

IDENTIFICATION OF KEY HABITATS AND CONSERVATION THREATS OF THE GANGES RIVER DOLPHIN (*PLATANISTA GANGETICA*) OF BANGLADESH

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ABSTRACT: Ganges River Dolphins (*Platanista gangetica*) are known to inhabit all major river systems in Bangladesh. However, comprehensive spatial records for this globally endangered aquatic mammal are notably scarce nationwide. Furthermore, their habitats are increasingly threatened due to excessive utilization of aquatic resources and their habitats by the growing human population. To allocate limited resources in safeguarding high-priority dolphin habitats, we conducted field surveys and arranged stakeholder consultations to identify key dolphin habitats and the conservation threats they face across Bangladesh. Through this process, we have identified 14 river segments as high-priority winter habitats for Ganges River Dolphins. These dolphins encounter both direct and indirect threats within their habitats. Direct threats include entanglement and occasional intentional killing for traditional medicinal purposes and as fish attractants. Indirect threats leading to habitat degradation comprise the construction of dams and barrages for upstream water extraction, increasing industrial pollution in river waters, overfishing, and alterations to river morphology caused by siltation and sedimentation. The heavy reliance of local communities on dolphin habitats, coupled with a lack of widespread awareness and insufficient conservation efforts, pose significant challenges to the future survival of Ganges River Dolphins in Bangladesh.

Key words: Cetaceans, Ganges River Dolphin, *Platanista gangetica*, Sundarbans, Winter habitat, Bangladesh

INTRODUCTION

Bangladesh harbours a number of cetacean species that play a crucial role in both riverine and coastal ecosystems. Of the cetacean species reported from inland and coastal waters of Bangladesh, the freshwater Ganges River Dolphin (*Platanista gangetica*) is an iconic aquatic mammal for the freshwater river

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systems of the country. It is endemic to the Indian Subcontinent, and it currently inhabits the major river systems comprising the Ganges-Meghna-Brahmaputra. An isolated population is also reported from the Karnaphuli-Sangu river systems of Bangladesh. Beyond these, few individuals have been reported from the Karnali, and the Sapta Kosi Rivers in Nepal (Sinha *et al.* 2010, IUCN Bangladesh 2015). An estimate of about 3500 individuals is thought to be existed across its global range, although reliable population counts are lacking (Sinha and Kanna 2014). Over decades, many local populations might have gone extinct from their historic distributional ranges.

Bangladesh is famous for extensive river systems, along with a vast expanse of seasonal wetlands. The entire delta, where the Bangladesh stands, is formed by the alluvial deposits of the Ganges, Brahmaputra, and the Meghna river systems. Around half of the land surface of Bangladesh encompasses waterbodies comprising network of rivers, streams, lakes, marshes, fish ponds, flooded cultivated fields, and estuarine mangrove swamps (Hughes *et al.* 1994). These waterbodies provide critical supports to the lives and livelihoods for the millions of marginalized communities across rural Bangladesh. In particular, large number of local communities heavily rely on wetlands and river ecosystems for their daily subsistence in the forms of food production, fishing, boat plying, and collecting aquatic vegetations (Sultana and Thompson 2017). On the other hand, the vast freshwater river systems and their many tributaries form the major habitats for the Ganges River Dolphin in Bangladesh. Sadly, the Ganges River Dolphin is Endangered nationally (IUCN Bangladesh 2015) and globally (Kelkar *et al.* 2022). It is included in the 1st Schedule of the Bangladesh Wildlife (Conservation and Security) Act, 2012 to uplift its protection level in the wild.

Kasuya and Hoque (1972) led the premier scientific expeditions that reported the presence of Ganges River Dolphins from many of river systems of the present-day Bangladesh. In particular, they provided critical information on the Ganges River Dolphin from the rivers of Meghna, Jamuna, Brahmaputra, and from the upstream rivers of the Sundarbans. Later, several workers studied the population abundance (Ahmed 2000, Smith *et al.* 2001, 1998), and dolphin hotspots and habitat preference in the Sundarbans (Smith *et al.* 2010, 2006). From other parts of the country, population abundance were investigated in the rivers Karnaphuli-Sangu (Smith *et al.* 2001), the Jamuna-Padma (Khan and Rahman 2013, Rashid *et al.* 2015), the Bhairab-Atai (IUCN Bangladesh 2018), the Turag (Baki *et al.* 2017), and the Buriganga (Alam and Sarker 2012). However, identifying the national key habitats of Ganges River Dolphin has never been attempted.

Conserving this important aquatic predator of the river ecosystem is a top priority management issue for the Government of Bangladesh (GoB, 2023).

Therefore, identifying important habitats and their threats are crucial in formulating the conservation strategy for the species that will also ensure the healthy river ecosystem benefiting millions of local people who obtain daily subsistence from the dolphin habitats. In this study, we aimed identifying the key winter habitats and threats of the Ganges River Dolphin in Bangladesh.

MATERIAL AND METHODS

Major river systems: The major rivers of Bangladesh can be characterized by the Ganges-Padma, Jamuna-Brahmaputra, Padma-Meghna, and Surma-Meghna river systems. The Ganges-Padma, segmented into two parts, the first segment extends from the western border with India to its meeting point with Jamuna, situated 72 km west of Dhaka. The second segment, named Padma, runs from the confluence with Jamuna to its merge with the Meghna in southern Bangladesh, spanning 126 km. The Jamuna-Brahmaputra system flows from the northern border of Bangladesh until it joins the Padma west of Dhaka. The Brahmaputra river receives water from five significant tributaries and transforms into the Jamuna upon merging with the Teesta river in northwestern Bangladesh. Known for its dynamic nature, the Jamuna river is characterized by sub-channel features and the formation of fertile silt islands along its course. The Surma-Meghna system originates from the northeastern border with India and extends to Chandpur, where it merges with the Padma. Subsequently, the combined Padma-Meghna system flows approximately 145 km to the Bay of Bengal (Akonda 1989, Rashid 1991). Another notable river system is the Karnaphuli-Sangu, which cuts through the Chattogram region and the Chattogram Hills before reaching the Bay of Bengal coast, with the Feni, Halda, and Matamuhari rivers being its primary contributors. The Kaptai reservoir and dam are located within this region. Additionally, the Baleshwar and Pasur rivers, along with their tributaries in the northeastern Sundarbans, serve as significant waterways that support the habitat of the Ganges River Dolphin.

Study techniques: We have conducted direct field surveys and stakeholder meetings in order to record key habitats and threats to the Ganges River Dolphins. The rivers Padma, Jamuna, Meghna, Karnaphuli, Halda, Baleshwar, Pasur, Sibsa, Arpangasia, Raimongal, etc. and their tributaries were surveyed covering over thousand kilometre of river courses, of which almost half were inside the Sundarbans. We also organised consultation meetings with communities living close to dolphin habitats across the country to assess threats to dolphins.

Field surveys: Field activities were conducted in dry season between September 2018 and February 2019. Before starting field surveys, we conducted

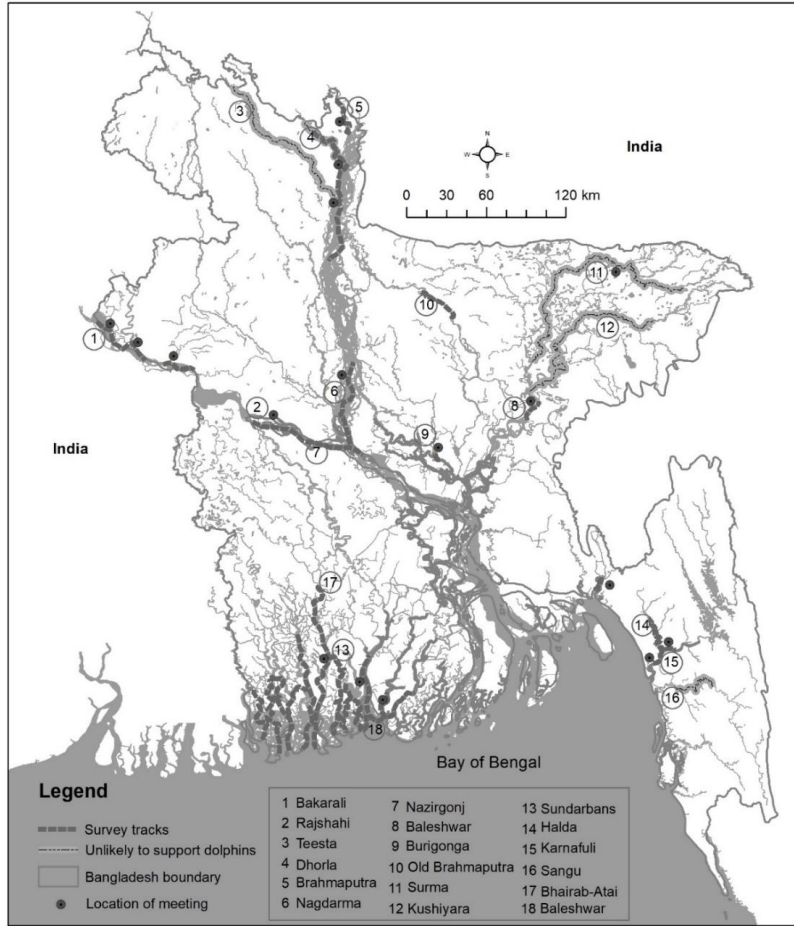


Fig. 1. Survey tracks, location of stakeholder meeting and key habitats of Ganges River Dolphin in Bangladesh.

a reconnaissance to identify the potential dolphin habitats for detailed field surveys. To this end, we communicated with frontline staffs and wildlife scouts, deployed across the country by the Bangladesh Forest Department, to identify potential survey sites. When our preliminary investigation appeared to be potential for the presence of dolphins of any particular site, we decided to conduct boat-based survey in respective river stretches. Given the limited resources for surveying vast stretches of rivers across the country, our survey was confined to areas where water level remains as critical for the survival of dolphins at winter months. Specifically, the survey segments were selected by assessing the river courses where water column was high and remain navigable

during winter months. Field survey was carried out using engine-driven medium-sized boat, running with average speed of 7-10 km/h. Information on dolphin sightings, their number, age structure (calf or adult), habitat conditions and threats were noted. During the survey, observations were also made on fishing practices, water column, sedimentation and siltation, and sources of pollution. Local fishermen who do fishing on regular basis in the rivers were asked about their fishing practices and approximate depth of water in the respective river segments. Sedimentation and siltation as well as pollution levels were visually assessed during field visits. A team of four wildlife biologists from Jahangirnagar University and field officers from the regional forest department conducted the survey. The survey team spotted dolphins with naked eye and aided by handheld binoculars wherever needed.

Key informant interviews: Information was collected through key informant interview and community meeting involving local fishers (56%), farmers (14%), fish-traders (5%), teachers (5%) and students (20%). A total of 17 stakeholder meetings and 174 interviews were conducted at Chapai Nawabgonj, Rajshahi, Sirajgong, Pabna, Kurigram, Brahmanbaria, Sunamgonj, Dhaka, Feni, Chattogram, Khulna and Bagerhat regions (Fig. 1). Using an open-ended questionnaire, we discussed the presence or absence of dolphins in their locality, traditional beliefs and use of dolphin parts, frequency of dolphin entanglement, availability of water and fishes in winter months, livelihood and fishing practices, etc. Regional forest and fishery departments assisted in organizing these meetings and interviews.

Data analysis: Dolphin sighting data were used to delineate dolphin distribution using ArcGIS v10.3. We have prioritized key habitats that we identified so that limited resources could be directed where they need first. Identified habitats were categorized on the basis of encounter rate as High (>0.5 dolphins/km river), Medium (0.06-0.5 dolphins/km river) and Low (<0.05 dolphins/km river or remain undetected any individual of dolphin). We combined this scale with habitat condition (confluence of rivers, water level, etc.) and presence of dolphin calves in the surveyed river segments to determine priority habitats. The high prioritized habitats were termed as key habitats.

RESULTS AND DISCUSSION

We have surveyed 1,123 km of river segments located in 29 different regions, covering the major river systems across Bangladesh. We have recorded a total of 287 individuals of dolphins, of which 79% were adults and the rest were calves. The Ganges River Dolphins are threatened with, among the others, the entanglement in fishing net, habitat degradation and excessive use of freshwater river systems.

Table 1: Salient features, encounter rate and priority habitats of the Ganges River Dolphins of Bangladesh

| Name of locality | River | District | Survey segment (km) | No. of dolphins counted | Encounter rate | Population status | Characteristics of river segments |
|-----------------------------|----------------|------------------|---------------------|-------------------------|----------------|-------------------|---|
| Godagari | Padma | Chapai Nawabganj | 23 | 11 | 0.48 | High | Water depth remains very good with lots of depressions and confluences. |
| Rajshahi T-band | Padma | Rajshahi | 10 | 7 | 0.70 | High | Water depth very good with depression, bending and confluences. |
| Bakarali | Padma | Chapai Nawabganj | 35 | 1 | 0.03 | Low | Water depth moderate with some sedimentations; human activities including vessel movements also moderate. |
| Nazirgonj [†] | Padma | Pabna | 51.8 | 4 | 0.08 | Medium | Dolphin sanctuary; water level moderate but with meandering; siltation is common. |
| Nagarbari-Mohongonj | Jamuna | Pabna | 42.7 | 8 | 0.19 | High | Dolphin sanctuary; medium level of water with lots of siltation and sedimentation; depression and multiple channels. |
| Chilmari port | Brahmaputra | Kurigram | 8.9 | 9 | 1.01 | High | Water depth is very good with meandering and confluence; however, vessels and fishing are also high. |
| Paikergachha | Dud Kumar | Kurigram | 34.9 | 1 | 0.03 | Low | Low depth of water with moderate depression; with some level of sedimentation and siltation. |
| Nagderma-Silonda | Baral | Pabna | 23 | 1 | 0.04 | Low | Dolphin sanctuary; moderate level of water with meandering and siltation. |
| Bhairab bridge | Meghna | Brahmanbaria | 7.5 | 8 | 1.07 | High | Water depth is very good with confluence, but high level of vessels and fishing. |
| Madumaghat-Sattarghat | Halda | Chattoogram | 39.8 | 40 | 1.01 | High | Bangabandhu Heritage Site; tidal river with moderate level of water; free of fishing and vessels. |
| Karnaphuli-Halda confluence | Karnaphuli | Chattoogram | 22.4 | 2 | 0.09 | Medium | Water depth is good but with high level of vessels and cargos. |
| Malancha-Harihanga | Malancha | Satkhira | 87 | 0 | 0.00 | Low | With many confluences and connecting channels, but high level of salinity. |
| Burigoalini-Arpangassia | Arpangassia | Satkhira | 61 | 0 | 0.00 | Low | Wide rivers with lots of connecting channels; however, waters have high salinity. |
| Bhairab-Atai [§] | Bhairab-Rupsha | Khulna | 11.5 | 13 | 1.13 | High | Tidal river with good level of water, with meandering and confluence; high level of human use. |
| Pankhali | Passur | Khulna | 12 | 16 | 1.33 | High | Newly declared dolphin sanctuary; a confluence in Rupsa and Chalna with good level of water; however, high level of industrial development and vessels. |
| Sela-Supati | Sela-Supati | Sundarbans | 78 | 47 | 0.60 | High | Tidal and medium river with lots of confluences and meandering; water level remains very good even in low tide. |

| Name of locality | River | District | Survey segment (km) | No. of dolphins counted | Encounter rate | Population status | Characteristics of river segments |
|------------------------|-------------------|------------|---------------------|-------------------------|----------------|-------------------|---|
| Bandarkhal-Pakhrirkhal | Baleshwar estuary | Barguna | 34 | 0 | 0.00 | Low | Estuarine areas thereby regularly flushed with saline waters; also high fishing activity. |
| Baillatoli-Payra | Payra | Barguna | 87 | 2 | 0.02 | Low | Medium water depth, with high level of human use for fishing. |
| Kalabogi-Nalian | Sibsa | Khulna | 17 | 0 | 0.00 | Low | Water current is very low due to less upstream water, salinity from sea by tide is common. |
| Passur | Passur | Sundarbans | 65 | 43 | 0.66 | High | One of the best habitats for dolphins; high water depth with meandering and confluences. |
| Baleshwar Estuary | Baleshwar | Barguna | 16 | 15 | 0.94 | High | Baleshwar estuary is a confluence for three important rivers in the region with good level of water; fishing activity is also high. |
| Chandpai | Passur-Sela | Sundarbans | 12 | 14 | 1.17 | High | One of the five dolphin sanctuaries in the Sundarbans; lots of confluences and meandering. |
| Sibsa-Morjat | Morjat | Khulna | 97 | 0 | 0.00 | Low | Wide rivers with lots of connecting channels; however, being estuary the waters have higher level of salinity. |
| Dhangmari | Passur-Dhangmari | Sundarbans | 8 | 16 | 2.00 | High | One of the five dolphin sanctuaries in the Sundarbans; relatively narrow channel with regular confluence and meandering. |
| Dudhmukhi | Bara Shawla | Sundarbans | 8.5 | 12 | 1.41 | High | One of the five dolphin sanctuaries in the Sundarbans, medium river channel with some confluences. |
| Bhodra-Nilkamal | Bhodra-Sibsa | Sundarbans | 72 | 15 | 0.21 | Medium | Half of the courses are potential habitat; however, the downstream segment has high level of salinity. |
| Majerchar-Charduani | Baleshwar | Barguna | 23 | 1 | 0.04 | Low | Water depth remains good, with less meandering and confluences; fishing activity is common. |
| Ladia-Bogi | Baleshwar | Barguna | 68 | 1 | 0.01 | Low | Water depth is good; however, fishing activity is high. |
| Tengragiri-Patharghata | Payra | Barguna | 67 | 0 | 0.00 | Low | Water depth is moderate, with lots of fishing activity; waters have higher level of salinity. |

† Khan and Rahman 2013, § IUCN Bangladesh 2018

Key habitats: We have identified 14 high priority river segments as the key winter habitats for the Ganges River Dolphins. Besides, 3 medium and 12 low category habitats were determined (Table 1). These key habitats encompassed river stretches ranging from half a kilometre to several kilometres in length. Dolphin key habitats were located in the Padma, Jamuna, Brahmaputra, Meghna, Halda and in several tributaries of Padma flowing through the Sundarbans. The eastern regions of the Sundarbans in Bangladesh are the key dolphin habitats, located in the rivers of the Sela-Supati, Pasur and estuarine of the Baleshwar. Three wildlife sanctuaries established for the conservation of dolphins inside the Sundarbans were also rated as high priority habitats. On the upstream of Pasur, approximately 15 km away from the northern border of the Sundarbans, we encountered high number of dolphins at Pankhali – a confluence of the river Pasur. Of the notable habitats beyond the Sundarbans, Godagari in the Padma, Chilmari in the Brahmaputra, Bhairab in the Meghna and the Halda tributary in Karnaphuli rivers have huge potential for long-term conservation of dolphins in Bangladesh. About 40 km water courses of the river Halda support one of the best dolphin populations because this river receives the highest level of protection for being the only natural spawning ground of carps in Bangladesh. Moreover, the key habitats identified within the Sundarbans are relatively more secured than those outside because the Sundarbans forest and its water courses are under systematic management and conservation actions. Sadly, all remaining key habitats are under tremendous pressure from uncontrolled fishing, vessel traffic and critically low level of water during winter months. For instance, the key dolphin habitats of Bhairab, Chilmari and Godagari having suitable river morphology and containing good level of water in winter months remain under huge pressure from fishing and vessels which require urgent attention for management actions.

The Ganges River Dolphins inhabit across all major river systems of the country, although their precise population status remains unknown. However, because many of the lower reaches of the river Padma-Meghna including their distributaries contain sufficient level of water during winter months, they are likely to support some important populations of dolphins which fell outside of the scope of this study. At the same time, several tributaries no longer support dolphins, at least in dry season which include the rivers Dhorla, Tista, Kushiya and Sangu (Fig. 1). For instance, earlier studies documented a population of 125 dolphins from the Karnaphuli-Sangu rivers (Smith *et al.* 2001), whereas we found only a few dolphins at Karnaphuli but none in the Sangu. Moreover, occasional sightings were also reported from the Kaptai Lake until the mid-1990s (Ahmed 2000) but no evidence found afterwards (Smith *et al.* 2001). This suggests that the Kaptai Dam built in 1961 has reduced population range

in the region. Our studies were compromised by limited resources which led us to focus in areas where dolphins appeared to be undergone to tremendous pressure from the low level of water and high concentration of aquatic resource extractions. In future, we recommend a nationwide extensive survey covering winter and monsoon months for a better resolution of temporal and spatial distribution of Ganges River Dolphins in the country.

Threats: Ganges River Dolphins face wide range threats and challenges. Direct threats include killing by gillnet entanglement during fishing. The use of dolphin extracts in traditional medicine and traditional fishing have been reported. Other threats leading to habitat degradation are the extraction of upstream waters for human use, industrial pollution of river waters, overfishing and harvesting of aquatic resources, modifications of river morphology through dredging, siltation and sedimentation, and agricultural use through dams and barrage

The incidental dolphin fatalities caused by fishing nets, especially gillnets, deployed within dolphin habitats, represent the most significant threat to dolphins in Bangladesh. Primarily, Ganges River Dolphins become ensnared and perish in gillnets. Specifically, the gillnets utilized for capturing Hilsa Shad *Tenualosa ilisha* in expansive rivers, estuaries, and coastal regions of the Sundarbans have been identified as causing dolphin fatalities. Reports indicate that roughly 90 cetaceans were unintentionally killed in gillnets between 2007 and 2013, with 63 of these being Ganges River Dolphins, of which 40 were from the Sundarbans region (GoB 2018). A recent study by Dewhurt-Richman *et al.* (2019) reported at least 14 mortalities from 170 bycatch events occurred by gillnets during 2010-2011 from the southern Bangladesh. Our interview data suggest that dolphins were killed intentionally for traditional medicinal use and fish attractant which, however, became a rare incidence nowadays. We found three cases where dolphins were sold in fish market with high price whilst one fisherman released a calf from his fishing net into his backyard pond which eventually died. Almost half of the respondents (45%) reported that fishermen do not intend to set their nets for catching dolphins. However, if entangled during fishing, a section of fishermen sells dolphins to the local traditional medicinal practitioners (locally known as *kabiraj*). Some fishermen (18%) also extract oil from the dead dolphins and sell oil to fellow fishermen for use as fish attractant. Evidence suggests that the intentional slaughter of river dolphins in the Kalni-Kushiyara River of Bangladesh (Smith *et al.* 1998), as well as in the upper reaches of the Brahmaputra River in Assam, was prevalent several decades ago (Mohan *et al.* 1997). Dolphins were also targeted by tribal communities along the Brahmaputra for their flesh, and fishermen in the Ganges for their oil which served as a lure for fish (Sinha 2000). However, deliberate dolphin killings for human consumption are exceedingly uncommon in Bangladesh.

Water pollution poses a significant threat to the degradation of river ecosystems nationwide. The influx of foreign or excessive substances or energy from both specific and diffuse origins, including industrial discharges, is widespread in numerous sections of our major river networks. For example, the Buriganga and Turag rivers, which once harboured dolphins, have been heavily polluted by industrial waste discharged directly from thousands of tanneries and garment factories situated along the banks. Specifically, the four primary rivers near Dhaka—the Buriganga, Shitalakhya, Turag, and Balu—receive 1.5 million cubic meters of wastewater daily from approximately 7,000 industrial facilities in the vicinity, along with an additional 0.5 million cubic meters from other origins (IWM 2004).

Fishing and the collection of aquatic resources have long been vital subsistence activities along the rivers and coastline of Bangladesh. For generations, millions of local communities depend on these activities for their livelihoods. However, this heavy reliance on dolphin habitats has contributed to the ongoing depletion of aquatic resources and the decline in the productivity of dolphin habitats, placing dolphins at risk over the long term. This is a concern that fish and crustacean populations in the Sundarbans and neighboring coastal areas are dwindling due to factors such as overfishing, the use of harmful fishing practices like poison fishing, and the collection of shrimp fry. The rate of fishing activity in the Sundarbans far exceeds sustainable limits, leading to a gradual decline in fish stocks (Khan and Aziz 2018). Over the past decade, there has been a reported 23% decrease in the production of fishery resources in the Sundarbans (Shah *et al.* 2010).

The degradation of river ecosystems and the extraction of upstream water through the construction of dams, barrages, embankments, and similar structures pose the most severe threats to dolphins across the Indian Subcontinent. For example, the construction of at least 50 dams and barriers within the known historical range of the species (Smith *et al.* 2000) has had a profound impact on the habitat, abundance, and population structure of dolphins. One notable example is the Farakka Barrage, erected across the River Ganges in the Murshidabad district of the Indian state of West Bengal, approximately 16.5 km from the border with Bangladesh. It has significantly diminished the freshwater flow and the habitat range of Ganges River Dolphins throughout the river and its associated distributaries. Specifically, in the northern tributaries of the Ganges in India, three subpopulations have been locally extinct due to population isolation caused by barrages (Sinha *et al.* 2000). Shipping lanes, dredging activities, and cargo ships can have adverse effects on dolphin populations and their habitats. Unpublished reports indicate that collisions between dolphins and water-vessels, including engine boats and

dredging vessels, could be fatal for dolphins. Such collisions have been identified as one of the causes of dolphin fatalities in the Halda River in recent years.

In the Sundarbans of Bangladesh, a significant increase in vessel traffic has been observed, particularly during the winter months, with up to 77 vessels per day in dolphin hotspot segments. The majority of these vessels are utilized for tourism purposes (UNDP 2014). The escalating vessel traffic and tourism activities in the Sundarbans are directly contributing to chemical and noise pollution, with accidental cargo vessel sinkings involving harmful chemicals posing the most serious threat (Khan and Aziz 2018).

Dredging activities have been widespread throughout the Ganges-Brahmaputra basins, including the extraction of stones (Shrestha 1989) and sand (Mohan *et al.* 1998). Extensive dredging is also evident in Bangladesh's major river systems, potentially compromising the ecological integrity of river health, particularly in small tributaries where suitable dolphin habitat is limited.

CONCLUSION

Ganges River Dolphin is a native aquatic mammal exclusive to the Indian subcontinent, including the expansive waters of Bangladesh. While dolphins still inhabit nearly all major rivers in Bangladesh, the impacts of fisheries bycatch, habitat degradation, and depletion have led many local populations to experience significant declines or local extinction from their historical ranges. Recognized as a flagship species for river conservation, the conservation of the Ganges River Dolphin holds profound importance, not only for the preservation of other aquatic species but also for the well-being of local communities who rely on these resources for their livelihoods. Given the paramount conservation significance of these dolphins, concerted efforts are urgently required to safeguard this charismatic aquatic mammal in Bangladesh. As an immediate action, the government should implement conservation measures that involve and integrate fishing communities, particularly targeting high-priority dolphin habitats identified in this study.

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