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COMMUNICATION

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POSSIBLE RANGE DECLINE OF GANGES RIVER DOLPHIN *PLATANISTA GANGETICA* (MAMMALIA: CETARTIODACTYLA: PLATANISTIDAE) IN INDIAN SUNDARBAN

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Abstract: Recent survey reports and observations from rivers in southern West Bengal (India) indicate the extirpation of Ganges River Dolphin (GRD) from the Indian Sundarbans. The present study undertaken during 2011–16 reviews the possible factors accountable for the disappearance of this obligatory freshwater cetacean from the major waterways of the Sundarbans, India and conclude that it is due to reasons of anthropogenic and geo-climatic origin. Sundarbans, the largest contiguous mangrove forest on earth encompassing almost 10,000km² of India and Bangladesh is located at the head of the Bay of Bengal within 21.533–22.666 °N and 88.083–89.850 °E, of which 62% lies within Bangladesh and 38% in India (Spalding et al. 2010). The landscape is a network of mudflats and islands at the deltaic mouth of the rivers Ganga, Brahmaputra and Meghna created by accumulated sediments carried by the snow-fed Himalayan rivers and their tributaries along with anastomosing tidal water channels. Historic reports reveal the occurrence of GRD in the Sundarbans waters of both India and Bangladesh (Anderson 1879). Current data, however, confirms the disappearance of *Platanista gangetica* but there is continued occurrence of *Orcaella brevirostris* in the Indian part of the estuary. Analysis of causative factors in light of existing evidence validates the potential extirpation of *Platanista* from the majority of the Sundarbans in India, except for its persistence in only the westernmost segment in the lower reaches of river Hooghly as confirmed by this study. The present study also records the habitat preferences and limiting factors affecting GRD distribution, and maps the decline of its range.

Keywords: Anthropogenic, freshwater, Hooghly, Irrawaddy, occurrence, river, Salinity.

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INTRODUCTION

The Ganges River Dolphin *Platanista gangetica gangetica* Lebeck, 1801 inhabits the river systems of the Ganga-Brahmaputra-Meghna and Karnaphuli-Sangu in Nepal, India and Bangladesh (Mohan 1995; Smith & Reeves 2000; Smith et al. 2001; Choudhary et al. 2006; Braulik & Smith 2017). Many river dolphin species are among the least known and endangered of all cetaceans (Hamilton et al. 2001).

Previous data on the status of Ganges River Dolphins in this unique estuarine water of the Indian Sundarbans is limited to historical reports (Anderson 1879; Jones 1982). In the past few decades, there has been no systematic and continuous survey of GRD in the Indian Sundarbans. The presence of GRD is doubtful in the Indian Sundarbans, as reported in the initial phase of a survey conducted by IUCN in 2014 (Wakid, A, 2017 pers comm). Mandal & Nandi (1989) reported the common occurrence of *Platanista* in estuarine waters of the Indian Sundarbans due to their entry from freshwater rivers. There was, however, no site specific data or any supporting image recorded. Surveys and observations carried out in the present study from West Bengal, India indicate that the current distribution of GRDs is confined to small pockets of habitat (Chowdhury et al. 2016). There has been no authentic record or observation of GRD in recent times especially in the central and eastern part of the Indian Sundarbans. Observations prior to this study were not clear about the range decline of *Platanista* in Indian Sundarbans, however, the present study confirms that GRD populations do not inhabit the waterways of central and eastern Sundarbans in India.

Nearly 9,630km² of area in the two districts of North and South 24 Parganas of West Bengal (Fig. 1) covering 1,692km² of core area, 2,233km² of buffer and 5,705km² of transition zone is presently known as the Sundarbans Biosphere Reserve (SBR). The extent of mangroves in the Indian Sundarbans has decreased over the past centuries, due to clearing of large tracts of forests and land reclamation for agricultural purposes. Currently the extent of the Sundarbans mangrove forest is limited to 4,264km² of SBR (Fig. 1) and the remaining landscape comprises of inhabited islands and human settlements in the adjacent mainland. Hydrological modifications like water diversion and commissioning of large barrages upstream has had a great impact on the salinity profile of the rivers downstream in central Sundarbans, which lose their freshwater supply for much of the year. The channels of the western segment (Hooghly and Muriganga) are hyposaline than in the 80s and 90s,

primarily due to the increased amount of freshwater. Intrusion of marine phytoplankton species indicates the increased salinity profile in the central Sundarbans (Banerjee 2013). Surface water salinity has increased in central Sundarbans at a rate of 1.09 psu per year during 1984–2013 (Trivedi et al. 2016). According to Manna et al. (2010) salinity in the Sundarbans estuary ranges from 11–25 psu, being highest in the dry season and lowest in the wet season.

Recent work from the Bangladesh Sundarbans shows that the Ganges River Dolphins share their habitat with Irrawaddy Dolphins *Orcaella brevirostris* but that Irrawaddy Dolphin distribution extends further southwest and offshore into the saline coastal waters of the Bay of Bengal (Smith et al. 2006). The range of *Platanista* has declined since the 19th century when it was mapped by Anderson (1879) especially in the upstream reaches (Sinha et al. 2000; Smith et al. 2001). Sighting of Irrawaddy Dolphins is common in the Indian Sundarbans (Chakraborty & De 2007), however, there is no estimated count available so far.

The trans-boundary waters adjacent to Bangladesh Sundarbans is low in salinity (5–15 ppt) compared to other segments eastward in Bangladesh which are moderately saline (15–25 ppt) and hypersaline (25–30 ppt) as reported by the Centre for Environmental Geographic Information Services, Dhaka (CEGIS 2006; Hussain et al. 2013). Smith et al. (2009) recorded distribution of GRD is dependent on low salinity in the Sundarbans mangrove forests of Bangladesh. They reported the presence of GRD in waterways with a mean salinity of 0.00 ppt in the low water seasons (March) and around 6.00 ppt during the high water seasons (Sept/Oct).

In August 2010, a floating carcass of a Ganges River Dolphin was reported from the river Bidya flowing through the eastern part of the Indian Sundarbans and a similar incident was recorded earlier in June 2010 from Jhingakhali (Fig. 3). Bahuguna & Mallick (2010) reported the occurrence of GRD in river Ichchamati based on a previous survey undertaken in 2002. Sighting records of three Indo-Pacific Hump-backed Dolphins *Sousa chinensis* in the Gomor River close to Sajneakhali Wildlife Sanctuary (Saha & Palchowdhury 2008) and by B.D. Smith in 2002 on the Raimangal River on the Indo-Bangladesh border indicate the likely continued occurrence of these marine cetaceans in the eastern Indian Sundarbans. There is no consistent sighting record or evidence of the GRD population from the central and eastern segment of the Indian Sundarbans in the recent past. Occurrence has been recorded only in the water channels of the

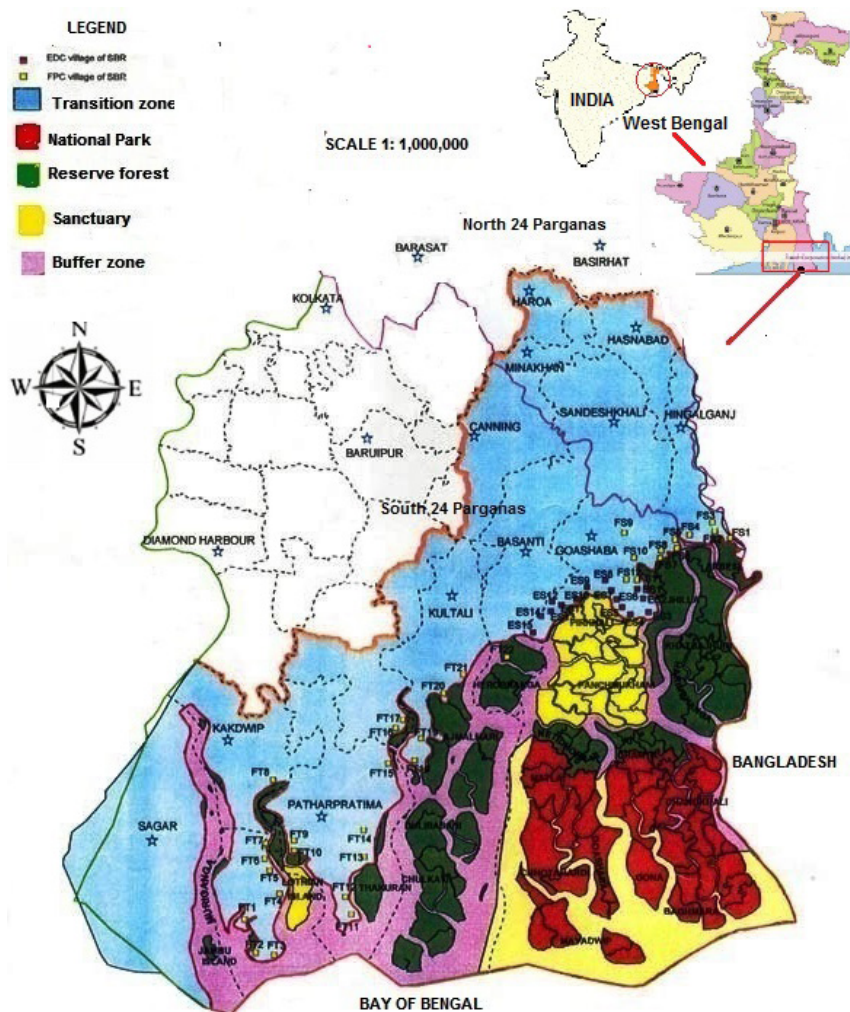


Figure 1. Map of Sundarban Biosphere Reserve

transition zones of SBR during 2015–2016.

coast.

Study Area

The present study was carried out in the river Hooghly, as the lower stretch is termed from the point where the Ganges meets with the river Jalangi at Nabadwip until it reaches the Bay of Bengal, eight tributaries of river Ganges upstream and also in the comparatively saline, estuarine creeks and channels of the Sundarbans in West Bengal, India (Fig. 2).

Selection of the river courses for survey was based on the secondary data collected from the literature review, interactions with communities presently residing along the river banks and primary data generated from direct observations and occurrence records of the Ganges River Dolphin in the last decade from the waterways flowing in this region. The coastline of southern West Bengal was avoided on the basis of less likelihood of sighting GRD and greater possibility of Irrawaddy Dolphins *Orcaella brevirostris* occurring in some channels and along the

MATERIALS AND METHODS

Interviews

Secondary data, both on the occurrence and absence of GRD, was collected by conducting interviews with local boatmen and fishers who spend a considerable amount of time on the rivers during their day-to-day activities. A total of 251 respondents of all age groups including boatmen, fishermen, fish vendors from the local community, officials of the forest department, and tourists were interviewed about the frequency and seasonal pattern of dolphin sightings in last 10 years, recent and past records of entanglement in fishing nets, mortality records, availability of fish species, habitat preference, and human induced pressures, etc.



Figure 2. Location of Sundarban in the study area of West Bengal, India



Figure 3. Occurrence records of *Platanista* (P) and *Orcaella* (O) from southern West Bengal

Boat-based surveys

A survey effort of a total stretch of 96.3km in rivers (Table 1) was utilized in selected channels of the Indian Sundarbans including visits to all segments in summer (March–June), monsoon (July–October) and winter (November–February) seasons during 2013–2016. The waterways were scanned in all the seasons to confirm the presence or absence of dolphins and to avoid any information gap due to seasonal differences. The observations following the method of Smith & Reeves (2000) were carried out by a team of 3–4 observers by sailing with the help of traditional country boats and mechanized boats as well, at a speed of a maximum of 5–8km/hr. Country boats of low height and comparatively higher mechanized boats with double decks were used. All encounters with dolphins and the respective geographical coordinates were recorded by a hand held GPS (GARMIN e-trex) and river depths measured by a hand held echo sounder. River width at specific locations was measured with the help of Google Earth imagery.

Land-based surveys

Point observations were made during 2012–2016 at different stretches of river Ganges, its tributaries and selected rivers and channels in the Sundarbans based on previous records of GRD. The observations were carried out by a team of 3–4 observers along the river banks or channels in summers, monsoons and winters. The observers watched the river courses from specific observation points on river banks for 7–9 hours, especially at confluences of rivers and stretches where there are regular sighting records of GRD. All land-based survey locations are shown in Fig. 1. All the sightings were confirmed by more than one observer. Photographs were captured in the areas with higher visibility of dolphins. River dolphins are extremely difficult to photograph, as the unpredictable surfacing of a solitary animal or two for a moment is difficult to capture. Wherever possible, images of surfacing GRD were captured and documented during the field observations to authenticate location, timing and records of the encounters. Digital photographs were taken using a DSLR camera Nikon D700, D300s with lenses of Nikkor 70–200 mm f/2.8 G ED VR II and Nikkor 24–70 mm f/2.8 G ED.

Monocular spotter (Bushnell) was used for better visibility in wider channels. Surface water salinity was obtained by using an optical refractometer and monitored every season in the study area at all focal points to understand the salinity preference of the GRD population in this region. Online Google Earth imagery

was used for geo-referencing and plotting of the ground observation points recorded from the field.

Analysis

Platanista and *Orcaella* both inhabiting the Sundarbans waterways are often considered as a single species by the locals. Therefore the secondary information was verified and the taxonomic identity of both the species was confirmed by direct sighting, photographic records and official records obtained from the forest department. Sighting of dolphins in any channel for two consecutive years or more in different seasons during this study was considered to confirm their year round occurrence. Absence of records or direct observation of the live species in any season at any channel or river for a period of 10 years or more based on primary and secondary data has been considered as local extirpation. Salinity was recorded in low water and high water seasons to understand the minimum–maximum range and preference to specific salinity range was calculated based on the frequency of dolphins' occurrence in consecutive seasons.

RESULTS

Out of a total survey effort of 373.5km in different waterways of southern West Bengal, nearly 96.3km estuarine section in five channels of the western, central and eastern Sundarbans in India was studied every season during 2012–2016. This could not confirm the presence of GRD from the central and eastern segment.

The major congregations of GRD or sighting points in the lower stretch of the Hooghly and some of the confluences show a preference to a hyposaline (Table 2) environment. Sightings of GRD by boat and land-based surveys reflect that distribution of the species is affected by salinity.

Among the hydrological parameters recorded so far, surface water salinity was found to be a key factor influencing the distribution of GRD in the estuary. Encounter rate (sightings/hr) of GRD has been recorded at different salinity levels in a boat-based survey effort at the lower reaches of Hooghly. There has been no sighting record in the waterways wherever the salinity level crosses 10 ppt (Fig. 4).

The present study clearly indicates that the encounter rate of dolphins was consistent in all seasons mostly in hyposaline waters (<1 ppt) and in moderate salinity (1–10ppt) which occurs close to the estuarine mouth of Ganges. The absence of GRD at salinity >10

Table 1. Boat-based surveys in selected water channels in Sundarban

Section	River/Channel	Survey length (km)	Sighting	Salinity range
Western	Hooghly	38	Y	<1.0–19 ppt
	Muriganga	14	Y	
Central	Matla	15	N	9.0–24.6 ppt
Eastern	Gomor	17	N	5.0–24 ppt
	Bidya	12.3	N	

Y - sighted, N - not sighted

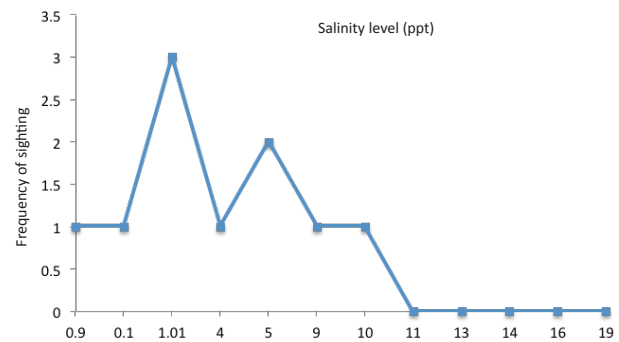
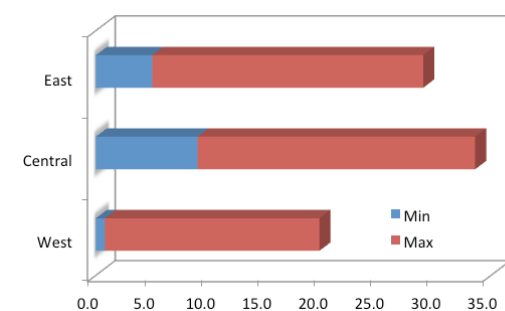
**Image 1. A pair of *Orcaella brevirostris* near eastern Sundarban, India**

ppt, however, indicates that the dolphins do prefer lower salinities. Findings and sighting records in the present study shows a correlation between dolphin sightings and salinity which suggests that this is an important environmental factor influencing the distribution.

Significant increase in salinity levels were documented in the river Ganges in India after the commissioning of the Farakka Barrage. Five rivers namely the Saptamukhi, Thakuran, Matla, Gosaba, and Harinbanga in central section (Fig. 2) of Indian Sundarban are also tidally fed and lost their upstream freshwater connectivity. Based on the current study, and historical records, there is no evidence that GRD occurs in the central section of the Sundarbans; however a group of Irrawaddy Dolphins (Fig. 4) was sighted in 2014 and also in 2016 in the central section (present study).

Salinity range varies on account of seasonal changes, fresh water flow and tidal influence (Fig. 5). The recorded salinity range from three zones in the Indian Sundarbans reflects a comparatively hypersaline central part, which is not preferred by the GRD. The eastern section is comparatively less saline upstream, however there is no sighting record in the present study.

The present study recorded the use of moderate to

**Figure 4. Encounter rate of GRD at different salinity levels from western Sundarban****Figure 5. Average salinity range in different zones of Indian Sundarban**

shallow depth (3.9–37 m) by GRD in the river Hooghly and its tributaries of southern West Bengal depending on seasonal flow in different channels having variable width from 88.39m - 4.3km.

DISCUSSION

The stretch selected in the present study so far is very limited compared to the span of this estuary. The likelihood of GRD occurring in the selected channels, however, was comparatively better than the other stretches downstream with higher salinity levels and no sighting records in the last decade. The GRD subpopulation occurring downstream of Farakka Barrage in the river Ganges and its tributaries in West Bengal was studied by Chowdhury et al. (2016). The present study confirmed the sightings of GRD in the western part of the Indian Sundarbans.

The study conducted so far indicates a possible decline in the range of *Platanista gangetica* in the Indian Sundarbans. Occurrence of the GRD in the river Hooghly, its tributaries and estuarine rivers depends on a combination of various factors. The geo-climatic

Table 2. Sightings of *Platanista gangetica* in lower reaches of river Hooghly and its tributaries

Land reference	District	River	Salinity (ppt)	Boat-based (B)/ land-based (L) Survey	Geographic Coordinates	Year
Budge budge river side	South 24 Paraganas	Hooghly	0	B, L	22.483°N & 88.183°E	2015
Bata nagar	South 24 Paraganas	Hooghly	0	L	22.500°N & 88.200°E	2015–16
Pujali	South 24 Paraganas	Hooghly	0	L	22.466°N & 88.150°E	2015
Millenium park	Kolkata	Hooghly	0	B	22.550°N & 88.031°E	2014–15
Diamond Harbour	South 24 Paraganas	Hooghly	0	B, L	22.160°N & 88.017°E	2015
Kachuberia	South 24 Paraganas	Muriganga	0	B, L	21.850°N & 88.133°E	2015–16
Namkhana	South 24 Paraganas	Confluence of River Muriganga and Hatania-Doania	1.01–9.0	B	21.750°N & 88.210°E	2015–16
Gadiara	Howrah	Confluence of Rupnarayan and Hooghly	0	B, L	22.216°N & 88.033°E	2012–15
Haldia	South 24 Paraganas	Confluence of Haldi and Hooghly	0	L	22.000°N & 88.050°E	2012
Garchumuk	Howrah	Confluence of Damodar and Hooghly	0	L	22.333°N & 88.080°E	2012–2015
Bakshi	Howrah	Confluence of Rupnarayan, Damodar and Mundeshwari	0	L	22.510°N & 88.016°E	2014–15
Kolaghat	East Midnapur	Rupnarayan	0	B, L	22.416°N & 87.883°E	2011–15
Belur	Howrah	Hooghly	0	L	22.616°N & 88.350°E	2015

Table 3. Recorded Salinity data and occurrence of *Platanista gangetica*

	Zone	Salinity Level	Occurrence of <i>Platanista</i>
1	River Ganga, Hooghly & tributaries	<1–1.014 ppt (present study)	Recorded in all the stretches (observation from nearly a total of 300km except the estuarine part in the present study)
2	Tidal lower reaches of Hooghly and Muriganga River	1–19 ppt (present study)	Occurrence in the salinity level up to 10 ppt (present study)
3	Rivers in Central and Eastern Sundarban	9–26.59 ppt (Mitra et al. 2010) 5–24.6ppt (present study)	Not recorded (present study)

factors gained prominence in all recent studies, more so because of climate change and the subsiding delta complex in the Ganga River Basin, which has a geotectonic evolutionary history. The decline of *Platanista* in the Indian Sundarbans, however, may be attributed to the combined effect of increased sedimentation, reduced freshwater discharge and increased salinity. It has been observed that the salinity level has a marked influence on the distribution of GRD in the Sundarbans. Salinity in this deltaic system is influenced by the combined action of the following factors:

1) Natural salinity level of the rivers is regulated by evaporation and recharge by rainwater as well as tidal

flow downstream.

2) Both the glacial melting and sea level rise due to climate induced changes affect the salinity level.

3) Anthropogenic factors like reduced discharge from barrages, runoff from adjacent lands, and water abstraction for irrigation etc.

4) The estuarine channels in the Indian Sundarbans at present are mostly fed by tidal flow and have lost their freshwater connectivity.

Primary and secondary data on surface water salinity obtained from Sundarbans in West Bengal, India show three distinct salinity zones in the Indian Sundarbans (Trivedi et al. 2016).

Table 4. Recent sightings of *Orcaella brevirostris* in West Bengal (India)

Land reference	District	River/ coast	Geographic Coordinates	Year	Observation from	Source
Kakdwip (Steamer Ghat)	South 24 Paraganas	Hooghly	21.850°N & 88.166°E	2012–13	River bank	Present study
Namkhana-Narayanpur	South 24 Paraganas	Hatania-duania	21.750°N & 88.216°E	2012–13	Boat	Present study
Sundarban	South 24 Paraganas	Bidya	21.933°N & 88.700°E	2016	Boat	(pers. comm)
Digha coast	West Medinipur	Bay of Bengal	21.616°N & 87.500°E	2014	Land	Present study

**Image 2. Incidental mortality due to river traffic in Kolkata**

In the present study, GRD has been recorded only in the hyposaline zone in western Sundarbans, which includes the flow of the river Ganges, Muriganga and Saptamukhi rivers (Figs. 2 & 3). The lower stretch of the Ganga in Southern West Bengal receives snow melt and monsoon fed river water from upstream but that is only the discharge allowed through the Farakka Barrage. Occurrence of *Platanista* was recorded in this section up to a maximum salinity of 10 ppt. Salinity recorded from this zone in the present study varied between <1.0–19 ppt depending on seasonal fluctuation.

Hypersaline zone in the central part lost the connectivity with upstream freshwater flow. Siltation and clogging of some channels in the late 15th century and thereafter completely deprived this central sector from freshwater flow (Choudhuri & Chaudhury 1994). Takhuran, Matla and Gosaba are the major waterways in this segment (Fig. 2). There has been no recent sighting record of GRD from this segment.

The eastern most part of the Indian Sundarbans having freshwater connectivity with river Padma of Bangladesh is moderately saline. The trans-boundary

**Image 3. Watercrafts in the movement route of dolphins on River Hooghly**

waters adjacent to Bangladesh Sundarbans are low in salinity (5–15 ppt), but it increases downstream and the southwest part of Bangladesh Sundarbans is hypersaline. There has been no sighting of *Platanista* reported in recent times or recorded in this study from this zone.

Biodiversity loss in the Sundarban waterways due to the cumulative effects of changing weather patterns, subsidence and reduced freshwater input due to dams and diversions have not been discussed much, however, these factors changed the salinity dynamics of the region (Raha et al. 2012). The reduced freshwater supply not only led to higher river water salinity, but the aquatic subsystem was significantly altered, resulting in a sharp decline in the fish varieties from the central tracts of the Sundarbans (Mitra et al. 2010). All of these may have certainly influenced an obligate freshwater species like *Platanista* and the present study recorded a similar finding. Smith & Braulik (2017) postulated that GRD are not commonly found in salinities greater

than 10 ppt. The findings from the present study conforms with the fact opined by Jensen et al. (2013) that distribution limits of GRD is related to its preference of low salinity in the water channel. The present study clearly indicates that the encounter rate of dolphins was consistent in all seasons mostly in hyposaline waters (<1 ppt) and sometimes in moderate salinity (1–10ppt) close to the estuarine mouth of the Ganges. However, the disappearance of GRD from channels due to increased salinity >10 ppt strongly confirms its preference to low salinity. Findings and sighting records in the present study reveal that distribution of GRD is directly influenced by the salinity level of the waterways.

At the northeastern edge of the mangrove forest in Bangladesh, there has been increase of salinity and decline in river flow of the Ganges. Increased sedimentation due to reduced discharges also contributed to the gradual drying up of tributaries (Smith et al. 2009). Smith et al. (2007) opined that the upstream range of Irrawaddy Dolphins in Bangladesh Sundarbans is more affected by interspecific competition with GRD than by any dependence on a particular salinity. Irrawaddy Dolphins also co-occur with *Platanista gangetica* in a relatively small portion of their range in the Sundarbans mangrove forest (Smith et al. 2006). In India, it needs further study to confirm if there is any interspecific competition or range overlap of both the species in this mangrove region. Present findings indicate the suitability of hyposaline stretches for GRD and areas with salinity level >5 ppt for Irrawaddy dolphins.

In a study by Choudhary et al. (2012) the minimum mid-channel depth requirements were estimated at 5.2m for dolphin adults and between 2.2m and 2.4m for mother-calf pairs. The channel depth and width recorded under the present study find that the channels and creeks of the Indian Sundarbans are suitable for Ganges River Dolphins.

Dolphins depend on freshwater fishes. River Hooghly and estuarine waters in the Sundarbans are intensive fishing zones. Around 94–95 % of the Hilsa, an iconic fish *Tenualosa ilisha* in this sub region are captured by drift gill nets in the lower stretch of the Hooghly estuarine system (De 2014). These nets have a direct or indirect impact on the availability of fish in the river. Fishermen have reported that dolphins target fisherman's nets under water in search of prey. It was reported that dolphins directly collect fishes from fishing nets and also damage the nets. However, entanglement in fishing nets was also recorded by local fishermen in Diamond Harbour, Garchumuk and Raghunathpur near

Farakka. Fishing nets increase vulnerability of dolphins to entanglement, however the present study didn't have the scope to establish the relationship of overfishing and use of unsustainable fishing gear with the non-occurrence of GRD in comparatively low saline water stretches of eastern Sundarbans.

Choudhury & Mitra (2014) reported the unsustainable use of fishing gear in the river Hooghly and its tributaries contributing to the loss of many fish varieties, especially their breeding grounds. Fishing is a common livelihood for the communities living in the Sundarbans or elsewhere in southern West Bengal. Exploitative fishing practices in many channels and use of destructive fishing gear contribute to the decline of fishes and incidental mortality of dolphins due to entanglement of dolphins in fishing nets. The most abundant gear observed in a survey at the lower reaches of Hooghly was the bottom set bag net (behundi jal) which accounted for nearly 98% of all gears recorded. Other gears were drag net, cast net along with a small percentage of hook and line fishing. The bag net is made of mosquito net and is mainly used to collect shrimps and their larvae. These nets are set in series across the river in many places obstructing the movement of dolphins. Mansur et al. (2008) has also cited incidents of entanglement of *Platanista* in the fishing nets in Bangladesh Sundarban.

Decline in fish variety and reduced wild catch prompted the fisher folks to look for other alternatives to compensate the economic loss. Establishment of brick kilns (10–11 / km) along river banks and sand or soil collection from riverbeds (8–9 boats/ 2–3 km stretch of river) in prolific quantity are recent practices that damage the riverfront and directly interfere with the fluvial habitat of river dolphins. These are more prominent in the main course of the Hooghly and its tributaries. All of these potential anthropogenic threats have been discussed by Chowdhury et al. (2016). Almost 70% of the respondents were unable to differentiate between different cetacean species, which often generates a generalized idea about the existence of GRD in the Sundarbans. Only confirmed sightings, however, have been considered in this study.

Relationship of dolphins with the fisher folk and the effect of underwater noise from the motorized boats are not favourable for dolphins. An encounter rate of 0.35 dolphins/km was recorded from the western part of the Indian Sundarbans. This rate was proportionately higher by around 55% in stretches of the rivers with limited use of motorized boats, less river traffic and more use of country boats; however, Kelkar et al. (2010) in his study on the habitat use and distribution of the Ganges River

Dolphin, opined that the number of motorised boats and boat noise were not significantly correlated with dolphin encounter rates. Motorised boats in good number (10–25/hr) travel at an average speed of 6–10km/hr across the dolphin movement route in different segments of the major rivers in South Bengal and near the inhabited islands of the Sundarbans. It is likely that underwater noise does affect the behavior of dolphins, which rely on sound for sensing of the environment. In Mahakam River of Indonesia, Irrawaddy dolphins dive for longer periods and avoid river traffic (Kreb & Rahadi 2004). Their study also highlighted the risk of vessel collision and impact of underwater noise pollution.

It was beyond the scope of this study to conclude that unsustainable fishery practices and underwater noise have a direct impact on the GRD population of the Sundarbans; however, salinity profile in different parts of the Indian Sundarbans, continued disappearance of Ganges Dolphin there along with its occurrence in hyposaline western segment indicate that the present habitat in the Indian Sundarbans may not be preferable to Ganges River Dolphins and none of the recent evidences indicate the existence of a population of GRD in most of the waterways of this estuary. Chowdhury et al. (2016) reported the confinement of the species in isolated pockets. Braulik & Smith (2017) reported non availability of information on the status of Ganges River Dolphins in the Indian Sundarbans. All secondary information or records of historical evidence indicate the existence of dolphins in estuarine channels of the Indian Sundarbans similar to the presence of GRD in the Bangladesh Sundarbans. Unlike Bangladesh, however, there has been no systematic and continuous survey on GRD in the Indian Sundarbans. In this context, the distribution of GRD in the Indian Sundarbans has been reviewed and visual surveys in this study and contemporary survey/observations by other workers indicate a restricted distribution of GRD in the westernmost part of the estuary at present. The decline of GRD population in the Indian Sundarban needs to be substantiated with further study, however the reduced freshwater flow in the channels and gradual rise of salinity clearly suggest a habitat unsuitability for GRD in this estuary. The extent of the former range of the species in light of previous records has definitely changed, but that has happened over a considerable time period while the waterways/channels have been losing their freshwater connectivity and some others have been drying up. Intensive study and long term survey data on this species in the Indian Sundarbans could further substantiate the viewpoints presented here.

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