Barn Swallow	*Hirundo rustica*	Least Concerned
5	Brown-headed Gull	*Chroicocephalus brunnicephalus*	Least Concerned
6	Black-headed Ibis	*Threskiornis melanocephalus*	Near Threatened
7	Black Kite	*Milvus migrans*	Least Concerned
8	Black-necked Stork	*Ephippiorhynchus asiaticus*	Near Threatened
9	Black Stork	*Ciconia nigra*	Least Concerned
10	Cattle Egret	*Bubulcus ibis*	Least Concerned
11	Common Kestrel	*Falco tinnunculus*	Least Concerned
12	Common Teal	*Anas crecca*	Least Concerned
13	Common Crane	*Grus grus*	Least Concerned
14	Common Greenshank	*Tringa nebularia*	Least Concerned
15	Crested Serpent-Eagle	*Spilornis cheela*	Least Concerned
16	Common Pochard	*Aythya ferina*	Vulnerable
17	Common Sandpiper	*Actitis hypoleucos*	Least Concerned
18	Egyptian Vulture	*Neophron percnopterus*	Endangered
19	Eurasian Wigeon	*Mareca penelope*	Least Concerned
20	Gadwall	*Mareca strepera*	Least Concerned
21	Garganey	*Spatula querquedula*	Least Concerned
22	Great Cormorant	*Phalacrocorax carbo*	Least Concerned
23	Great Crested Grebe	*Podiceps cristatus*	Least Concerned
24	Great Egret	*Ardea alba*	Least Concerned
25	Greater Coucal	*Centropus sinensis*	Least Concerned
26	Great Thick-knee	*Esacus recurvirostris*	Near Threatened
27	Greater White-Fronted Goose	*Anser albifrons*	Least Concerned
28	Green Sandpiper	*Tringa ochropus*	Least Concerned
29	Grey Heron	*Ardea cinerea*	Least Concerned
30	Greylag Goose	*Anser anser*	Least Concerned
31	Plain Martin	*Riperia chinensis*	Least Concerned
32	Indian Spotted Eagle	*Clanga hastata*	Vulnerable
33	Indian Spot-billed Duck	*Anas poecilorhyncha*	Least Concerned
34	Intermediate Egret	*Ardea intermedia*	Least Concerned
35	Little Cormorant	*Microcarbo niger*	Least Concerned
36	Little Egret	*Egretta garzetta*	Least Concerned

37	Little Ringed Plover	*Charadrius dubius*	Least Concerned
38	Long-legged Buzzard	*Buteo rufinus*	Least Concerned
39	Mallard	*Anas platyrhynchos*	Least Concerned
40	Northern Pintail	*Anas acuta*	Least Concerned
41	Northern Shoveler	*Spatula clypeata*	Least Concerned
42	Oriental Darter	*Anhinga melanogaster*	Near Threatened
43	Osprey	*Pandion haliaetus*	Least Concerned
44	Painted Stork	*Mycteria leucocephala*	Near Threatened
45	Pallas's Gull	*Ichthyaetus ichthyaetus*	Least Concerned
46	Peregrine Falcon	*Falco peregrinus*	Least Concerned
47	Pheasant-tailed Jacana	*Hydrophasianus chirurgus*	Least Concerned
48	Pied Avocet	*Recurvirostra avosetta*	Least Concerned
49	Pied Kingfisher	*Ceryle rudis*	Least Concerned
50	Red-crested Pochard	*Netta rufina*	Least Concerned
51	Red-wattled Lapwing	*Vanellus indicus*	Least Concerned
52	Red-naped Ibis	*Pseudibis papillosa*	Least Concerned
53	River Lapwing	*Vanellus duvaucelii*	Near Threatened
54	Ruddy Shelduck	*Tadorna ferruginea*	Least Concerned
55	Sand Lark	*Alaudala raytal*	Least Concerned
56	Siberian Stonechat	*Saxicola maurus*	Least Concerned
57	Striated Heron	*Butorides striata*	Least Concerned
58	Small Pratincole	*Glareola lactea*	Least Concerned
59	White-throated Kingfisher	*Halcyon smyrnensis*	Least Concerned
60	White Wagtail	*Motacilla alba*	Least Concerned
61	Wood Sandpiper	*Tringa glareola*	Least Concerned
62	Asian Woolly-necked Stork	*Ciconia episcopus*	Near Threatened

Reptile Species - 5.2



Sl. No.	Common Name	Scientific Name	IUCN Status
1	Brown Roofed Turtle	*Pangshura smithii*	Near Threatened
2	Gharial	*Gavialis gangeticus*	Critically Endangered
3	Indian Flap-shelled Turtle	*Lissemys punctata*	Vulnerable
4	Indian Roofed Turtle	*Pangshura tecta*	Vulnerable
5	Ganges Soft-shelled Turtle	*Nilssonia gangetica*	Endangered
6	Indian Tent Turtle	*Pangshura tentoria*	Least Concerned
7	Mugger	*Crocodylus palustris*	Vulnerable

Mammal Species - 5.3

Sl. No.	Common Name	Scientific Name	IUCN Status
1	Golden Jackal	*Canis aureus*	Least Concerned

Ghaghara Bird Species - 6.1

Sl. No.	Common Name	Scientific Name	IUCN Status
1	Asian Openbill	*Anastomus oscitans*	Least Concerned
2	Asian Palm Swift	*Cypsiurus balasiensis*	Least Concerned
3	Indian Pied Starling	*Gracupica contra*	Least Concerned
4	Bar-headed Goose	*Anser indicus*	Least Concerned
5	Brown-headed Gull	*Chroicocephalus brunnicephalus*	Least Concerned
6	Black Drongo	*Dicrurus macrocercus*	Least Concerned
7	Barn Swallow	*Hirundo rustica*	Least Concerned
8	Black-headed Gull	*Chroicocephalus ridibundus*	Least Concerned
9	Black-headed Ibis	*Threskiornis melanocephalus*	Near Threatened
10	Black Kite	*Milvus migrans*	Least Concerned
11	Black-necked Stork	*Ephippiorhynchus asiaticus*	Near Threatened
12	Black Stork	*Ciconia nigra*	Least Concerned
13	Black-winged Kite	*Elanus caeruleus*	Least Concerned
14	Blue Blue Rock Pigeon	*Columba livia*	Least Concerned
15	Black-crowned Night-Heron	*Nycticorax nycticorax*	Least Concerned
16	Cattle Egret	*Bubulcus ibis*	Least Concerned
17	Common Crane	*Grus grus*	Least Concerned
18	Common Greenshank	*Tringa nebularia*	Least Concerned
19	Common Merganser	*Mergus merganser*	Least Concerned
20	Common Pochard	*Aythya ferina*	Vulnerable
21	Common Redshank	*Tringa totanus*	Least Concerned
22	Common Sandpiper	*Actitis hypoleucos*	Least Concerned
23	Common Teal	*Anas crecca*	Least Concerned
24	Dunlin	*Calidris alpina*	Least Concerned
25	Egyptian Vulture	*Neophron percnopterus*	Endangered
26	Eurasian Curlew	*Numenius arquata*	Near threatened
27	Eurasian Wigeon	*Mareca penelope*	Least Concerned
28	Gadwall	*Mareca strepera*	Least Concerned
29	Garganey	*Spatula querquedula*	Least Concerned

30	Great Cormorant	*Phalacrocorax carbo*	Least Concerned
31	Great Crested Grebe	*Podiceps cristatus*	Least Concerned
32	Great Egret	*Ardea alba*	Least Concerned
33	Greater Coucal	*Centropus sinensis*	Least Concerned
34	Grey Heron	*Ardea cinerea*	Least Concerned
35	Greylag Goose	*Anser anser*	Least Concerned
36	Indian Grey Hornbill	*Ocyceros birostris*	Least Concerned
37	Plain Martin	*Riperia chinensis*	Least Concerned
38	House Sparrow	*Passer domesticus*	Least Concerned
39	Indian Pond-Heron	*Ardeola grayii*	Least Concerned
40	Indian Spotted Eagle	*Clanga hastata*	Vulnerable
41	Indian Spot-billed Duck	*Anas poecilorhyncha*	Least Concerned
42	Large-billed Crow	*Corvus macrorhynchos*	Least Concerned
43	Lesser Whistling-Duck	*Dendrocygna javanica*	Least Concerned
44	Little Cormorant	*Microcarbo niger*	Least Concerned
45	Little Egret	*Egretta garzetta*	Least Concerned
46	Little Swift	*Apus affinis*	Least Concerned
47	Long-legged Buzzard	*Buteo rufinus*	Least Concerned
48	Mallard	*Anas platyrhynchos*	Least Concerned
49	Marsh Sandpiper	*Tringa stagnatilis*	Least Concerned
50	Northern Pintail	*Anas acuta*	Least Concerned
51	Northern Shoveler	*Spatula clypeata*	Least Concerned
52	Oriental Honey-buzzard	*Pernis ptilorhynchus*	Least Concerned
53	Oriental Darter	*Anhinga melanogaster*	Near Threatened
54	Osprey	*Pandion haliaetus*	Least Concerned
55	Painted Stork	*Mycteria leucocephala*	Near Threatened
56	Pallas's Gull	*Ichthyaetus ichthyaetus*	Least Concerned
57	Peregrine Falcon	*Falco peregrinus*	Least Concerned
58	Pied Avocet	*Recurvirostra avosetta*	Least Concerned
59	Pied Kingfisher	*Ceryle rudis*	Least Concerned
60	Pied Bushchat	*Saxicola caprata*	Least Concerned
61	Red-crested Pochard	*Netta rufina*	Least Concerned
62	Red-wattled Lapwing	*Vanellus indicus*	Least Concerned
63	Red-naped Ibis	*Pseudibis papillosa*	Least Concerned
64	River Lapwing	*Vanellus duvaucelii*	Near Threatened
65	Ruddy Shelduck	*Tadorna ferruginea*	Least Concerned
66	Pale Martin	*Riparia diluta*	Least Concerned
67	Small Pratincole	*Glareola lactea*	Least Concerned
68	Siberian Stonechat	*Saxicola maurus*	Least Concerned
69	Striated Heron	*Butorides striata*	Least Concerned
70	White-throated Kingfisher	*Halcyon smyrnensis*	Least Concerned

71	White-Eyed Buzzard	*Butastur teesa*	Least Concerned
72	White Wagtail	*Motacilla alba*	Least Concerned
73	Asian Woolly-necked Stork	*Ciconia episcopus*	Near Threatened

Reptile Species - 6.2



Sl. No.	Common Name	Scientific Name	IUCN Status
1	Brown Roofed Turtle	*Pangshura smithii*	Near Threatened
2	Checkered Keelback	*Fowlea piscator*	Least Concerned
3	Gharial	*Gavialis gangeticus*	Critically Endangered
4	Indian Ratsnake	*Ptyas mucosa*	Least Concerned
5	Ganges Soft-shelled Turtle	*Nilssonia gangetica*	Endangered
6	Indian Tent Turtle	*Pangshura tentoria*	Least Concerned
7	Mugger	*Crocodylus palustris*	Vulnerable
8	Spectacled Cobra	*Naja naja*	Least Concerned

Mammal Species - 6.3



Sl. No.	Common Name	Scientific Name	IUCN Status
1	Golden Jackal	Canis aureus	Least Concerned
2	Hog Deer	Axis porcinus	Endangered
3	Nilgai	Boselaphus tragocamelus	Least Concerned
4	Northern Plains Grey Langur	Semnopithecus entellus	Least Concerned
5	Rhesus Macaque	Macaca mulatta	Least Concerned

Geruwa
Bird Species - 7.1



Sl. No.	Common Name	Scientific Name	IUCN Status
1	Barn Swallow	*Hirundo rustica*	Least Concerned
2	Black-necked Stork	*Ephippiorhynchus asiaticus*	Near Threatened
3	Common Greenshank	*Tringa nebularia*	Least Concerned
4	Common Redshank	*Tringa totanus*	Least Concerned
5	Egyptian Vulture	*Neophron percnopterus*	Endangered
6	Great Cormorant	*Phalacrocorax carbo*	Least Concerned
7	Great Crested Grebe	*Podiceps cristatus*	Least Concerned
8	Great Egret	*Ardea alba*	Least Concerned
9	Grey Heron	*Ardea cinerea*	Least Concerned

10	Grey-headed Fish-Eagle	*Icthyophaga ichthyaetus*	Near Threatened
11	Little Cormorant	*Microcarbo niger*	Least Concerned
12	Little Egret	*Egretta garzetta*	Least Concerned
13	Lesser Whistling-Duck	*Dendrocygna javanica*	Least Concerned
14	Oriental Darter	*Anhinga melanogaster*	Near Threatened
15	Osprey	*Pandion haliaetus*	Least Concerned
16	Oriental Honey-buzzard	*Pernis ptilorhynchus*	Least Concerned
17	Painted Stork	*Mycteria leucocephala*	Near Threatened
18	Pied Kingfisher	*Ceryle rudis*	Least Concerned
19	Purple Heron	*Ardea purpurea*	Least Concerned
20	Red-wattled Lapwing	*Vanellus indicus*	Least Concerned
21	Red-naped Ibis	*Pseudibis papillosa*	Least Concerned
22	River Lapwing	*Vanellus duvaucelii*	Near Threatened
23	Ruddy Shelduck	*Tadorna ferruginea*	Least Concerned
24	Siberian Stonechat	*Saxicola maurus*	Least Concerned
25	White-throated Kingfisher	*Halcyon smyrnensis*	Least Concerned
26	White Wagtail	*Motacilla alba*	Least Concerned
27	Asian Woolly-necked Stork	*Ciconia episcopus*	Near Threatened

Reptile Species - 7.2



Sl. No.	Common Name	Scientific Name	IUCN Status
1	Brown Roofed Turtle	*Pangshura smithii*	Near Threatened
2	Gharial	*Gavialis gangeticus*	Critically Endangered
3	Ganges Soft-shelled Turtle	*Nilssonia gangetica*	Endangered
4	Mugger	*Crocodylus palustris*	Vulnerable



BIHAR



GANGA
Bird Species - 8.1

Sl. No.	Common Name	Scientific Name	IUCN Status
1	Asian Koel	*Eudynamys scolopaceus*	Least Concerned
2	Asian Openbill	*Anastomus oscitans*	Least Concerned
3	Asian Palm Swift	*Cypsiurus balasiensis*	Least Concerned
4	Bank Myna	*Acridotheres ginginianus*	Least Concerned
5	Bar-headed Goose	*Anser indicus*	Least Concerned
6	Black-bellied Tern	*Sterna acuticauda*	Endangered
7	Black Drongo	*Dicrurus macrocercus*	Least Concerned
8	Black-headed Gull	*Chroicocephalus ridibundus*	Least Concerned
9	Black-headed Ibis	*Threskiornis melanocephalus*	Near Threatened
10	Black Kite	*Milvus migrans*	Least Concerned
11	Black-necked Stork	*Ephippiorhynchus asiaticus*	Near Threatened
12	Black Stork	*Ciconia nigra*	Least Concerned
13	Black-winged Stilt	*Himantopus himantopus*	Least Concerned
14	Blue-tailed Bee-eater	*Merops philippinus*	Least Concerned
15	Cattle Egret	*Bubulcus ibis*	Least Concerned
16	Citrine Wagtail	*Motacilla citreola*	Least Concerned
17	Common Crane	*Grus grus*	Least Concerned
18	Common Greenshank	*Tringa nebularia*	Least Concerned
19	Common Redshank	*Tringa totanus*	Least Concerned
20	Common Sandpiper	*Actitis hypoleucos*	Least Concerned
21	Common Teal	*Anas crecca*	Least Concerned
22	Crested Lark	*Galerida cristata*	Least Concerned
23	Crested Serpent-Eagle	*Spilornis cheela*	Least Concerned
24	Eurasian Collared-Dove	*Streptopelia decaocto*	Least Concerned
25	Eurasian Coot	*Fulica atra*	Least Concerned
26	Eurasian Curlew	*Numenius arquata*	Near Threatened
27	Eurasian Spoonbill	*Platalea leucorodia*	Least Concerned
28	Eurasian Wigeon	*Mareca penelope*	Least Concerned
29	Gadwall	*Mareca strepera*	Least Concerned
30	Garganey	*Spatula querquedula*	Least Concerned
31	Great Cormorant	*Phalacrocorax carbo*	Least Concerned
32	Great Crested Grebe	*Podiceps cristatus*	Least Concerned
33	Great Egret	*Ardea alba*	Least Concerned
34	Greater Adjutant	*Leptoptilos dubius*	Endangered
35	Greater Coucal	*Centropus sinensis*	Least Concerned
36	Asian Green Bee-eater	*Merops orientalis*	Least Concerned

37	Grey Heron	*Ardea cinerea*	Least Concerned
38	House Crow	*Corvus splendens*	Least Concerned
39	Indian Pond-Heron	*Ardeola grayii*	Least Concerned
40	Intermediate Egret	*Ardea intermedia*	Least Concerned
41	Kentish Plover	*Charadrius alexandrinus*	Least Concerned
42	Large-billed Crow	*Corvus macrorhynchos*	Least Concerned
43	Lesser Adjutant	*Leptoptilos javanicus*	Vulnerable
44	Little Cormorant	*Microcarbo niger*	Least concerned
45	Little Egret	*Egretta garzetta*	Least Concerned
46	Little Grebe	*Tachybaptus ruficollis*	Least Concerned
47	Little Ringed Plover	*Charadrius dubius*	Least Concerned
48	Little Stint	*Calidris minuta*	Least Concerned
49	Little Tern	*Sternula albifrons*	Least Concerned
50	Long-legged Buzzard	*Buteo rufinus*	Least Concerned
51	Northern Pintail	*Anas acuta*	Least Concerned
52	Northern Shoveler	*Spatula clypeata*	Least Concerned
53	Osprey	*Pandion haliaetus*	Least Concerned
54	Painted Stork	*Mycteria leucocephala*	Near Threatened
55	Pallas's Gull	*Ichthyaetus ichthyaetus*	Least Concerned
56	Peregrine Falcon	*Falco peregrinus*	Least Concerned
57	Pied Avocet	*Recurvirostra avosetta*	Least Concerned
58	Pied Kingfisher	*Ceryle rudis*	Least Concerned
59	Plain Martin	*Prinia inornata*	Least Concerned
60	Red-crested Pochard	*Netta rufina*	Least Concerned
61	Red-wattled Lapwing	*Vanellus indicus*	Least Concerned
62	Red-naped Ibis	*Pseudibis papillosa*	Least Concerned
63	River Lapwing	*Vanellus duvaucelii*	Near Threatened
64	River Tern	*Sterna aurantia*	Vulnerable
65	Blue Rock Pigeon	*Columba livia*	Least Concerned
66	Ruddy Shelduck	*Tadorna ferruginea*	Least Concerned
67	Ruff	*Calidris pugnax*	Least Concerned
68	Pale Martin	*Riparia diluta*	Least Concerned
69	Siberian Stonechat	*Saxicola maurus*	Least Concerned
70	Small Pratincole	*Glareola lactea*	Least Concerned
71	Spotted Redshank	*Tringa erythropus*	Least Concerned
72	Temminck's Stint	*Calidris temminckii*	Least Concerned
73	Tufted Duck	*Aythya fuligula*	Least Concerned
74	Western Yellow Wagtail	*Motacilla flava*	Least Concerned
75	Whiskered Tern	*Chlidonias hybrida*	Least Concerned
76	White-breasted Waterhen	*Amaurornis phoenicurus*	Least Concerned
77	White-throated Kingfisher	*Halcyon smyrnensis*	Least Concerned

78	White Wagtail	*Motacilla alba*	Least Concerned
79	White-eyed Buzzard	*Butastur teesa*	Least Concerned
80	Wire-tailed Swallow	*Hirundo smithii*	Least Concerned
81	Asian Woolly-necked Stork	*Ciconia episcopus*	Near Threatened

Reptile Species - 8.2



Sl. No.	Common Name	Scientific Name	IUCN Status
1	Brown Roofed Turtle	*Pangshura smithii*	Near Threatened

Mammal Species - 8.3



Sl. No.	Common Name	Scientific Name	IUCN Status
1	Golden Jackal	*Canis aureus*	Least Concerned
2	Indian Flying Fox	*Pteropus giganteus*	Least Concerned
3	Nilgai	*Boselaphus tragocamelus*	Least Concerned
4	Smooth-coated Otter	*Lutrogale perspicillata*	Vulnerable

Gandak
Bird Species - 9.1



Sl. No.	Common Name	Scientific Name	IUCN Status
1	Asian Openbill	*Anastomus oscitans*	Least Concerned
2	Asian Palm Swift	*Cypsiurus balasiensis*	Least Concerned
3	Bar-headed Goose	*Anser indicus*	Least Concerned
4	Barn Swallow	*Hirundo rustica*	Least Concerned
5	Black Drongo	*Dicrurus macrocercus*	Least Concerned
6	Black Kite	*Milvus migrans*	Least Concerned
7	Black Stork	*Ciconia nigra*	Least Concerned
8	Citrine Wagtail	*Motacilla citreola*	Least Concerned
9	Common Greenshank	*Tringa nebularia*	Least Concerned
10	Common Kestrel	*Falco tinnunculus*	Least Concerned
11	Common Merganser	*Mergus merganser*	Least Concerned

12	Common Sandpiper	*Actitis hypoleucos*	Least Concerned
13	Common Shelduck	*Tadorna tadorna*	Least Concerned
14	Common Teal	*Anas crecca*	Least Concerned
15	Egyptian Vulture	*Neophron percnopterus*	Endangered
16	Eurasian Curlew	*Numenius arquata*	Near Threatened
17	Eurasian Wigeon	*Mareca penelope*	Least Concerned
18	Gadwall	*Mareca strepera*	Least Concerned
19	Great Cormorant	*Phalacrocorax carbo*	Least Concerned
20	Great Crested Grebe	*Podiceps cristatus*	Least Concerned
21	Great Egret	*Ardea alba*	Least Concerned
22	Greater Coucal	*Centropus sinensis*	Least Concerned
23	Grey Heron	*Ardea cinerea*	Least Concerned
24	Indian Pond-Heron	*Ardeola grayii*	Least Concerned
25	Intermediate Egret	*Ardea intermedia*	Least Concerned
26	Large-billed Crow	*Corvus macrorhynchos*	Least Concerned
27	Lesser Whistling-Duck	*Dendrocygna javanica*	Least Concerned
28	Little Cormorant	*Microcarbo niger*	Least concerned
29	Little Egret	*Egretta garzetta*	Least Concerned
30	Little Ringed Plover	*Charadrius dubius*	Least Concerned
31	Little Swift	*Apus affinis*	Least Concerned
32	Long-legged Buzzard	*Buteo rufinus*	Least Concerned
33	Mallard	*Anas platyrhynchos*	Least Concerned
34	Northern Pintail	*Anas acuta*	Least Concerned
35	Oriental Darter	*Anhinga melanogaster*	Near Threatened
36	Oriental Honey-buzzard	*Pernis ptilorhynchus*	Least Concerned
37	Osprey	*Pandion haliaetus*	Least Concerned
38	Painted Stork	*Mycteria leucocephala*	Near Threatened
39	Pallas's Gull	*Ichthyaetus ichthyaetus*	Least Concerned
40	Peregrine Falcon	*Falco peregrinus*	Least Concerned
41	Pied Kingfisher	*Ceryle rudis*	Least Concerned

42	Red-crested Pochard	*Netta rufina*	Least Concerned
43	Red-wattled Lapwing	*Vanellus indicus*	Least Concerned
44	Ruddy Shelduck	*Tadorna ferruginea*	Least Concerned
45	Pale Martin	*Riparia diluta*	Least Concerned
46	Shikra	*Accipiter badius*	Least Concerned
47	Striated Heron	*Butorides striata*	Least Concerned
48	Oriental Turtle-Dove	*Streptopelia orientalis*	Least Concerned
49	White Wagtail	*Motacilla alba*	Least Concerned
50	White-throated Kingfisher	*Halcyon smyrnensis*	Least Concerned
51	Asian Woolly-necked Stork	*Ciconia episcopus*	Near Threatened

Reptile Species - 9.2



Sl. No.	Common Name	Scientific Name	IUCN Status
1	Brown Roofed Turtle	*Pangshura smithii*	Near Threatened
2	Checkered Keelback	*Fowlea piscator*	Least concerned
3	Gharial	*Gavialis gangeticus*	Critically Endangered
4	Indian Tent Turtle	*Pangshura tentoria*	Least concerned
5	Mugger	*Crocodylus palustris*	Vulnerable

Mammal Species - 9.3



Sl. No.	Common Name	Scientific Name	IUCN Status
1	Northern Plains Grey Langur	*Semnopithecus entellus*	Least Concerned
3	Nilgai	*Boselaphus tragocamelus*	Least Concerned
4	Rhesus Macaque	*Macaca mulatta*	Least Concerned

Mahananda Bird Species - 10.1



Sl. No.	Common Name	Scientific Name	IUCN Status
1	Asian Openbill	*Anastomus oscitans*	Least Concerned
2	Asian Palm Swift	*Cypsiurus balasiensis*	Least Concerned
3	Indian Pied Starling	*Gracupica contra*	Least Concerned

4	Bar-headed Goose	*Anser indicus*	Least Concerned
5	Barn Swallow	*Hirundo rustica*	Least Concerned
6	Black Drongo	*Dicrurus macrocercus*	Least Concerned
7	Black Kite	*Milvus migrans*	Least Concerned
8	Black-headed Ibis	*Threskiornis melanocephalus*	Near Threatened
9	Black-winged Kite	*Elanus caeruleus*	Least Concerned
10	Cattle Egret	*Bubulcus ibis*	Least Concerned
11	Common Greenshank	*Tringa nebularia*	Least Concerned
12	Common Kestrel	*Falco tinnunculus*	Least Concerned
13	Common Kingfisher	*Alcedo atthis*	Least Concerned
14	Common Merganser	*Mergus merganser*	Least Concerned
15	Common Sandpiper	*Actitis hypoleucos*	Least Concerned
16	Common Teal	*Anas crecca*	Least Concerned
17	Eurasian Collared-Dove	*Streptopelia decaocto*	Least Concerned
18	Gadwall	*Mareca strepera*	Least Concerned
19	Great Cormorant	*Phalacrocorax carbo*	Least Concerned
20	Great Crested Grebe	*Podiceps cristatus*	Least Concerned
21	Great Egret	*Ardea alba*	Least Concerned
22	Grey Heron	*Ardea cinerea*	Least Concerned
23	Grey Wagtail	*Motacilla cinerea*	Least Concerned
24	Indian Pond-Heron	*Ardeola grayii*	Least Concerned
25	Indian Spotted Eagle	*Clanga hastata*	Vulnerable
26	Intermediate Egret	*Ardea intermedia*	Least Concerned
27	Lesser Adjutant	*Leptoptilos javanicus*	Vulnerable
28	Lesser Whistling-Duck	*Dendrocygna javanica*	Least Concerned
29	Little Cormorant	*Microcarbo niger*	Least concerned
30	Little Egret	*Egretta garzetta*	Least Concerned
31	Little Ringed Plover	*Charadrius dubius*	Least Concerned
32	Long-legged Buzzard	*Buteo rufinus*	Least Concerned
33	Little Swift	*Apus affinis*	Least Concerned
34	Northern Lapwing	*Vanellus vanellus*	Near Threatened
35	Oriental Magpie-Robin	*Copsychus saularis*	Least Concerned
36	Osprey	*Pandion haliaetus*	Least Concerned
37	Peregrine Falcon	*Falco peregrinus*	Least Concerned
38	Pied Kingfisher	*Ceryle rudis*	Least Concerned
39	Pallas's Gull	*Ichthyaetus ichthyaetus*	Least Concerned
40	Red-naped Ibis	*Pseudibis papillosa*	Least Concerned
41	River Lapwing	*Vanellus duvaucelii*	Near Threatened
42	Ruddy Shelduck	*Tadorna ferruginea*	Least Concerned

43	Pale Martin	*Riparia diluta*	Least Concerned
44	Small Pratincole	*Glareola lactea*	Least Concerned
45	Spotted Dove	*Streptopelia chinensis*	Least Concerned
46	Striated Heron	*Butorides striata*	Least Concerned
47	White Wagtail	*Motacilla alba*	Least Concerned
48	White-throated Kingfisher	*Halcyon smyrnensis*	Least Concerned
49	Asian Woolly-necked Stork	*Ciconia episcopus*	Near Threatened

Reptile Species - 10.2



Sl. No.	Common Name	Scientific Name	IUCN Status
1	Gharial	*Gavialis gangeticus*	Critically endangered

Mammal Species - 10.3



Sl. No.	Common Name	Scientific Name	IUCN Status
1	Golden Jackal	*Canis aureus*	Least Concerned

Kosi
Bird Species - 11.1



Sl. No.	Common Name	Scientific Name	IUCN Status
1	Asian Openbill	*Anastomus oscitans*	Least Concerned
2	Indian Pied Starling	*Gracupica contra*	Least Concerned
3	Bar-headed Goose	*Anser indicus*	Least Concerned
4	Barn Swallow	*Hirundo rustica*	Least Concerned
5	Black Drongo	*Dicrurus macrocercus*	Least Concerned
6	Black Kite	*Milvus migrans*	Least Concerned
7	Black Stork	*Ciconia nigra*	Least Concerned
8	Black-headed Ibis	*Threskiornis melanocephalus*	Near Threatened
9	Black-necked Stork	*Ephippiorhynchus asiaticus*	Near Threatened
10	Black-winged Kite	*Elanus caeruleus*	Least Concerned
11	Cattle Egret	*Bubulcus ibis*	Least Concerned
12	Common Greenshank	*Tringa nebularia*	Least Concerned

13	Common Kingfisher	*Alcedo atthis*	Least Concerned
14	Common Merganser	*Mergus merganser*	Least Concerned
15	Common Myna	*Acridotheres tristis*	Least Concerned
16	Common Redshank	*Tringa totanus*	Least Concerned
17	Common Sandpiper	*Actitis hypoleucos*	Least Concerned
18	Eurasian Coot	*Fulica atra*	Least Concerned
19	Gadwall	*Mareca strepera*	Least Concerned
20	Great Cormorant	*Phalacrocorax carbo*	Least Concerned
21	Great Crested Grebe	*Podiceps cristatus*	Least Concerned
22	Great Egret	*Ardea alba*	Least Concerned
23	Greater Adjutant	*Leptoptilos dubius*	Endangered
24	Greater Coucal	*Centropus sinensis*	Least Concerned
25	Grey Heron	*Ardea cinerea*	Least Concerned
26	Eurasian Hoopoe	*Upupa epops*	Least Concerned
27	Indian Pond-Heron	*Ardeola grayii*	Least Concerned
28	Indian Spot-billed Duck	*Anas poecilorhyncha*	Least Concerned
29	Indian Spotted Eagle	*Clanga hastata*	Vulnerable
30	Kentish Plover	*Charadrius alexandrinus*	Least Concerned
31	Large-billed Crow	*Corvus macrorhynchos*	Least Concerned
32	Lesser Adjutant	*Leptoptilos javanicus*	Vulnerable
33	Little Cormorant	*Microcarbo niger*	Least concerned
34	Little Egret	*Egretta garzetta*	Least Concerned
35	Little Ringed Plover	*Charadrius dubius*	Least Concerned
36	Little Stint	*Calidris minuta*	Least Concerned
37	Long-legged Buzzard	*Buteo rufinus*	Least Concerned
38	Oriental Darter	*Anhinga melanogaster*	Near Threatened
39	Oriental Honey-buzzard	*Pernis ptilorhynchus*	Least Concerned
40	Osprey	*Pandion haliaetus*	Least Concerned
41	Painted Stork	*Mycteria leucocephala*	Near Threatened
42	Pallas's Gull	*Ichthyaetus ichthyaetus*	Least Concerned
43	Peregrine Falcon	*Falco peregrinus*	Least Concerned
44	Pied Harrier	*Circus melanoleucos*	Least Concerned
45	Pied Kingfisher	*Ceryle rudis*	Least Concerned
46	Purple Heron	*Ardea purpurea*	Least Concerned
47	Red-crested Pochard	*Netta rufina*	Least Concerned
48	Red-naped Ibis	*Pseudibis papillosa*	Least Concerned
49	River Lapwing	*Vanellus duvaucelii*	Near Threatened
50	River Tern	*Sterna aurantia*	Vulnerable
51	Ruddy Shelduck	*Tadorna ferruginea*	Least Concerned
52	Pale Martin	*Riparia diluta*	Least Concerned

53	Shikra	*Accipiter badius*	Least Concerned
54	Small Pratincole	*Glareola lactea*	Least Concerned
55	Striated Heron	*Butorides striata*	Least Concerned
56	White Wagtail	*Motacilla alba*	Least Concerned
57	White-browed Wagtail	*Motacilla maderaspatensis*	Least Concerned
58	White-throated Kingfisher	*Halcyon smyrnensis*	Least Concerned
59	Asian Woolly-necked Stork	*Ciconia episcopus*	Near Threatened

Reptile Species - 11.2



Sl. No.	Common Name	Scientific Name	IUCN Status
1	Brown Roofed Turtle	*Pangshura smithii*	Near Threatened
2	Checkered Keelback	*Fowlea piscator*	Least concerned
3	Gharial	*Gavialis gangeticus*	Critically endangered
4	Indian Tent Turtle	*Panshura tentoria*	Least concerned

Mammal Species - 11.3



Sl. No.	Common Name	Scientific Name	IUCN Status
1	Golden Jackal	*Canis aureus*	Least Concerned
2	Nilgai	*Boselaphus tragocamelus*	Least Concerned

JHARKHAND



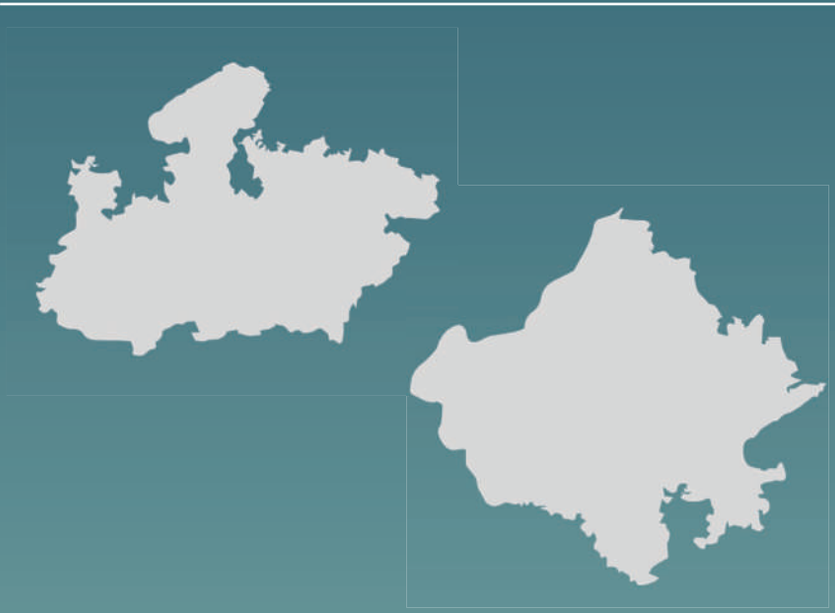
GANGA
Bird Species - 12.1

Sl. No.	Common name	Scientific name	IUCN status
1	Asian Openbill	*Anastomus oscitans*	Least Concerned
2	Indian Pied Starling	*Gracupica contra*	Least Concerned
3	Bank Myna	*Acridotheres ginginianus*	Least Concerned
4	Barn Swallow	*Hirundo rustica*	Least Concerned
5	Black Drongo	*Dicrurus macrocercus*	Least Concerned
6	Black-headed Gull	*Chroicocephalus ridibundus*	Least Concerned
7	Black-headed Ibis	*Threskiornis melanocephalus*	Near Threatened
8	Black Kite	*Milvus migrans*	Least Concerned
9	Black-crowned Night-Heron	*Nycticorax nycticorax*	Least Concerned
10	Blue-tailed Bee-eater	*Merops philippinus*	Least Concerned
11	Brown-headed Gull	*Chroicocephalus brunnicephalus*	Least Concerned
12	Cattle Egret	*Bubulcus ibis*	Least Concerned
13	Citrine Wagtail	*Motacilla citreola*	Least Concerned
14	Common Greenshank	*Tringa nebularia*	Least Concerned
15	Common Myna	*Acridotheres tristis*	Least Concerned
16	Eurasian Curlew	*Numenius arquata*	Near Threatened
17	Garganey	*Spatula querquedula*	Least Concerned
18	Great Cormorant	*Phalacrocorax carbo*	Least Concerned
19	Great Crested Grebe	*Podiceps cristatus*	Least Concerned
20	Great Egret	*Ardea alba*	Least Concerned
21	Grey Heron	*Ardea cinerea*	Least Concerned
22	House Crow	*Corvus splendens*	Least Concerned
23	Indian Pond-Heron	*Ardeola grayii*	Least Concerned
24	Intermediate Egret	*Ardea intermedia*	Least Concerned
25	Kentish Plover	*Charadrius alexandrinus*	Least Concerned
26	Large-billed Crow	*Corvus macrorhynchos*	Least Concerned
27	Lesser Adjutant	*Leptoptilos javanicus*	Vulnerable
28	Little Cormorant	*Microcarbo niger*	Least Concerned
29	Little Egret	*Egretta garzetta*	Least Concerned
30	Little Grebe	*Tachybaptus ruficollis*	Least Concerned
31	Little Ringed Plover	*Charadrius dubius*	Least Concerned
32	Little Stint	*Calidris minuta*	Least Concerned
33	Little tern	*Sternula albifrons*	Least Concerned
34	Northern Pintail	*Anas acuta*	Least Concerned
35	Osprey	*Pandion haliaetus*	Least Concerned
36	Pallas's Gull	*Ichthyaetus ichthyaetus*	Least Concerned

37	Pied Avocet	*Recurvirostra avosetta*	Least Concerned
38	Pied Harrier	*Circus melanoleucos*	Least Concerned
39	Pied Kingfisher	*Ceryle rudis*	Least Concerned
40	Plain Martin	*Prinia inornata*	Least Concerned
41	Red-wattled Lapwing	*Vanellus indicus*	Least Concerned
42	Red-naped Ibis	*Pseudibis papillosa*	Least Concerned
43	River Lapwing	*Vanellus duvaucelii*	Near Threatened
44	Ruddy Shelduck	*Tadorna ferruginea*	Least Concerned
45	Pale Martin	*Riparia diluta*	Least Concerned
46	Small Pratincole	*Glareola lactea*	Least Concerned
47	Tufted Duck	*Aythya fuligula*	Least Concerned
48	Whiskered Tern	*Chlidonias hybrida*	Least Concerned
49	White-throated Kingfisher	*Halcyon smyrnensis*	Least Concerned
50	White-breasted Waterhen	*Amaurornis phoenicurus*	Least Concerned
51	White Wagtail	*Motacilla alba*	Least Concerned
52	Asian Woolly-necked Stork	*Ciconia episcopus*	Near Threatened



MADHYA PRADESH & RAJASTHAN



CHAMBAL
Bird Species - 13.1

Sl. No.	Common name	Scientific name	IUCN status
1	Bar-headed Goose	*Anser indicus*	Least Concerned
2	Black-bellied Tern	*Sterna acuticauda*	Endangered
3	Black-headed Gull	*Chroicocephalus ridibundus*	Least Concerned
4	Black-winged Kite	*Elanus caeruleus*	Least Concerned
5	Black-winged Stilt	*Himantopus himantopus*	Least Concerned
6	Blue Rock-Thrush	*Monticola solitarius*	Least Concerned
7	Brown-headed Gull	*Chroicocephalus brunnicephalus*	Least Concerned
8	Cattle Egret	*Bubulcus ibis*	Least Concerned
9	Common Crane	*Grus grus*	Least Concerned
10	Common Greenshank	*Tringa nebularia*	Least Concerned
11	Common Sandpiper	*Actitis hypoleucos*	Least Concerned
12	Egyptian Vulture	*Neophron percnopterus*	Endangered
13	Eurasian Coot	*Fulica atra*	Least Concerned
14	Eurasian Spoonbill	*Platalea leucorodia*	Least Concerned
15	Common Teal	*Anas crecca*	Least Concerned
16	Great Cormorant	*Phalacrocorax carbo*	Least Concerned
17	Great Egret	*Ardea alba*	Least Concerned
18	Great Thick-knee	*Esacus recurvirostris*	Near Threatened
19	Great White Pelican	*Pelecanus onocrotalus*	Least Concerned
20	Green Sandpiper	*Tringa ochropus*	Least Concerned
21	Grey Heron	*Ardea cinerea*	Least Concerned
22	Indian Cormorant	*Phalacrocorax fuscicollis*	Least Concerned
23	Indian Peafowl	*Pavo cristatus*	Least Concerned
24	Indian Skimmer	*Rynchops albicollis*	Endangered
25	Indian Spot-billed Duck	*Anas poecilorhyncha*	Least Concerned
26	Intermediate Egret	*Ardea intermedia*	Least Concerned
27	Knob-billed Duck	*Sarkidiornis melanotos*	Least Concerned
28	Lesser Whistling-Duck	*Dendrocygna javanica*	Least Concerned
29	Little Cormorant	*Microcarbo niger*	Least Concerned
30	Little Egret	*Egretta garzetta*	Least Concerned
31	Little Ringed Plover	*Charadrius dubius*	Least Concerned
32	Little Stint	*Calidris minuta*	Least Concerned
33	Marsh Sandpiper	*Tringa stagnatilis*	Least Concerned
34	Osprey	*Pandion haliaetus*	Least Concerned
35	Painted Stork	*Mycteria leucocephala*	Near Threatened
36	Pallas's Gull	*Ichthyaetus ichthyaetus*	Least Concerned

37	Pied Kingfisher	*Ceryle rudis*	Least Concerned
38	Purple Heron	*Ardea purpurea*	Least Concerned
39	Red-naped Ibis	*Pseudibis papillosa*	Least Concerned
40	Red-wattled Lapwing	*Vanellus indicus*	Least Concerned
41	River Lapwing	*Vanellus duvaucelii*	Near Threatened
42	River Tern	*Sterna aurantia*	Vulnerable
43	Blue Rock Pigeon	*Columba livia*	Least Concerned
44	Rose-ringed Parakeet	*Psittacula krameri*	Least Concerned
45	Ruddy Shelduck	*Tadorna ferruginea*	Least Concerned
46	Sirkeer malkoha	*Taccocua leschenaultii*	Least Concerned
47	White Wagtail	*Motacilla alba*	Least Concerned
48	White-browed Wagtail	*Motacilla maderaspatensis*	Least Concerned
49	White-throated Kingfisher	*Halcyon smyrnensis*	Least Concerned
50	Asian Woolly-necked Stork	*Ciconia episcopus*	Near Threatened

Reptile Species - 13.2



Sl. No.	Common name	Scientific name	IUCN status
1	Brown Roofed Turtle	*Pangshura smithii*	Near Threatened
2	Gharial	*Gavialis gangeticus*	Critically Endangered
3	Ganges Soft-shelled Turtle	*Nilssonia gangetica*	Endangered
4	Indian Tent Turtle	*Pangshura tentoria*	Least Concerned
5	Mugger	*Crocodylus palustris*	Vulnerable
6	Red-crowned Roofed turtle	*Batagur kachuga*	Critically Endangered
7	Three-striped Roofed Turtle	*Batagur dhongoka*	Critically Endangered

Mammal Species - 13.3



Sl. No.	Common name	Scientific name	IUCN status
1	Nilgai	*Boselaphus tragocamelus*	Least Concerned


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WEST BENGAL



Bhagirathi-Hooghly Bird Species - 14.1

Sl. No.	Common name	Scientific name	IUCN status
1	Asian Koel	*Eudynamys scolopaceus*	Least Concern
2	Asian Openbill	*Anastomus oscitans*	Least Concern
3	Asian Palm Swift	*Cypsiurus balasiensis*	Least Concern
4	Indian Pied Starling	*Gracupica contra*	Least Concern
5	Bank Myna	*Acridotheres ginginianus*	Least Concern
6	Barn Swallow	*Hirundo rustica*	Least Concern
7	Black Drongo	*Dicrurus macrocercus*	Least Concern
8	Black-headed Gull	*Chroicocephalus ridibundus*	Least Concern
9	Black-headed Ibis	*Threskiornis melanocephalus*	Near Threatened
10	Black Kite	*Milvus migrans*	Least Concern
11	Black-winged Stilt	*Himantopus himantopus*	Least Concern
12	Black-crowned Night-Heron	*Nycticorax nycticorax*	Least Concern
13	Blue-tailed Bee-eater	*Merops philippinus*	Least Concern
14	Brown-headed Gull	*Chroicocephalus brunnicephalus*	Least Concern
15	Cattle Egret	*Bubulcus ibis*	Least Concern
16	Chestnut-headed Bee-eater	*Merops leschenaulti*	Least Concern
17	Common Greenshank	*Tringa nebularia*	Least Concern
18	Common Hawk-Cuckoo	*Hierococcyx varius*	Least Concern
19	Common Kingfisher	*Alcedo atthis*	Least Concern
20	Common Pochard	*Aythya ferina*	Vulnerable
21	Common Redshank	*Tringa totanus*	Least Concern
22	Common Sandpiper	*Actitis hypoleucos*	Least Concern
23	Eurasian Wigeon	*Mareca penelope*	Least Concern
24	Garganey	*Spatula querquedula*	Least Concern
25	Grey Wagtail	*Motacilla cinerea*	Least Concern
26	Great Cormorant	*Phalacrocorax carbo*	Least Concern
27	Great Egret	*Ardea alba*	Least Concern
28	Greater Coucal	*Centropus sinensis*	Least Concern
29	Asian Green Bee-eater	*Merops orientalis*	Least Concern
30	Green Sandpiper	*Tringa ochropus*	Least Concern
31	Grey-headed Lapwing	*Vanellus cinereus*	Least Concern
32	Grey Heron	*Ardea cinerea*	Least Concern
33	House Crow	*Corvus splendens*	Least Concern
34	Indian Cormorant	*Phalacrocorax fuscicollis*	Least Concern
35	Indian Pond-Heron	*Ardeola grayii*	Least Concern
36	Indian Skimmer	*Rynchops albicollis*	Endangered
37	Indian Spot-billed Duck	*Anas poecilorhyncha*	Least Concern
38	Intermediate Egret	*Ardea intermedia*	Least Concern
39	Kentish Plover	*Charadrius alexandrinus*	Least Concern
40	Large-billed Crow	*Corvus macrorhynchos*	Least Concern

41	Lesser Whistling-Duck	*Dendrocygna javanica*	Least Concern
42	Little Cormorant	*Microcarbo niger*	Least Concern
43	Little Egret	*Egretta garzetta*	Least Concern
44	Little Ringed Plover	*Charadrius dubius*	Least Concern
45	Little Stint	*Calidris minuta*	Least Concern
46	Little Tern	*Sternula albifrons*	Least Concern
47	Marsh Sandpiper	*Tringa stagnatilis*	Least Concern
48	Oriental Honey buzzard	*Pernis ptilorhynchus*	Least Concern
49	Oriental Darter	*Anhinga melanogaster*	Near Threatened
50	Osprey	*Pandion haliaetus*	Least Concern
51	Pallas's Gull	*Ichthyaetus ichthyaetus*	Least Concern
52	Pied Kingfisher	*Ceryle rudis*	Least Concern
53	Plain Martin	*Prinia inornata*	Least Concern
54	Red-wattled Lapwing	*Vanellus indicus*	Least Concern
55	Red-naped Ibis	*Pseudibis papillosa*	Least Concern
56	River Lapwing	*Vanellus duvaucelii*	Near Threatened
57	Ruddy Shelduck	*Tadorna ferruginea*	Least Concern
58	Rufous Treepie	*Dendrocitta vagabunda*	Least Concern
59	Pale Martin	*Riparia diluta*	Least Concern
60	Shikra	*Accipiter badius*	Least Concern
61	Small Pratincole	*Glareola lactea*	Least Concern
62	Spotted Dove	*Spilopelia chinensis*	Least Concern
63	Spotted Redshank	*Tringa erythropus*	Least Concern
64	Stork-billed Kingfisher	*Pelargopsis capensis*	Least Concern
65	Streak-throated Swallow	*Petrochelidon fluvicola*	Least Concern
66	Striated Heron	*Butorides striata*	Least Concern
67	Temminck's Stint	*Calidris temminckii*	Least Concern
68	White-breasted Waterhen	*Amaurornis phoenicurus*	Least Concern
69	White-browed Wagtail	*Motacilla maderaspatensis*	Least Concern
70	White-throated Kingfisher	*Halcyon smyrnensis*	Least Concern
71	White Wagtail	*Motacilla alba*	Least Concern
72	Wood Sandpiper	*Tringa glareola*	Least Concern

Mammal Species - 14.2



Sl. No.	Common name	Scientific name	IUCN status
1	Golden Jackal	*Canis aureus*	Least Concern
2	Northern Plains Grey Langur	*Semnopithecus entellus*	Least Concern
3	Indian Flying Fox	*Pteropus giganteus*	Least Concern

RUPNARAYAN
Bird Species - 15.1

Sl. No.	Common name	Scientific name	IUCN status
1	Asian Openbill	*Anastomus oscitans*	Least Concern
2	Asian Palm Swift	*Cypsiurus balasiensis*	Least Concern
3	Indian Pied Starling	*Gracupica contra*	Least Concern
4	Black Drongo	*Dicrurus macrocercus*	Least Concern
5	Black Kite	*Milvus migrans*	Least Concern
6	Brown-headed Gull	*Chroicocephalus brunnicephalus*	Least Concern
7	Cattle Egret	*Bubulcus ibis*	Least Concern
8	Common Greenshank	*Tringa nebularia*	Least Concern
9	Common Myna	*Acridotheres tristis*	Least Concern
10	Common Sandpiper	*Actitis hypoleucos*	Least Concern
11	Great Egret	*Ardea alba*	Least Concern
12	Greater Coucal	*Centropus sinensis*	Least Concern
13	Indian Pond-Heron	*Ardeola grayii*	Least Concern
14	Little Cormorant	*Microcarbo niger*	Least Concern
15	Little Egret	*Egretta garzetta*	Least Concern
16	Oriental Honey-buzzard	*Pernis ptilorhynchus*	Least Concern
17	Osprey	*Pandion haliaetus*	Least Concern
18	Red-wattled Lapwing	*Vanellus indicus*	Least Concern
19	Rufous Treepie	*Dendrocitta vagabunda*	Least Concern
20	Shikra	*Accipiter badius*	Least Concern
21	Spotted Dove	*Spilopelia chinensis*	Least Concern
22	White Wagtail	*Motacilla alba*	Least Concern
23	White-throated Kingfisher	*Halcyon smyrnensis*	Least Concern

SHILABATI
Bird Species - 16.1

Sl. No.	Common name	Scientific name	IUCN status
1	Asian Palm Swift	*Cypsiurus balasiensis*	Least Concern
2	Common Kingfisher	*Alcedo atthis*	Least Concern
3	Indian Pond-Heron	*Ardeola grayii*	Least Concern
4	Little Egret	*Egretta garzetta*	Least Concern
5	Rufous Treepie	*Dendrocitta vagabunda*	Least Concern
6	Spotted Dove	*Spilopelia chinensis*	Least Concern
7	White-throated Kingfisher	*Halcyon smyrnensis*	Least Concern

Mundeswari
Bird Species - 17.1



Sl. No.	Common name	Scientific name	IUCN status
1	Asian Palm Swift	*Cypsiurus balasiensis*	Least Concern
2	Black Kite	*Milvus migrans*	Least Concern
3	Cattle Egret	*Bubulcus ibis*	Least Concern
4	Common Sandpiper	*Actitis hypoleucos*	Least Concern
5	Great Egret	*Ardea alba*	Least Concern
6	Indian Pond-Heron	*Ardeola grayii*	Least Concern
7	Little Cormorant	*Microcarbo niger*	Least Concern
8	Little Egret	*Egretta garzetta*	Least Concern
9	Rufous Treepie	*Dendrocitta vagabunda*	Least Concern
10	Spotted Dove	*Spilopelia chinensis*	Least Concern

Reptile Species - 17.2



Sl. No.	Common name	Scientific name	IUCN status
1	Bengal Monitor	*Varanus bengalensis*	Least Concern

Bakshi CANAL
Bird Species - 18.1



Sl. No.	Common name	Scientific name	IUCN status
1	Asian Openbill	*Anastomus oscitans*	Least Concern
2	Indian Pied Starling	*Gracupica contra*	Least Concern
3	Black Drongo	*Dicrurus macrocercus*	Least Concern
4	Cattle Egret	*Bubulcus ibis*	Least Concern
5	Common Sandpiper	*Actitis hypoleucos*	Least Concern
6	Indian Pond-Heron	*Ardeola grayii*	Least Concern
7	Little Egret	*Egretta garzetta*	Least Concern
8	Pied Kingfisher	*Ceryle rudis*	Least Concern
9	Red-vented Bulbul	*Pycnonotus cafer*	Least Concern
10	Red-wattled Lapwing	*Vanellus indicus*	Least Concern
11	Rufous Treepie	*Dendrocitta vagabunda*	Least Concern
12	Spotted Dove	*Spilopelia chinensis*	Least Concern
13	White-throated Kingfisher	*Halcyon smyrnensis*	Least Concern

Dwarakeswar
Bird Species - 19.1



Sl. No.	Common name	Scientific name	IUCN status
1	Asian Palm Swift	*Cypsiurus balasiensis*	Least Concern
2	Cattle Egret	*Bubulcus ibis*	Least Concern
3	Little Cormorant	*Microcarbo niger*	Least Concern
4	Little Egret	*Egretta garzetta*	Least Concern
5	Pied Kingfisher	*Ceryle rudis*	Least Concern
6	Rufous Treepie	*Dendrocitta vagabunda*	Least Concern
7	Spotted Dove	*Spilopelia chinensis*	Least Concern
8	Striated Heron	*Butorides striata*	Least Concern
9	White-breasted Waterhen	*Amaurornis phoenicurus*	Least Concern

Reptile Species - 19.2



Sl. No.	Common name	Scientific name	IUCN status
1	Bengal Monitor	*Varanus bengalensis*	Least Concern

Mammal Species - 19.3



Sl. No.	Common name	Scientific name	IUCN status
1	Indian Grey Mongoose	*Herpestes edwardsii*	Least Concern

HALDI
Bird Species - 20.1



Sl. No.	Common name	Scientific name	IUCN status
1	Asian Openbill	*Anastomus oscitans*	Least Concern
2	Indian Pied Starling	*Gracupica contra*	Least Concern
3	Black Drongo	*Dicrurus macrocercus*	Least Concern
4	Cattle Egret	*Bubulcus ibis*	Least Concern
5	Common Myna	*Acridotheres tristis*	Least Concern
6	Common Redshank	*Tringa totanus*	Least Concern
7	Common Sandpiper	*Actitis hypoleucos*	Least Concern
8	Great Cormorant	*Phalacrocorax carbo*	Least Concern

9	Great Egret	*Ardea alba*	Least Concern
10	Gull-billed Tern	*Gelochelidon nilotica*	Least Concern
11	Indian Pond-Heron	*Ardeola grayii*	Least Concern
12	Little Cormorant	*Microcarbo niger*	Least Concern
13	Little Egret	*Egretta garzetta*	Least Concern
14	Little Ringed Plover	*Charadrius dubius*	Least Concern
15	Little Swift	*Apus affinis*	Least Concern
16	Osprey	*Pandion haliaetus*	Least Concern
17	Red-wattled Lapwing	*Vanellus indicus*	Least Concern
18	Shikra	*Accipiter badius*	Least Concern
19	White Wagtail	*Motacilla alba*	Least Concern

Churni
Bird Species - 21.1



Sl. No.	Common name	Scientific name	IUCN status
1	Ashy Drongo	*Dicrurus leucophaeus*	Least Concern
2	Asian Openbill	*Anastomus oscitans*	Least Concern
3	Asian Palm Swift	*Cypsiurus balasiensis*	Least Concern
4	Black Drongo	*Dicrurus macrocercus*	Least Concern
5	Blue-tailed Bee-eater	*Merops philippinus*	Least Concern
6	Cattle Egret	*Bubulcus ibis*	Least Concern
7	Common Myna	*Acridotheres tristis*	Least Concern
8	Common Sandpiper	*Actitis hypoleucos*	Least Concern
9	Indian Pond-Heron	*Ardeola grayii*	Least Concern
10	Golden-fronted Leafbird	*Chloropsis aurifrons*	Least Concern
11	Jungle Babbler	*Argya striata*	Least Concern
12	Large-billed Crow	*Corvus macrorhynchos*	Least Concern
13	Lesser Coucal	*Centropus bengalensis*	Least Concern
14	Little Cormorant	*Microcarbo niger*	Least Concern
15	Little Egret	*Egretta garzetta*	Least Concern
16	Red-wattled Lapwing	*Vanellus indicus*	Least Concern
17	Rufous Treepie	*Dendrocitta vagabunda*	Least Concern
18	Spotted Dove	*Spilopelia chinensis*	Least Concern
19	Stork-billed kingfisher	*Pelargopsis capensis*	Least Concern
20	White Wagtail	*Motacilla alba*	Least Concern
21	White-browed Wagtail	*Motacilla maderaspatensis*	Least Concern
22	White-throated Kingfisher	*Halcyon smyrnensis*	Least Concern

Reptile Species - 21.2



Sl. No.	Common name	Scientific name	IUCN status
1	Indian Ratsnake	*Ptyas mucosa*	Least Concern

Mammal Species - 21.3



Sl. No.	Common name	Scientific name	IUCN status
1	Golden Jackal	*Canis aureus*	Least Concern

Torsa
Bird Species - 22.1



Sl. No.	Common name	Scientific name	IUCN status
1	Asian Openbill	*Anastomus oscitans*	Least Concern
2	Black Drongo	*Dicrurus macrocercus*	Least Concern
3	Black Kite	*Milvus migrans*	Least Concern
4	Cinnamon Bittern	*Ixobrychus cinnamomeus*	Least Concern
5	Common Greenshank	*Tringa nebularia*	Least Concern
6	Common Sandpiper	*Actitis hypoleucos*	Least Concern
7	Great Egret	*Ardea alba*	Least Concern
8	Green Sandpiper	*Tringa ochropus*	Least Concern
9	Grey-headed Lapwing	*Vanellus cinereus*	Least Concern
10	Indian Pond-Heron	*Ardeola grayii*	Least Concern
11	Intermediate Egret	*Ardea intermedia*	Least Concern
12	Lesser Whistling-Duck	*Dendrocygna javanica*	Least Concern
13	Little Cormorant	*Microcarbo niger*	Least Concern
14	Little Egret	*Egretta garzetta*	Least Concern
15	Osprey	*Pandion haliaetus*	Least Concern
16	Pacific Golden-Plover	*Pluvialis fulva*	Least Concern
17	Pied Kingfisher	*Ceryle rudis*	Least Concern
18	Red-naped Ibis	*Pseudibis papillosa*	Least Concern
19	Red-wattled Lapwing	*Vanellus indicus*	Least Concern
20	River Lapwing	*Vanellus duvaucelii*	Near Threatened
21	Striated Heron	*Butorides striata*	Least Concern
22	White-throated Kingfisher	*Halcyon smyrnensis*	Least Concern

KALJANI
Bird Species - 23.1

Sl. No.	Common name	Scientific name	IUCN status
1	Asian Openbill	*Anastomus oscitans*	Least Concern
2	Bank Myna	*Acridotheres ginginianus*	Least Concern
3	Black Drongo	*Dicrurus macrocercus*	Least Concern
4	Black Kite	*Milvus migrans*	Least Concern
5	Blue-tailed Bee-eater	*Merops philippinus*	Least Concern
6	Cattle Egret	*Bubulcus ibis*	Least Concern
7	Common Greenshank	*Tringa nebularia*	Least Concern
8	Common Sandpiper	*Actitis hypoleucos*	Least Concern
9	Great Egret	*Ardea alba*	Least Concern
10	Jungle Babbler	*Argya striata*	Least Concern
11	Lesser Whistling-Duck	*Dendrocygna javanica*	Least Concern
12	Little Cormorant	*Microcarbo niger*	Least Concern
13	Little Egret	*Egretta garzetta*	Least Concern
14	Pied Kingfisher	*Ceryle rudis*	Least Concern
15	Red-wattled Lapwing	*Vanellus indicus*	Least Concern
16	River Lapwing	*Vanellus duvaucelii*	Near Threatened
17	Stork-billed kingfisher	*Pelargopsis capensis*	Least Concern
18	Striated Heron	*Butorides striata*	Least Concern
19	White-throated Kingfisher	*Halcyon smyrnensis*	Least Concern

SUNDARBANS BIOSPHERE RESERVE (SBR)
Bird Species - 24.1

Sl. No.	Common name	Scientific name	IUCN status
1	Ashy Prinia	*Prinia socialis*	Least Concerned
2	Asian Koel	*Eudynamys scolopaceus*	Least Concerned
3	Asian Openbill	*Anastomus oscitans*	Least Concerned
4	Asian Palm Swift	*Cypsiurus balasiensis*	Least Concerned
5	Bar-headed Goose	*Anser indicus*	Least Concerned
6	Barn Swallow	*Hirundo rustica*	Least Concerned
7	Black Bittern	*Ixobrychus flavicollis*	Least Concerned
8	Black Drongo	*Dicrurus macrocercus*	Least Concerned
9	Black Kite	*Milvus migrans*	Least Concerned
10	Black-capped kingfisher	*Halcyon pileata*	Least Concerned
11	Black-crowned Night-Heron	*Nycticorax nycticorax*	Least Concerned

12	Black-headed Gull	*Chroicocephalus ridibundus*	Least Concerned
13	Black-headed Ibis	*Threskiornis melanocephalus*	Near Threatened
14	Black-hooded Oriole	*Oriolus xanthornus*	Least Concerned
15	Black-winged Kite	*Elanus caeruleus*	Least Concerned
16	Black-winged Stilt	*Himantopus himantopus*	Least Concerned
17	Bramhiny Kite	*Haliastur indus*	Least Concerned
18	Brown-headed Gull	*Chroicocephalus brunnicephalus*	Least Concerned
19	Brown-winged Kingfisher	*Pelargopsis amauroptera*	Near Threatened
20	Cattle Egret	*Bubulcus ibis*	Least Concerned
21	Collared Kingfisher	*Todiramphus chloris*	Least Concerned
22	Common Greenshank	*Tringa nebularia*	Least Concerned
23	Common Kingfisher	*Alcedo atthis*	Least Concerned
24	Common Myna	*Acridotheres tristis*	Least Concerned
25	Common Redshank	*Tringa totanus*	Least Concerned
26	Common Sandpiper	*Actitis hypoleucos*	Least Concerned
27	Common Tailorbird	*Orthotomus sutorius*	Least Concerned
28	Eurasian Collared-Dove	*Streptopelia decaocto*	Least Concerned
29	Eurasian Curlew	*Numenius arquata*	Near Threatened
30	Eurasian Wigeon	*Mareca penelope*	Least Concerned
31	Gadwall	*Mareca strepera*	Least Concerned
32	Great Egret	*Ardea alba*	Least Concerned
33	Greater Coucal	*Centropus sinensis*	Least Concerned
34	Asian Green Bee-eater	*Merops orientalis*	Least Concerned
35	Grey Heron	*Ardea cinerea*	Least Concerned
36	Grey-headed Lapwing	*Vanellus cinereus*	Least Concerned
37	Gull-billed Tern	*Gelochelidon nilotica*	Least Concerned
38	Common Hawk-Cuckoo	*Hierococcyx varius*	Least Concerned
39	House Crow	*Corvus splendens*	Least Concerned
40	Indian Pond-Heron	*Ardeola grayii*	Least Concerned
41	Intermediate Egret	*Ardea intermedia*	Least Concerned
42	Jungle Babbler	*Argya striata*	Least Concerned
43	Kentish Plover	*Charadrius alexandrinus*	Least Concerned
44	Large-billed Crow	*Corvus macrorhynchos*	Least Concerned
45	Large-tailed Nightjar	*Caprimulgus macrurus*	Least Concerned
46	Lesser adjutant	*Leptoptilos javanicus*	Vulnerable
47	Lesser Goldenbacked Woodpecker	*Dinopium benghalense*	Least Concerned
48	Lesser Sand-Plover	*Charadrius mongolus*	Least Concerned
49	Lesser Whistling-Duck	*Dendrocygna javanica*	Least Concerned
50	Little Cormorant	*Microcarbo niger*	Least Concerned

51	Little Egret	*Egretta garzetta*	Least Concerned
52	Little Ringed Plover	*Charadrius dubius*	Least Concerned
53	Northern Shoveler	*Spatula clypeata*	Least Concerned
54	Oriental Honey-buzzard	*Pernis ptilorhynchus*	Least Concerned
55	Oriental Magpie-Robin	*Copsychus saularis*	Least Concerned
56	Pacific Golden-Plover	*Pluvialis fulva*	Least Concerned
57	Pallas's Gull	*Ichthyaetus ichthyaetus*	Least Concerned
58	Pied Kingfisher	*Ceryle rudis*	Least Concerned
59	Purple Heron	*Ardea purpurea*	Least Concerned
60	Purple Sunbird	*Cinnyris asiaticus*	Least Concerned
61	Red-vented Bulbul	*Pycnonotus cafer*	Least Concerned
62	Red-wattled Lapwing	*Vanellus indicus*	Least Concerned
63	Red-whiskered Bulbul	*Pycnonotus jocosus*	Least Concerned
64	River Tern	*Sterna aurantia*	Vulnerable
65	Rose-ringed Parakeet	*Psittacula krameri*	Least Concerned
66	Ruddy kingfisher	*Halcyon coromanda*	Least Concerned
67	Rufous Treepie	*Dendrocitta vagabunda*	Least Concerned
68	Shikra	*Accipiter badius*	Least Concerned
69	Small Minivet	*Pericrocotus cinnamomeus*	Least Concerned
70	Spotted Dove	*Streptopelia chinensis*	Least Concerned
71	Spotted Owlet	*Athene brama*	Least Concerned
72	Striated Heron	*Butorides striata*	Least Concerned
73	Whimbrel	*Numenius phaeopus*	Least Concerned
74	White-breasted Waterhen	*Amaurornis phoenicurus*	Least Concerned
75	White-throated Fantail	*Rhipidura albicollis*	Least Concerned
76	White-throated Kingfisher	*Halcyon smyrnensis*	Least Concerned
77	Yellow-footed Green Pigeon	*Treron phoenicoptera*	Least Concerned

Reptile Species - 24.2



Sl. No.	Common name	Scientific name	IUCN status
1	Dog-faced Water Snake	*Cerberus rynchops*	Least Concerned
2	Saltwater Crocodile	*Crocodylus porosus*	Least Concerned

Mammal Species - 24.3



Sl. No.	Common name	Scientific name	IUCN status
1	Cheetal	*Axis axis*	Least Concerned
2	Indian Flying Fox	*Pteropus giganteus*	Least Concerned

3	Rhesus Macaque	*Macaca mulatta*	Least Concerned

SUNDARBANS TIGER RESERVE (STR)
Bird Species - 25.1

Sl. No.	Common name	Scientific name	IUCN status
1	Alexandrine Parakeet	*Psittacula eupatria*	Near Threatened
2	Ashy Woodswallow	*Artamus fuscus*	Least Concerned
3	Asian Openbill	*Anastomus oscitans*	Least Concerned
4	Asian Palm Swift	*Cypsiurus balasiensis*	Least Concerned
5	Indian Pied Starling	*Gracupica contra*	Least Concerned
6	Barn Swallow	*Hirundo rustica*	Least Concerned
7	Black Drongo	*Dicrurus macrocercus*	Least Concerned
8	Black Kite	*Milvus migrans*	Least Concerned
9	Black-capped Kingfisher	*Halcyon pileata*	Least Concerned
10	Black-crowned Night-Heron	*Nycticorax nycticorax*	Least Concerned
11	Black-headed Gull	*Chroicocephalus ridibundus*	Least Concerned
12	Black-headed Ibis	*Threskiornis melanocephalus*	Near Threatened
13	Black-hooded oriole	*Oriolus xanthornus*	Least Concerned
14	Blue Blue Rock Pigeon	*Columba livia*	Least Concerned
15	Blue-tailed Bee-eater	*Merops philippinus*	Least Concerned
16	Bramhiny Kite	*Haliastur indus*	Least Concerned
17	Bronzed Drongo	*Dicrurus aeneus*	Least Concerned
18	Brown-headed Gull	*Chroicocephalus brunnicephalus*	Least Concerned
19	Brown-winged Kingfisher	*Pelargopsis amauroptera*	Near Threatened
20	Caspian Tern	*Hydroprogne caspia*	Least Concerned
21	Cattle Egret	*Bubulcus ibis*	Least Concerned
22	Changeable Hawk-Eagle	*Nisaetus cirrhatus*	Least Concerned
23	Collared Kingfisher	*Todiramphus chloris*	Least Concerned
24	Common Greenshank	*Tringa nebularia*	Least Concerned
25	Common Kingfisher	*Alcedo atthis*	Least Concerned
26	Common Myna	*Acridotheres tristis*	Least Concerned
27	Common Redshank	*Tringa totanus*	Least Concerned
28	Common Sandpiper	*Actitis hypoleucos*	Least Concerned
29	Crested Serpent-Eagle	*Spilornis cheela*	Least Concerned
30	Eurasian Collared-Dove	*Streptopelia decaocto*	Least Concerned
31	Eurasian Curlew	*Numenius arquata*	Near Threatened

32	Eurasian Wigeon	*Mareca penelope*	Least Concerned
33	Gadwall	*Mareca strepera*	Least Concerned
34	Great Cormorant	*Phalacrocorax carbo*	Least Concerned
35	Great Egret	*Ardea alba*	Least Concerned
36	Greater Coucal	*Centropus sinensis*	Least Concerned
37	Greater Flameback	*Chrysoscolaptes guttacristatus*	Least Concerned
38	Greater Sand-Plover	*Charadrius leschenaultii*	Least Concerned
39	Asian Green Bee-eater	*Merops orientalis*	Least Concerned
40	Grey-headed Lapwing	*Vanellus cinereus*	Least Concerned
41	Grey Heron	*Ardea cinerea*	Least Concerned
42	Plain Martin	*Riperia chinensis*	Least Concerned
43	House Crow	*Corvus splendens*	Least Concerned
44	Indian Pond-Heron	*Ardeola grayii*	Least Concerned
45	Intermediate Egret	*Ardea intermedia*	Least Concerned
46	Jungle Myna	*Acridotheres fuscus*	Least Concerned
47	Kentish Plover	*Charadrius alexandrinus*	Least Concerned
48	Large-billed Crow	*Corvus macrorhynchos*	Least Concerned
49	Lesser Adjutant	*Leptoptilos javanicus*	Vulnerable
50	Lesser Goldenbacked Woodpecker	*Dinopium benghalense*	Least Concerned
51	Lesser Sand-Plover	*Charadrius mongolus*	Least Concerned
52	Little Cormorant	*Microcarbo niger*	Least Concerned
53	Little Egret	*Egretta garzetta*	Least Concerned
54	Little Ringed Plover	*Charadrius dubius*	Least Concerned
55	Northern Pintail	*Anas acuta*	Least Concerned
56	Northern Shoveler	*Spatula clypeata*	Least Concerned
57	Orange Minivet	*Pericrocotus flammeus*	Least Concerned
58	Oriental Magpie-Robin	*Copsychus saularis*	Least Concerned
59	Osprey	*Pandion haliaetus*	Least Concerned
60	Pacific Golden-Plover	*Pluvialis fulva*	Least Concerned
61	Pied Avocet	*Recurvirostra avosetta*	Least Concerned
62	Pied Kingfisher	*Ceryle rudis*	Least Concerned
63	Purple Sunbird	*Cinnyris asiaticus*	Least Concerned
64	Red-vented Bulbul	*Pycnonotus cafer*	Least Concerned
65	Rose-ringed Parakeet	*Psittacula krameri*	Least Concerned
66	Rufous Treepie	*Dendrocitta vagabunda*	Least Concerned
67	Shikra	*Accipiter badius*	Least Concerned
68	Short-toed Snake Eagle	*Circaetus gallicus*	Least Concerned

69	Small Minivet	*Pericrocotus cinnamomeus*	Least Concerned
70	Spotted Dove	*Streptopelia chinensis*	Least Concerned
71	Streak-throated Woodpecker	*Picus xanthopygaeus*	Least Concerned
72	Striated Heron	*Butorides striata*	Least Concerned
73	Western Reef-Heron	*Egretta gularis*	Least Concerned
74	Whimbrel	*Numenius phaeopus*	Least Concerned
75	Whiskered Tern	*Chlidonias hybrida*	Least Concerned
76	White-bellied Sea-Eagle	*Haliaeetus leucogaster*	Least Concerned
77	White-breasted Waterhen	*Amaurornis phoenicurus*	Least Concerned
78	White-browed Wagtail	*Motacilla maderaspatensis*	Least Concerned
79	White-throated Kingfisher	*Halcyon smyrnensis*	Least Concerned
80	Wood Sandpiper	*Tringa glareola*	Least Concerned

Reptile Species - 25.2



Sl. No.	Common name	Scientific name	IUCN status
1	Saltwater Crocodile	*Crocodylus porosus*	Least Concerned
2	Common Water Monitor	*Varanus salvator*	Least Concerned

Mammal Species - 25.3



Sl. No.	Common name	Scientific name	IUCN status
1	Cheetal	*Axis axis*	Least Concerned
2	Rhesus Macaque	*Macaca mulatta*	Least Concerned
3	Wild Boar	*Sus scrofa*	Least Concerned

ASSAM



Brahmaputra
Bird Species - 26.1

Sl. No.	Common name	Scientific name	IUCN status
1	Asian Openbill	*Anastomus oscitans*	Least Concern
2	Bar-headed Goose	*Anser indicus*	Least Concern
3	Black-bellied Tern	*Sterna acuticauda*	Endangered
4	Black Drongo	*Dicrurus macrocercus*	Least Concern
5	Black-headed Gull	*Chroicocephalus ridibundus*	Least Concern
6	Black Kite	*Milvus migrans*	Least Concern
7	Black-necked Stork	*Ephippiorhynchus asiaticus*	Near Threatened
9	Black Stork	*Ciconia nigra*	Least Concern
9	Black-winged Stilt	*Himantopus himantopus*	Least Concern
10	Bonelli's Eagle	*Aquila fasciata*	Least Concern
11	Booted Eagle	*Hieraaetus pennatus*	Least Concern
12	Brown-headed Gull	*Chroicocephalus brunnicephalus*	Least Concern
13	Cattle Egret	*Bubulcus ibis*	Least Concern
14	Eastern Spot-billed Duck	*Anas zonorhyncha*	Least Concern
15	Common Crane	*Grus grus*	Least Concern
16	Common Greenshank	*Tringa nebularia*	Least Concern
17	Common kestrel	*Falco tinnunculus*	Least Concern
18	Common Kingfisher	*Alcedo atthis*	Least Concern
19	Common Merganser	*Mergus merganser*	Least Concern
20	Common Pochard	*Aythya ferina*	Vulnerable
21	Common Sandpiper	*Actitis hypoleucos*	Least Concern
22	Common Shelduck	*Tadorna tadorna*	Least Concern
23	Common Snipe	*Gallinago gallinago*	Least Concern
24	Common Teal	*Anas crecca*	Least Concern
25	Eurasian Curlew	*Numenius arquata*	Near Threatened
26	Eurasian Griffon	*Gyps fulvus*	Least Concern
27	Eurasian Marsh-Harrier	*Circus aeruginosus*	Least Concern
28	Eurasian Wigeon	*Mareca penelope*	Least Concern
29	Falcated Duck	*Mareca falcata*	Near Threatened
30	Ferruginous Pochard	*Aythya nyroca*	Near Threatened
31	Gadwall	*Mareca strepera*	Least Concern
32	Great Cormorant	*Phalacrocorax carbo*	Least Concern
33	Great Crested Grebe	*Podiceps cristatus*	Least Concern

34	Great Egret	*Ardea alba*	Least Concern
35	Great Thick-knee	*Esacus recurvirostris*	Near Threatened
36	Greater Adjutant	*Leptoptilos dubius*	Endangered
37	Green Sandpiper	*Tringa ochropus*	Least Concern
38	Grey-headed Fish-Eagle	*Icthyophaga ichthyaetus*	Near Threatened
39	Grey Heron	*Ardea cinerea*	Least Concern
40	Greylag Goose	*Anser anser*	Least Concern
41	Hen Harrier	*Circus cyaneus*	Least Concern
42	Indian Pond-Heron	*Ardeola grayii*	Least Concern
43	Indian Spot-billed Duck	*Anas poecilorhyncha*	Least Concern
44	Intermediate Egret	*Ardea intermedia*	Least Concern
45	Kentish Plover	*Charadrius alexandrinus*	Least Concern
46	Large-billed Crow	*Corvus macrorhynchos*	Least Concern
47	Lesser Adjutant	*Leptoptilos javanicus*	Vulnerable
48	Little Cormorant	*Microcarbo niger*	Least Concern
49	Little Egret	*Egretta garzetta*	Least Concern
50	Little Ringed Plover	*Charadrius dubius*	Least Concern
51	Long-legged Buzzard	*Buteo rufinus*	Least Concern
52	Mallard	*Anas platyrhynchos*	Least Concern
53	Northern Lapwing	*Vanellus vanellus*	Near Threatened
54	Northern Pintail	*Anas acuta*	Least Concern
55	Northern Shoveler	*Spatula clypeata*	Least Concern
56	Oriental Honey-buzzard	*Pernis ptilorhynchus*	Least Concern
57	Oriental Darter	*Anhinga melanogaster*	Near Threatened
58	Osprey	*Pandion haliaetus*	Least Concern
59	Pacific Golden-Plover	*Pluvialis fulva*	Least Concern
60	Pallas's Fish-Eagle	*Haliaeetus leucoryphus*	Endangered
61	Pallas's Gull	*Ichthyaetus ichthyaetus*	Least Concern
62	Peregrine Falcon	*Falco peregrinus*	Least Concern
63	Pied Avocet	*Recurvirostra avosetta*	Least Concern
64	Pied Harrier	*Circus melanoleucos*	Least Concern
65	Pied Kingfisher	*Ceryle rudis*	Least Concern
66	Plain Martin	*Prinia inornata*	Least Concern
67	Red-crested Pochard	*Netta rufina*	Least Concern
68	Red-wattled Lapwing	*Vanellus indicus*	Least Concern
69	River Lapwing	*Vanellus duvaucelii*	Near Threatened
70	River Tern	*Sterna aurantia*	Vulnerable
71	Ruddy Shelduck	*Tadorna ferruginea*	Least Concern

72	Shikra	*Accipiter badius*	Least Concern
73	Slender-billed Vulture	*Gyps tenuirostris*	Critically Endangered
74	Small Pratincole	*Glareola lactea*	Least Concern
75	Spot-billed Pelican	*Pelecanus philippensis*	Near Threatened
76	Steppe Eagle	*Aquila nipalensis*	Endangered
77	Striated Heron	*Butorides striata*	Least Concern
78	Swamp Francolin	*Francolinus gularis*	Vulnerable
79	Temminck's Stint	*Calidris temminckii*	Least Concern
80	Tufted duck	*Aythya fuligula*	Least Concern
81	Whiskered Tern	*Chlidonias hybrida*	Least Concern
82	White-rumped Vulture	*Gyps bengalensis*	Critically Endangered
83	White-tailed Sea Eagle	*Haliaeetus albicilla*	Least Concern
84	White-throated Kingfisher	*Halcyon smyrnensis*	Least Concern
85	White Wagtail	*Motacilla alba*	Least Concern
86	Asian Woolly-necked Stork	*Ciconia episcopus*	Near Threatened

Reptile Species - 26.2



Sl. No.	Common name	Scientific name	IUCN status
1	Assam Roofed Turtle	*Pangshura sylhetensis*	Critically Endangered
2	Indian Tent Turtle	*Pangshura tentoria*	Least Concern

Mammal Species - 26.3



Sl. No.	Common name	Scientific name	IUCN status
1	Asian Elephant	*Elephas maximus*	Endangered
2	Northern Red Muntjac	*Muntiacus vaginalis*	Least Concern
3	Greater One-horned Rhino	*Rhinoceros unicornis*	Vulnerable
4	Hog Deer	*Axis porcinus*	Endangered
5	Smooth-coated Otter	*Lutrogale perspicillata*	Vulnerable
6	Wild Water Buffalo	*Bubalus arnee*	Endangered

SUBANSIRI
Bird Species - 27.1



Sl. No.	Common name	Scientific name	IUCN status
1	Bar-headed Goose	*Anser indicus*	Least Concern

2	Black Kite	*Milvus migrans*	Least Concern
3	Black-winged Kite	*Elanus caeruleus*	Least Concern
4	Black-winged Stilt	*Himantopus himantopus*	Least Concern
5	Booted eagle	*Hieraaetus pennatus*	Least Concern
6	Cattle Egret	*Bubulcus ibis*	Least Concern
7	Eastern Spot-billed Duck	*Anas zonorhyncha*	Least Concern
8	Common Greenshank	*Tringa nebularia*	Least Concern
9	Common Kestrel	*Falco tinnunculus*	Least Concern
10	Common Kingfisher	*Alcedo atthis*	Least Concern
11	Common Pochard	*Aythya ferina*	Vulnerable
12	Common Sandpiper	*Actitis hypoleucos*	Least Concern
13	Eurasian Curlew	*Numenius arquata*	Near Threatened
14	Eurasian Wigeon	*Mareca penelope*	Least Concern
15	Ferruginous Pochard	*Aythya nyroca*	Near Threatened
16	Gadwall	*Mareca strepera*	Least Concern
17	Great Cormorant	*Phalacrocorax carbo*	Least Concern
18	Great Crested Grebe	*Podiceps cristatus*	Least Concern
19	Great Egret	*Ardea alba*	Least Concern
20	Green Sandpiper	*Tringa ochropus*	Least Concern
21	Grey Heron	*Ardea cinerea*	Least Concern
22	Hen Harrier	*Circus cyaneus*	Least Concern
23	Indian Pond-Heron	*Ardeola grayii*	Least Concern
24	Indian Spot-billed Duck	*Anas poecilorhyncha*	Least Concern
25	Lesser Adjutant	*Leptoptilos javanicus*	Vulnerable
26	Little Cormorant	*Microcarbo niger*	Least Concern
27	Little Egret	*Egretta garzetta*	Least Concern
28	Long-legged Buzzard	*Buteo rufinus*	Least Concern
29	Mallard	*Anas platyrhynchos*	Least Concern
30	Northern Pintail	*Anas acuta*	Least Concern
31	Oriental Darter	*Anhinga melanogaster*	Near Threatened
32	Osprey	*Pandion haliaetus*	Least Concern
33	Pacific Golden-Plover	*Pluvialis fulva*	Least Concern
34	Pied Kingfisher	*Ceryle rudis*	Least Concern
35	Plain Martin	*Prinia inornata*	Least Concern
36	Red-wattled Lapwing	*Vanellus indicus*	Least Concern
37	Ruddy Shelduck	*Tadorna ferruginea*	Least Concern
38	Small Pratincole	*Glareola lactea*	Least Concern
39	Steppe Eagle	*Aquila nipalensis*	Endangered
40	Striated Heron	*Butorides striata*	Least Concern
41	Temminck's Stint	*Calidris temminckii*	Least Concern
42	Tufted duck	*Aythya fuligula*	Least Concern

43	White-throated Kingfisher	*Halcyon smyrnensis*	Least Concern

Kulsi
Bird Species - 28.1

Sl. No.	Common name	Scientific name	IUCN status
1	Asian Openbill	*Anastomus oscitans*	Least Concern
2	Black Kite	*Milvus migrans*	Least Concern
3	Bronze-winged Jacana	*Metopidius indicus*	Least Concern
4	Cattle Egret	*Bubulcus ibis*	Least Concern
5	Common Greenshank	*Tringa nebularia*	Least Concern
6	Common Kingfisher	*Alcedo atthis*	Least Concern
7	Common Sandpiper	*Actitis hypoleucos*	Least Concern
8	Glossy Ibis	*Plegadis falcinellus*	Least Concern
9	Great Egret	*Ardea alba*	Least Concern
10	Green Sandpiper	*Tringa ochropus*	Least Concern
11	Indian Pond-Heron	*Ardeola grayii*	Least Concern
12	Intermediate Egret	*Ardea intermedia*	Least Concern
13	Lesser Adjutant	*Leptoptilos javanicus*	Vulnerable
14	Lesser Whistling-Duck	*Dendrocygna javanica*	Least Concern
15	Little Cormorant	*Microcarbo niger*	Least Concern
16	Little Egret	*Egretta garzetta*	Least Concern
17	Little-ringed Plover	*Charadrius dubius*	Least Concern
18	Oriental Darter	*Anhinga melanogaster*	Near Threatened
19	Oriental Honey-buzzard	*Pernis ptilorhynchus*	Least Concern
20	Osprey	*Pandion haliaetus*	Least Concern
21	Pied Kingfisher	*Ceryle rudis*	Least Concern
22	Plain Martin	*Prinia inornata*	Least Concern
23	Red-wattled Lapwing	*Vanellus indicus*	Least Concern
24	Rosy Pipit	*Anthus roseatus*	Least Concern
25	Ruddy Shelduck	*Tadorna ferruginea*	Least Concern
26	Striated Heron	*Butorides striata*	Least Concern
27	Temminck's Stint	*Calidris temminckii*	Least Concern
28	White-breasted Waterhen	*Amaurornis phoenicurus*	Least Concern
29	White-throated Kingfisher	*Halcyon smyrnensis*	Least Concern
30	Wood Sandpiper	*Tringa glareola*	Least Concern
31	Yellow Wattled Lapwing	*Vanellus malabaricus*	Least Concern

Mammal Species - 28.2

Sl. No.	Common name	Scientific name	IUCN status
1	Small Indian Mongoose	*Herpestes auropunctatus*	Least Concern

Kopili
Bird Species - 29.1

Sl. No.	Common name	Scientific name	IUCN status
1	Alexandrine Parakeet	*Psittacula eupatria*	Near Threatened
2	Ashy Prinia	*Prinia socialis*	Least Concern
3	Ashy Woodswallow	*Artamus fuscus*	Least Concern
4	Asian Koel	*Eudynamys scolopaceus*	Least Concern
5	Asian Openbill	*Anastomus oscitans*	Least Concern
6	Asian Palm Swift	*Cypsiurus balasiensis*	Least Concern
7	Indian Pied Starling	*Gracupica contra*	Least Concern
8	Bank Myna	*Acridotheres ginginianus*	Least Concern
9	Barn Swallow	*Hirundo rustica*	Least Concern
10	Baya Weaver	*Ploceus philippinus*	Least Concern
11	Black Drongo	*Dicrurus macrocercus*	Least Concern
12	Black Kite	*Milvus migrans*	Least Concern
13	Black-crowned Night-Heron	*Nycticorax nycticorax*	Least Concern
14	Black-headed Ibis	*Threskiornis melanocephalus*	Near Threatened
15	Black-hooded Oriole	*Oriolus xanthornus*	Least Concern
16	Black-winged Kite	*Elanus caeruleus*	Least Concern
17	Blue Blue Rock Pigeon	*Columba livia*	Least Concern
18	Blue-tailed Bee-eater	*Merops philippinus*	Least Concern
19	Blue-throated Barbet	*Psilopogon asiaticus*	Least Concern
20	Cattle Egret	*Bubulcus ibis*	Least Concern
21	Chestnut-tailed Starling	*Sturnia malabarica*	Least Concern
22	Cinereous Tit	*Parus cinereus*	Least Concern
23	Common Greenshank	*Tringa nebularia*	Least Concern
24	Common Hawk-Cuckoo	*Hierococcyx varius*	Least Concern
25	Common Kingfisher	*Alcedo atthis*	Least Concern
26	Common Myna	*Acridotheres tristis*	Least Concern
27	Common Sandpiper	*Actitis hypoleucos*	Least Concern
28	Common Tailorbird	*Orthotomus sutorius*	Least Concern
29	Coppersmith Barbet	*Psilopogon haemacephalus*	Least Concern
30	Crested Serpent-Eagle	*Spilornis cheela*	Least Concern
31	Eurasian Collared-Dove	*Streptopelia decaocto*	Least Concern

32	Eurasian Eurasian Hoopoe	*Upupa epops*	Least Concern
33	Great Cormorant	*Phalacrocorax carbo*	Least Concern
34	Great Egret	*Ardea alba*	Least Concern
35	Greater Adjutant	*Leptoptilos dubius*	Endangered
36	Green Sandpiper	*Tringa ochropus*	Least Concern
37	Hair-crested Drongo	*Dicrurus hottentottus*	Least Concern
38	Indian Pond-Heron	*Ardeola grayii*	Least Concern
39	Indochinese Roller	*Coracias affinis*	Least Concern
40	Jungle Babber	*Argya striata*	Least Concern
41	Jungle Myna	*Acridotheres fuscus*	Least Concern
42	Large-billed Crow	*Corvus macrorhynchos*	Least Concern
43	Lesser Adjutant	*Leptoptilos javanicus*	Vulnerable
44	Lesser Coucal	*Centropus bengalensis*	Least Concern
45	Lesser Goldenbacked Woodpecker	*Dinopium benghalense*	Least Concern
46	Lineated Barbet	*Psilopogon lineatus*	Least Concern
47	Little Cormorant	*Microcarbo niger*	Least Concern
48	Little Egret	*Egretta garzetta*	Least Concern
49	Little Asian Green Bee-eater	*Merops orientalis*	Least Concern
50	Long-tailed Shrike	*Lanius schach*	Least Concern
51	Oriental Darter	*Anhinga melanogaster*	Near Threatened
52	Oriental Magpie-Robin	*Copsychus saularis*	Least Concern
53	Pied Harrier	*Circus melanoleucos*	Least Concern
54	Pied Kingfisher	*Ceryle rudis*	Least Concern
55	Plain Martin	*Prinia inornata*	Least Concern
56	Purple Heron	*Ardea purpurea*	Least Concern
57	Red Collared-Dove	*Streptopelia tranquebarica*	Least Concern
58	Red-vented Bulbul	*Pycnonotus cafer*	Least Concern
59	Red-wattled Lapwing	*Vanellus indicus*	Least Concern
60	River Lapwing	*Vanellus duvaucelii*	Near Threatened
61	Rose-ringed Parakeet	*Psittacula krameri*	Least Concern
62	Rufous Treepie	*Dendrocitta vagabunda*	Least Concern
63	Shikra	*Accipiter badius*	Least Concern
64	Spotted Dove	*Spilopelia chinensis*	Least Concern
65	Striated Heron	*Butorides striata*	Least Concern
66	White Wagtail	*Motacilla alba*	Least Concern
67	White-breasted Waterhen	*Amaurornis phoenicurus*	Least Concern
68	White-throated Kingfisher	*Halcyon smyrnensis*	Least Concern
69	Yellow-footed Green Pigeon	*Treron phoenicopterus*	Least Concern

Mammal Species - 29.2

Sl. No.	Common name	Scientific name	IUCN status
1	Indian Flying Fox	*Pteropus giganteus*	Least Concern

BEKI
Bird Species - 30.1

Sl. No.	Common name	Scientific name	IUCN status
1	Asian Openbill	*Anastomus oscitans*	Least Concern
2	Asian Palm Swift	*Cypsiurus balasiensis*	Least Concern
3	Indian Pied Starling	*Gracupica contra*	Least Concern
4	Barn Swallow	*Hirundo rustica*	Least Concern
5	Baya Weaver	*Ploceus philippinus*	Least Concern
6	Black Drongo	*Dicrurus macrocercus*	Least Concern
7	Black Kite	*Milvus migrans*	Least Concern
8	Cattle Egret	*Bubulcus ibis*	Least Concern
9	Citrine Wagtail	*Motacilla citreola*	Least Concern
10	Common Greenshank	*Tringa nebularia*	Least Concern
11	Common Kingfisher	*Alcedo atthis*	Least Concern
12	Common Myna	*Acridotheres tristis*	Least Concern
13	Common Sandpiper	*Actitis hypoleucos*	Least Concern
14	Eastern Spot-billed Duck	*Anas zonorhyncha*	Least Concern
15	Eurasian Collared-Dove	*Streptopelia decaocto*	Least Concern
16	Eurasian Eurasian Hoopoe	*Upupa epops*	Least Concern
17	Eurasian Kestrel	*Falco tinnunculus*	Least Concern
18	Eurasian Wigeon	*Mareca penelope*	Least Concern
19	Grey Wagtail	*Motacilla cinerea*	Least Concern
20	Great Cormorant	*Phalacrocorax carbo*	Least Concern
21	Great Crested Grebe	*Podiceps cristatus*	Least Concern
22	Great Egret	*Ardea alba*	Least Concern
23	House Crow	*Corvus splendens*	Least Concern
24	House Sparrow	*Passer domesticus*	Least Concern
25	Indian Pond-Heron	*Ardeola grayii*	Least Concern
26	Indian Spot-billed Duck	*Anas poecilorhyncha*	Least Concern
27	Jungle Myna	*Acridotheres fuscus*	Least Concern
28	Kentish Plover	*Charadrius alexandrinus*	Least Concern
29	Large-billed Crow	*Corvus macrorhynchos*	Least Concern
30	Lesser Sand-Plover	*Charadrius mongolus*	Least Concern

31	Little Cormorant	*Microcarbo niger*	Least Concern
32	Little Egret	*Egretta garzetta*	Least Concern
33	Little Ringed Plover	*Charadrius dubius*	Least Concern
34	Little Stint	*Calidris minuta*	Least Concern
35	Long-tailed Shrike	*Lanius schach*	Least Concern
36	Oriental Magpie-Robin	*Copsychus saularis*	Least Concern
37	Osprey	*Pandion haliaetus*	Least Concern
38	Plain Martin	*Prinia inornata*	Least Concern
39	Red-wattled Lapwing	*Vanellus indicus*	Least Concern
40	River Lapwing	*Vanellus duvaucelii*	Near Threatened
41	Ruddy Shelduck	*Tadorna ferruginea*	Least Concern
42	Sand Lark	*Alaudala raytal*	Least Concern
43	Siberian Stonechat	*Saxicola maurus*	Least Concern
44	Small Pratincole	*Glareola lactea*	Least Concern
45	Spotted Dove	*Spilopelia chinensis*	Least Concern
46	Steppe Eagle	*Aquila nipalensis*	Endangered
47	Striated Grassbird	*Megalurus palustris*	Least Concern
48	Temminck's Stint	*Calidris temminckii*	Least Concern
49	White Wagtail	*Motacilla alba*	Least Concern
50	White-throated Kingfisher	*Halcyon smyrnensis*	Least Concern

PUNJAB



Beas
Bird Species - 31.1

Sl.no	Species	Scientific name	IUCN Status
1	Asian openbill	*Anastomus oscitans*	Least Concern
2	Bank Myna	*Acridotheres ginginianus*	Least Concern
3	Bar-headed Goose	*Anser indicus*	Least Concern
4	Barn Swallow	*Hirundo rustica*	Least Concern
5	Black Bittern	*Ixobrychus flavicollis*	Least Concern
6	Black Drongo	*Dicrurus macrocercus*	Least Concern
7	Black Francolin	*Francolinus francolinus*	Least Concern
8	Black-headed Gull	*Chroicocephalus ridibundus*	Least Concern
9	Black Kite	*Milvus migrans*	Least Concern
10	Black-winged Stilt	*Himantopus himantopus*	Least Concern
11	Black-crowned Night-Heron	*Nycticorax nycticorax*	Least Concern
12	Black-headed Ibis	*Threskiornis melanocephalus*	Near Threatened
13	Cattle Egret	*Bubulcus ibis*	Least Concern
14	Common Greenshank	*Tringa nebularia*	Least Concern
15	Common Kingfisher	*Alcedo atthis*	Least Concern
16	Eurasian Moorhen	*Gallinula chloropus*	Least Concern
17	Common Myna	*Acridotheres tristis*	Least Concern
18	Common Pochard	*Aythya ferina*	Vulnerable
19	Common Redshank	*Tringa totanus*	Least Concern
20	Common Sandpiper	*Actitis hypoleucos*	Least Concern
21	Common Shelduck	*Tadorna tadorna*	Least Concern
22	Eurasian Collared-Dove	*Streptopelia decaocto*	Least Concern
23	Eurasian Marsh-Harrier	*Circus aeruginosus*	Least Concern
24	Eurasian Spoonbill	*Platalea leucorodia*	Least Concern
25	Eurasian Wigeon	*Mareca penelope*	Least Concern
26	Eurasian Wryneck	*Jynx torquilla*	Least Concern
27	Gadwall	*Mareca strepera*	Least Concern
28	Glossy Ibis	*Plegadis falcinellus*	Least Concern
29	Great Cormorant	*Phalacrocorax carbo*	Least Concern
30	Great Egret	*Ardea alba*	Least Concern
31	Great Thick-knee	*Esacus recurvirostris*	Near Threatened
32	Greater Coucal	*Centropus sinensis*	Least Concern

33	Green Sandpiper	*Tringa ochropus*	Least Concern
34	Common Teal	*Anas carolinensis*	Least Concern
35	Grey Heron	*Ardea cinerea*	Least Concern
36	Grey-headed Swamphen	*Porphyrio poliocephalus*	Least Concern
37	Greylag Goose	*Anser anser*	Least Concern
38	House Crow	*Corvus splendens*	Least Concern
39	House Sparrow	*Passer domesticus*	Least Concern
40	Indian Grey Hornbill	*Ocyceros birostris*	Least Concern
41	Indian Peafowl	*Pavo cristatus*	Least Concern
42	Indian Pond-Heron	*Ardeola grayii*	Least Concern
43	Indian Spot-billed Duck	*Anas poecilorhyncha*	Least Concern
44	Indian Spotted Eagle	*Clanga hastata*	Vulnerable
45	Intermediate Egret	*Ardea intermedia*	Least Concern
46	Knob-billed Duck	*Sarkidiornis melanotos*	Least Concern
47	Little Cormorant	*Microcarbo niger*	Least Concern
48	Little Egret	*Egretta garzetta*	Least Concern
49	Little Ringed Plover	*Charadrius dubius*	Least Concern
50	Long-tailed Shrike	*Lanius schach*	Least Concern
51	Mallard	*Anas platyrhynchos*	Least Concern
52	Northern Shoveler	*Spatula clypeata*	Least Concern
53	Oriental Darter	*Anhinga melanogaster*	Near Threatened
54	Oriental Honey-buzzard	*Pernis ptilorhynchus*	Least Concern
55	Osprey	*Pandion haliaetus*	Least Concern
56	Pied Kingfisher	*Ceryle rudis*	Least Concern
57	Plain Prinia	*Prinia inornata*	Least Concern
58	Purple Heron	*Ardea purpurea*	Least Concern
59	Red-wattled Lapwing	*Vanellus indicus*	Least Concern
60	Red-naped Ibis	*Pseudibis papillosa*	Least Concern
61	River Tern	*Sterna aurantia*	Vulnerable
62	Indian Eagle-Owl	*Bubo bengalensis*	Least Concern
63	Blue Rock Pigeon	*Columba livia*	Least Concern
64	Rose-ringed Parakeet	*Psittacula krameri*	Least Concern
65	Ruddy Shelduck	*Tadorna ferruginea*	Least Concern
66	Ruff	*Calidris pugnax*	Least Concern
67	Rufous Treepie	*Dendrocitta vagabunda*	Least Concern
68	Shikra	*Accipiter badius*	Least Concern

69	Siberian Stonechat	*Saxicola maurus*	Least Concern
70	Streaked Weaver	*Ploceus manyar*	Least Concern
71	Striated Grassbird	*Megalurus palustris*	Least Concern
72	White-breasted Waterhen	*Amaurornis phoenicurus*	Least Concern
73	White-throated Kingfisher	*Halcyon smyrnensis*	Least Concern
74	White Wagtail	*Motacilla alba*	Least Concern
75	White-browed Wagtail	*Motacilla maderaspatensis*	Least Concern
76	White-tailed Lapwing	*Vanellus leucurus*	Least Concern
77	Wood Sandpiper	*Tringa glareola*	Least Concern
78	Asian Woolly-necked Stork	*Ciconia episcopus*	Near Threatened

Reptile Species - 31.2



Sl.No	Species	Scientific name	IUCN Status
1	Checkered Keelback	*Fowlea piscator*	Least Concern
2	Gharial	*Gavialis gangeticus*	Critically Endangered
3	Indian Ratsnake	*Ptyas mucosa*	Least Concern
4	Ganges Soft-shelled Turtle	*Nilssonia gangetica*	Endangered
5	Brown Roofed Turtle	*Pangshura smithii*	Near Threatened
6	Russell's Viper	*Daboia russelii*	Least Concern

Mammal Species - 31.3



Sl. No	Common name	Scientific name	IUCN Status
1	Wild Boar	*Sus scrofa*	Least Concern
2	Indian Grey Mongoose	*Herpestes edwardsii*	Least Concern



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