CONSERVATION ACTION PLAN FOR GANGES RIVER DOLPHIN AND IRRAWADDY DOLPHIN OF BANGLADESH

Expanding The Protected Area System To Incorporate Important Aquatic Ecosystems Project

2019

WRITERS LINE UP

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Prepared by-

Mohammad Abdul Aziz, PhD
National Consultant, Preparation of Atlas on dolphins &
Professor of Zoology, Jahangirnagar University

Technical Advisor-

Md. Modinul Ahsan
Project Director, EPASIIAE Project, Bangladesh Forest Department

Md. Rezaul Karim Chowdhury
Project Manager, EPASIIAE Project, UNDP, Bangladesh

Arif Mohammad Faisal
Programme Specialist - Environmental Sustainability and Energy, UNDP Bangladesh

Khurshid Alam
Asstistant Resident Representative, UNDP, Bangladesh

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Message

Md. Shahab Uddin MP
Minister
Ministry of Environment, Forest and Climate Change
Govt. of the People's Republic of Bangladesh

Bangladesh is an abode of numerous flora and fauna which are both globally very important. On its aquatic ecosystem, Bangladesh is fortunate to harbor 10 (ten) species of cetaceans including the freshwater Ganges River Dolphin surviving on its vast freshwater river systems. The Ganges River Dolphin is considered as one of the globally endangered species. Irrawaddy dolphin has also been facing different kinds of threats around the globe. Bangladesh Government is committed to working with best efforts to conserve the threatened wildlife species through different programs, adopting strategies, formulating and implementing policies and legislations.

The common threats to Cetaceans are incidental and intentional killing, sedimentation, reduction of fresh water flow, pollution, dam construction, increased traffic etc. Considering all these threats, this Action Plan has tried to identify effective actions that require further coordination among government agencies, strong involvement of local communities, NGOs and academia. Regional cooperation will also greatly enhance conservation of the Cetaceans communities.

The Ministry of Environment, Forest and Climate Change supports the Bangladesh Forest Department to take further initiatives to light these threats, establish a coordination mechanism, and initiate coordinated programs identified in the Action Plan (2020-2029) involving communities to ensure habitat conservation and connectivity. Such conservation efforts can benefit other aquatic and threatened species in rivers and will ensure better health of our riverine ecosystem that will ultimately benefit millions of local communities who survive on aquatic resources.

I would like to take this opportunity to express my gratitude to the officials and experts of the Ministry of Environment, Forest and Climate Change; Forest Department, United Nations Development Program, academia and local communities for their dedication and commitment in the preparation of this document through a participatory process. I would like to request all officials, experts and stakeholders do their utmost to mobilize support and resource for best utilization of the Action Plan (2020-2029) for national and global benefits.

Joy Bangla, Joy Bangabandhu

Md. Shahabuddin

(Md. Shahab Uddin MP)



Message

Ziaul Hasan ndc
Secretary Ministry of Environment,
Forest and Climate Change

This is indeed a great achievement for the Government of Bangladesh for preparing and publishing the 'Bangladesh Dolphin Action Plan (2020-2029)'. It is very much linked to maintaining long-term biodiversity conservation in our country. Thus the current initiative to formulate the 'Bangladesh Dolphin Action Plan (2020-2029)' would ultimately help accomplish the greater effort initiated by the Government of Bangladesh to conserve country's biodiversity.

Ganges river dolphin and the Irrawaddy dolphin are considered as 'Key stone species. The Ganges river dolphins are widely distributed across many of our river systems including the rivers of Padma, Jamuna, Meghna, Sangu-Karnafuli and the Sundarbans, and the Irrawaddy dolphins are mostly limited to brackish and less saline waters across the coastline of Bangladesh. Both the species are threatened with various challenges including direct loss of the individual and degradation of their habitat. But this important Key stone species must be protected for the conservation of other aquatic species in rivers as well as ensuring our river ecosystem, on which millions of local people rely for livelihoods.

This action plan provides a roadmap for dolphin conservation and management efforts over the next ten years both on policy issues and on the ground tasks. For achieving stipulated outcome , the development practitioners and the communities must work hand in hand with the government to implement the suggested actions of the plan . Accordingly I look forward for sincere collaboration and contribution of all concerned agencies for the successful implementation of the 'Bangladesh Dolphin Action Plan (2020-2029)'. I heartily thank my colleagues from different ministries, representatives from universities, civil societies and development practitioners who have s worked rigorously to develop this Action Plan.



(Ziaul Hasan ndc)



Message

Mohammad Shafiul Alam Chowdhury
Chief Conservator of Forests
Forest Department, Bangladesh

The dolphin is an important indicator species in the riverine ecosystems considering the conservation of biological biodiversity. That can benefit other aquatic flora and fauna including the threatened species. Presence of dolphin indicates the better health of any river ecosystem on which millions of local communities depend for their living of course' But due to lack of priority to the conservation of dolphins in the last 3-4 decades Ganges River Dolphins have moved away from some moderately smal size rivers like Kushiara, Dhorola, Korotoa, etc.

The Dolphin Conservation Action Plan (2020-2030) has mentioned the nationat and global distribution of dolphins, importance of dolphin in the aquatic ecosystems, the threats to dolphin, impact of climate events and. mitigation measures (long term and short term action plan), monitoring and evaluation, etc. The conservation importance of these species is therefore foremost and our greater emphasis are needed on the ground to save these wonderful and intelligent aquatic mammals of Bangladesh.

I would like to express my gratitude to the Ministry of Environment, Forest and Climate Change for the approval and adoption of this Action plan. I would also thank UNDP Bangladesh, the consultant Prof. Dr, Abdul Aziz and the project Director and other officials of 'Expalding the Protected Area System to Incorporated Important Aquatic Ecosystems Project' for preparing the Dolphin Conservation Action plan of Bangladesh.

(Mohammad Shafiul Alam Chowdhury)



Message

Sudipto Mukerjee
Resident Representative
UNDP Bangladesh

At the outset, I congratulate the Government of Bangladesh for preparing a Dolphin Conservation Action Plan for the country with GEF financial assistance under the 'Expanding the Protected Area System to Incorporate Important Aquatic Ecosystems Project'.

Dolphins are flagship species in river ecosystems that not only benefit other aquatic and threatened species but also are a useful indicator to study for ensuring better health of river ecosystems. The river systems of Bangladesh are an excellent natural hub of the enormous marine resources including dolphins. While the population of two globally threatened dolphin species viz. Ganges River Dolphin and Irrawaddy Dolphins remains satisfactory in the coastal areas, the Ganges River Dolphin remains at huge risk in the inland waterways with increasing drought induced water scarcity, increasingly rivers becoming shallow, overfishing, and frequent accidental catches. Some freshwater inland waterways such as the old Brahmaputra, Surma-Kushiara river, Dhaleswary, Dhorola, etc. have almost lost their natural capacity to host optimum fish biodiversity.

This action plan highlights the status and distribution of the Ganges River Dolphin and Irrawaddy Dolphin in the country, their threats and mitigation, climate change perspectives, monitoring and evaluation strategy considering their distribution of these two important aquatic mammals. I strongly encourage the Forest Department, Bangladesh and the Ministry of Environment, Forest and Climate Change to continue to play their critical role in the implementation of the recommendations provided in this Action Plan and in the long-term conservation of this important aquatic flagship species.

(Sudipto Mukerjee)

Table of Contents

Executive Summary	**07**
CHAPTER I: BACKGROUND	**07**
1.1. Introduction	**07**
1.2. Bangladesh – a land of rivers for dolphins	**10**
1.3. Focal cetaceans	**12**
1.3.1. Ganges river dolphin	**12**
1.3.2. Irrawaddy dolphin	**14**
1.4. Why it is important to conserve dolphins	**16**
CHAPTER II: STATUS AND DISTRIBUTION	**17**
2.1. Ganges river dolphin	**17**
2.2. Irrawaddy dolphin	**21**
2.3. Dolphin conservation in Bangladesh	**23**
CHAPTER III: ACTION PLAN	**24**
3.1. Overview	**24**
3.2. Threats to dolphins	**24**
3.2.1 Direct loss of dolphins	**25**
3.2.2. Habitat loss and degradation	**26**
3.3. Vision and goals	**32**
3.4. Objectives and strategic actions	**32**
3.5. Monitoring and evaluation	**33**
Literature cited	**36**

Table of Figures

Fig. 1. Protected areas of Bangladesh. 08

Fig. 2. Field survey team at Rajshahi T-band area of the Padma River. 09

Fig. 3. The Chief Conservator of Forest, consultants and other officials of the Bangladesh Forest Department in the national workshop held at Dhaka. 09

Fig. 4. Boat plying in rivers – has been an important activity of Bangladeshi people where dolphins live. 11

Fig. 5. Google Earth image showing the vast river networks in the Indian Subcontinent, ultimately find their ways to the Bay of Bengal through the land of Bangladesh. 11

Fig. 6. River networks in Bangladesh (adapted from WARPO). 12

Fig. 7. Geographical distribution of river dolphins in Asian countries. 13

Fig. 8. Distribution of Ganges river dolphin in the Indian Subcontinent. 14

Fig. 9. Global range of Irrawaddy dolphin (adapted from IUCN). 16

Fig. 10. Natural environmental setting of the River Halda has been an important stronghold for Ganges river dolphin in the southeast region of Bangladesh. 18

Fig. 11. Distribution of Ganges river dolphin in Bangladesh. 20

Fig. 12. The Sundarabans of Bangladesh has been an important habitat for cetaceans. 21

Fig. 13. Distribution of Irrawaddy sightings in the Sundarbans and adjacent cost of Bangladesh. 22

Fig. 14. Three wildlife sanctuaries within the Sundarbans (from top: Chandpai, Dudhmukhi, and Dhangmari) established for the protection of dolphins. 23

Fig. 15. Gillnets (current jal) used for catching Hilsha shad are widespread across all major rivers of Bangladesh. 25

Fig. 16. Carcases of Irrawaddy dolphin in the Sundarbans of Bangladesh, might have died due to entanglement. 26

Fig. 17. Rubber Dam at Bhuzpur on the upstream of the Halda River. 27

Fig. 18. Immediate downstream of Feni Regulator on Feni River no longer supports Ganges river dolphin. 28

Fig. 19. Industrial effluent ultimately finds the river and aquatic ecosystems across the country. 28

Fig. 20. Plastic entangled on the bank vegetation appears widespread in Halda River. 29

Fig. 21. Fishing is an important activity across the rivers of Sundarbans. 30

Fig. 22. Decrease of waterflow and siltation at old Bramaputra River in Mymensingh make it unsuitable for dolphins in winter. 31

Fig. 23. Dredging (of majority illegal) is widespread across rivers of Bangladesh. 31

Fig. 24. This Action Plan is equally applicable to other cetaceans like this rare Indo-Pacific Humpback dolphin in the Sundarbans of Bangladesh. 33

List of Table

Table 1. Important habitats of Ganges river dolphin in Bangladesh 19

Table 2. Threat objectives and strategic actions including priority, timeline and implementing agencies. 34

Table 3. Threat objectives and strategic actions with priority, timeline and implementing agencies. 35

Executive Summary

Cetaceans constitute an important component of aquatic biodiversity in the vast wetlands of Bangladesh. Of the 10 cetacean species reported to occur in the country, the Ganges river dolphin and Irrawaddy dolphin are two significant aquatic mammals – an ideal indicator species to monitor our river's health. To conserve the remaining cetaceans in the country, guided actions using updated scientific information are urgently needed. Taking this into account, the Bangladesh Forest Department has initiated the 'Expanding the Protected Areas System to Incorporate Important Aquatic Ecosystems (EPASIIAE)' project with support from the Global Environment Facility through United Nations Development Programme. Under this project, the present study has focused developing a conservation action plan on the Ganges river dolphin and Irrawaddy dolphin of Bangladesh.

The Ganges river dolphins were reported earlier from many of our river systems, with particular mentions from the rivers of Padma, Jamuna, Meghna, Sangu-Karnafuli and the Sundarbans. Whilst the Irrawaddy dolphin is restricted to brackish and less saline waters across the coast of Bangladesh including river networks of Sundarbans. Given the wide distribution in Bangladesh, the Ganges river dolphin faces higher range of threats than the Irrawaddy dolphin. The major category of threats includes direct loss of dolphins, and habitat loss and degradation. Dolphins are being lost directly through incidental entanglement in gillnets and intentional killing to use as fish attractant and traditional medicine. Habitat loss and degradation includes decrease of freshwater flow from the upstream due to the construction of dams and barrage, unregulated harvesting of fish and aquatic resources, pollution from industrial effluents, poison fishing in Sundarbans, sedimentation and siltation, modification of riverbed through dredging, and excessive vessel traffic. The action plan outlined activity-oriented 26 strategic action points to address these threats on priority basis by next 10 years between 2020 and 2029. Several action points included priority research items which are needed to be done urgently to implement this action plan. The dolphins are flagship species for river conservation which can benefit other aquatic and threatened species as well as ensure better health of our river ecosystem on which millions of local communities rely on for their living. The conservation importance of these species is therefore paramount and our greater efforts are needed on the ground to save these charismatic aquatic mammals of Bangladesh.

CHAPTER I: BACKGROUND

1.1. Introduction

Biodiversity conservation has been an important global issue over decades due to its rapid depletion worldwide. Consequently, the Convention of Biological Diversity (CBD) adopted in 1992 categorically warned about the loss of biodiversity that would affect directly the poorest people of the developing countries who entirely rely upon local ecosystems for their livelihoods. Therefore, aligned with the CBD guidelines as a signatory and recognising the importance of biodiversity as a fundamental natural resource, Bangladesh government have been working to conserve the threatened animal species through different programs and strategies as well as adopting various policies, legislations and innovative approaches. As part of these initiatives, Bangladesh has established a network of protected areas under the Wildlife (Protection and Security) Act, 2012 across the country to conserve the wildlife and their habitats. The core protected area networks encompass 17 national parks and 20 wildlife sanctuaries comprising mostly forests alongside the Swatch of No-ground Marine Protected Area in

the Bay of Bengal (Fig. 1). The wetland-based protected areas are however largely insignificant in terms of spatial coverage except the Marine Protected Area. In the meantime, six wildlife sanctuaries have been established specifically for dolphin conservation in the Sundarbans and Padma-Jamuna confluence which altogether cover only 1,648 ha (BFD, 2017).

The fundamental principle of conserving biodiversity lies with ensuring in-situ protection of ecosystems, and the maintenance of viable populations of species in their habitats. Although Bangladesh is a populous country, it still supports a rich biodiversity within its natural habitats. Bangladesh is blessed with 10 species of cetaceans across its coasts (IUCN Bangladesh, 2015), including the freshwater Ganges river dolphin surviving on its vast freshwater river systems. The Ganges river dolphin is one of the most beautiful and significant aquatic mammalian species – an ideal candidate of indicator species for our river's health. Although a number of studies have been done on cetaceans in Bangladesh (Smith et al., 2010, 2006, 2001), countrywide updated status and distribution of dolphins are largely lacking. In order to conserve the remaining cetacean populations and their habitats, guided actions for mitigating threats are prerequisites. Taking this into account, the United Nations Development Programme (UNDP Bangladesh office) in partnership with the Government of Bangladesh (through the Bangladesh Forest Department) has initiated a project titled 'Expanding the Protected Areas System to Incorporate Important Aquatic Ecosystems (EPASIIAE)' with support from the Global Environment Facility. Under this project, the present study has aimed to prepare a conservation action plan for long-term protection of Ganges river dolphin and Irrawaddy dolphin of Bangladesh.

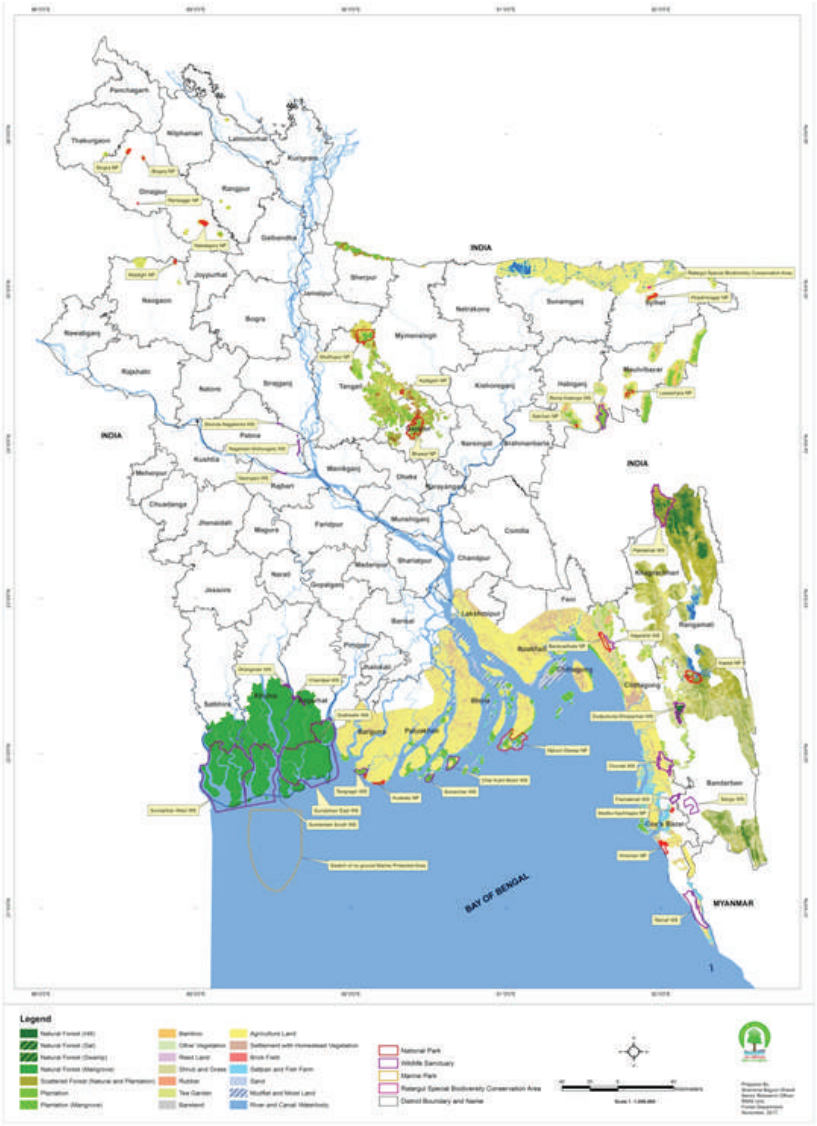


Fig. 1. Protected areas of Bangladesh (BFD, 2017).

This action plan has been formulated using information collected from diverse sources including published and unpublished reports, field surveys, workshops, meetings and com-

munity consultations. We conducted field surveys, community meetings, consultations and key informant interviews covering major areas of dolphin ranges to collect data on presence/absence and abundance of dolphins, abundance of fish and threats to dolphins (Fig. 2). All these efforts were made for delineating population distribution and their range, identifying their threats and possible mitigation options. Direct sightings of dolphins and other parameters were used to outline GIS-based distributional range map across Bangladesh; and to prepare an Action plan on the Ganges river dolphin and Irrawaddy dolphin. The field work was conducted between 23 September 2018 and 28 February 2019 (Fig. 3).



Fig. 2. Field survey team at Rajshahi T-band area of the Padma River (25/12/2018).



Fig. 3. The Chief Conservator of Forest, consultants and other officials of the Bangladesh Forest Department in the national workshop held at Dhaka (29/4/2019).

The draft action plan was presented and shared in a national seminar with participants from BFD officials, conservationists and field researchers held at conference room of the Bangladesh Forest Department on 25th April 2019. The comments and suggestions from the participants were incorporated to revise and improve the content of the action plan.

1.2. Bangladesh – a land of rivers for dolphins

Bangladesh lies in the largest delta of the world, the Bengal Basin, formed by the several river systems of the mighty Ganges, Brahmaputra, and Meghna along with their tributaries. The Bengal Basin is a vast lowland, therefore, almost half of the country's land surface can be considered as wetlands which include complex networks of rivers and streams, freshwater lakes and marshes, fish ponds, flooded cultivated fields and estuarine systems with extensive mangrove swamps (Hughes et al., 1994). These wetlands have a wide range of ecological, socio-cultural and economic significance that have a broader implication on lives and livelihoods of our 'ecosystem people'. A large chunk of the country's 160 million people depend on rivers for a living and for transportation (Fig. 4).

Bangladesh is popularly known as land of rivers, where the entire delta is formed by the deposits of the three major river systems of the Ganges, Brahmaputra-Jamuna, and Meghna Rivers (Fig. 5). There are around 700 rivers in Bangladesh stretching over 24,140 km, with thousands of smaller channels, floodplain depressions and extensive seasonally flooded lands that collectively form the floodplain ecosystems (Akonda, 1989). These rivers generally flowing from north to south have significantly influenced the overall physiography of the country. The total wetland area of Bangladesh is estimated to be from 7 to 8 million hectares. These wetlands encompass a wide variety of dynamic ecosystems, including rivers (7,497 km2), estuaries and mangrove swamps (6,102 km2), beels and haors (1,142 km2), floodplains (45,866 km2), Kaptai Lake (artificial reservoir, 688 km2), ponds (1,469 km2), baors (oxbow lakes, 55 km2), and brackish-water farms (72,899 km2) (Khan et al., 1994). Estimates of the area of floodplain range up to 80% (Brammer, 1990), and about 25% to 33% of the country remains under water every year for four to six months during the monsoon (rainy season). The country's rivers can be described briefly by the following four major river systems:

(a) The Jamuna-Brahmaputra river system extends from northern Bangladesh to its confluence with the Padma. The Brahmaputra ('Son of Brahma') receives waters from five major tributaries and at the point where the Brahmaputra meets the Teesta River in Bangladesh, it becomes known as the Jamuna. The Jamuna is a very dynamic and notorious river due to its subchannel characteristics and for the formation of fertile silt islands.

(b) The Padma-Ganges, which is divided into two sections: a 258-kilometer segment, the Ganges, which extends from the western border with India to its confluence with the Jamuna some 72 km west of Dhaka, and a 126-kilometer segment, the Padma, which runs from the Ganges-Jamuna confluence to where it joins the Meghna River at Chandpur.

(c) The Surma-Meghna system, which courses from the northeastern border with India to Chandpur, where it joins the Padma.

(d) Padma-Meghna system: When the Padma and Meghna join together, they form the fourth river system – the Padma-Meghna – which flows 145 km to the way of Bay of Bengal.

(e) A relatively minor river system, unconnected to the other four, is the Karnaphuli-Sangu system. Flowing through the region of Chattragram and the Chattagram Hills, it cuts across the hills and runs rapidly downhill to the west and southwest and then to the sea. The Feni, Karnaphuli, Sangu, Halda and Matamuhari—an aggregate of some 420 km – are the main rivers in the region. The Kaptai reservoir and dam are located in this area.



Fig. 4. Boat plying in rivers – has been an important activity of Bangladeshi people where dolphins live (12/11/2014).

The last population census suggests that up to 120 million people lived in the country's floodplains which provide a range of ecosystem services. A large proportion of the rural poor depend on natural water bodies in the floodplains for their livelihoods. Their subsistence is based on food production, fishing, harvesting wetland plants, plying country boats, and other activities that depend on healthy aquatic ecosystems (Sultana and Thompson, 2017). Therefore conserving river and coastal ecosystems using cetaceans as flagship species can be a way forward to keep our wetlands viable, productive and sustainable for generations to come.

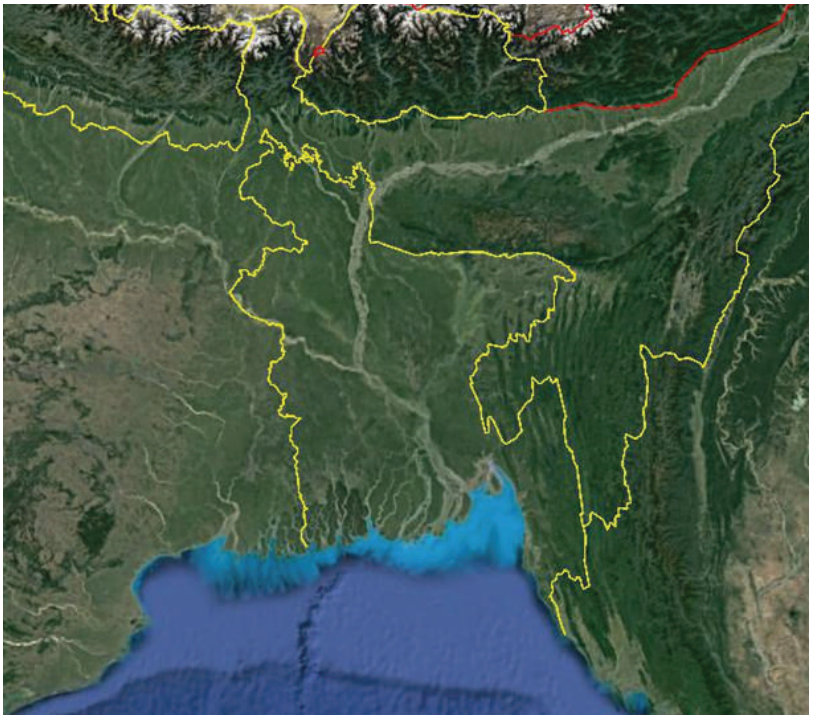


Fig. 5. Google Earth image showing the vast river networks in the Indian Subcontinent, ultimately find their ways to the Bay of Bengal through the land of Bangladesh.

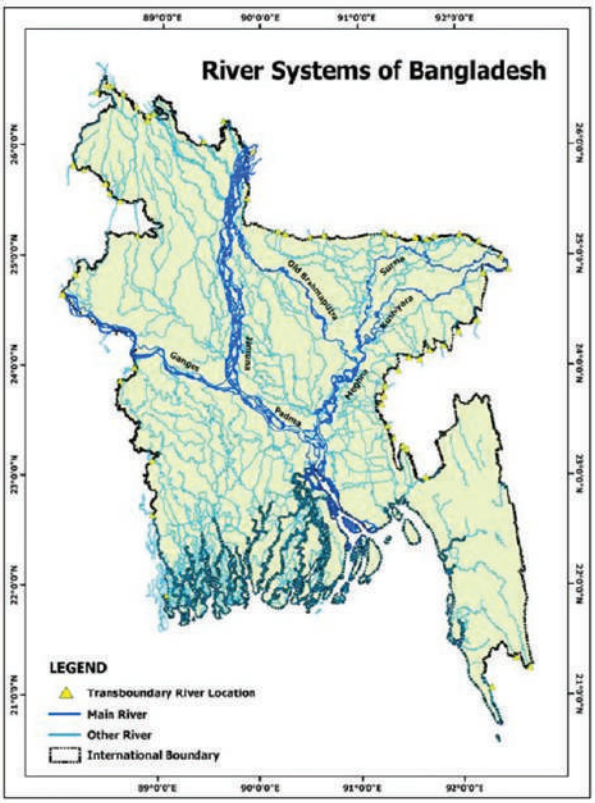


Fig. 6. River networks in Bangladesh (adapted from WARPO).

Apart from these river systems, there are potential regions that are known to support dolphins include the Sundarbans and the vast coastal waters. The coast of Bangladesh is about 700 km long that can be characterized by a vast network of rivers covering an area of 9380 km2, a large number of islands between channels, a submarine canyon of the Swatch of no-Ground. The Ganges, Brahmaputra and Meghna estuaries in the south and the Karnaphuli, Halda and Sangu rivers and Arakan ranges shoreline in the southeast have given a distinct feature of the whole coastal zones of Bangladesh. Kaptai Lake is the largest man-made freshwater body in Bangladesh which was created by damming the river Karnaphuli near Kaptai town in the Chattogram Hill Tracts (Fig. 6).

All these river systems and associated wetlands/rivers and coastal waters are the important habitats for a large variety of flora and fauna of local, national and regional significance. In particular, the major river systems and coastal waters of Bangladesh have been known to support a high diversity of cetaceans (Smith et al., 2010, 2006).

1.3. Focal cetaceans

Two species of dolphins, namely the Ganges river dolphin *Platanista gangetica gangetica* and Irrawaddy dolphin have been considered as focal species in this action plan. The former species is known to occur in freshwater rivers and estuaries whilst the later in the brakish and saline waters, generally across the coast of Bangladesh. Actions outlined for the protection of these two cetaceans are equally applicable to other cetaceans as well as animals living in the aquatic ecosystems of the country. The following section provides a brief account on these cetaceans.

1.3.1. Ganges river dolphin

Ganges river dolphin was discovered in 1801 (Roxburgh, 1801). There were four obligate freshwater dolphin species existed globally, which include the Ganges river dolphin (*Platanista gangetica gangetica*), Amazon River Dolphin (*Inia geoffrensis*), Indus River Dolphin (*Platanista gangetica minor*) and Yangtze River Dolphin (*Lipotes vexillifer*) (Fig. 7). In 2006, the Yangtze River Dolphin was declared functionally extinct in the Yangtze River of China where the species once occurred (Hopkin, 2006). The Ganges river dolphin is believed to be closely related to the now extinct, but once widespread, shark-toothed dolphins. One of its remarkable features is that this species moves and feeds in a murky riverine environment using echolocation. Their eyes, which are only capable of distinguishing light from dark, are tiny and effectively non-functional, giving also a name of blind-river dolphin (Rice, 1998). This dolphin is almost identical to its closest living relative, Indus River Dolphin (*Platanista platanista minor*) (Grill, 2000). Although several marine dolphin species are commonly found in rivers far upstream of freshwater ecosystems, Ganges river dolphins are morphologically and phylogenetically distinct from marine dolphins (Sinha et al., 2010).

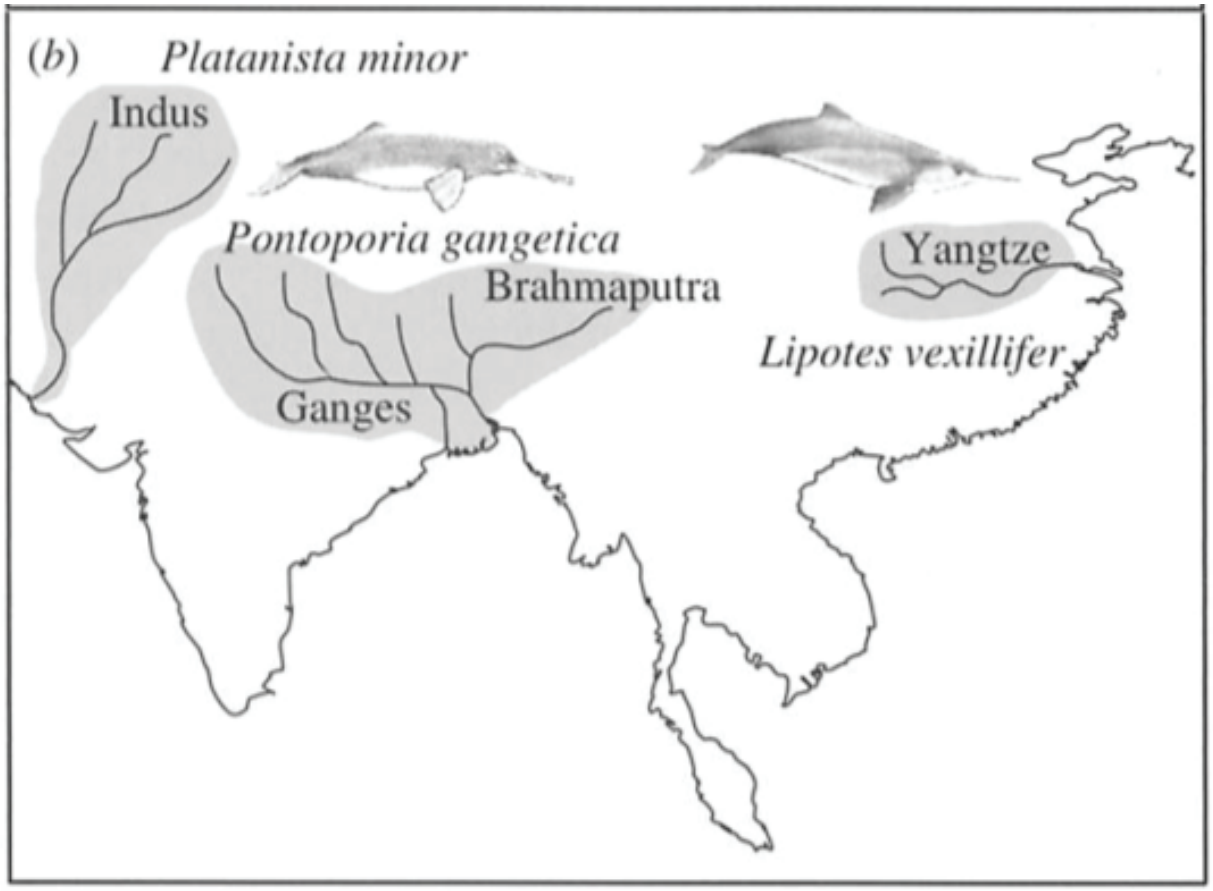


Fig. 7. Geographical distribution of river dolphins in Asian countries (adapted from Hamilton et al. 2001).

An adult Ganges river dolphin can grow from 2.3 to 2.6 m in total length, although there is one record of a specimen measuring 4 m. Generally, the females are larger than the males (Prater, 1971). They live in small groups, often a mother and calf can be seen together. They give birth once every two to three years to only one calf, which is chocolate brown. Adult turns into grey-brown.

The Ganges river dolphin has been imprinted in the history of the region over centuries. Historically, the Ganges river dolphin occurred across the entire Ganga and Brahmaputra rivers, and all their tributaries from the delta at the Bay of Bengal till the Himalayan foothills. On the distribution of Ganges river dolphin across the Indian Subcontinent, an impression could be found in the *Baburnama* (ca. 1500 AD) where Babur said, "The 'water-hog' is in all Hindustan rivers" (Sinha et al., 2010). Cuvier goes even further saying that the 'susu' ascended the Ganges in great numbers to the limit of their navigability (Cuvier, 1836).

The Ganges river dolphin is endemic to the Indian Subcontinent. In the region, the distribution of this species had been restricted to Bangladesh, India, Nepal, and possibly Sikkim and Bhutan, below an elevation of about 250 m (Rice, 1998). Currently the species survives in the Ganges-Brah-

maputra-Meghna and Karnaphuli-Sangu river systems, while a few individuals may survive in the Karnali, and the Sapta Kosi Rivers in Nepal (Sinha et al., 2010) (Fig. 8).

The global population estimates are about 3500 individuals throughout its distribution range (Sinha et al. 2014). The Ganges river dolphin was officially declared as the National Aquatic Animal of India in 2010 to highlight the importance of this species in the river ecology and to ensure long term survival in the rivers of India (Sinha et al., 2010)



Fig. 8. Distribution of Ganges river dolphin in the Indian Subcontinent (adapted from IUCN 2019).

1.3.2. Irrawaddy dolphin

Named after the Irrawaddy River of Myanmar, the Irrawaddy dolphin has many characteristics that place it in the family of oceanic dolphins. Although some researchers consider this dolphin species closely related to the beluga family. In the wild this dolphin can be confused with the Finless porpoise, which is, however much smaller and has no dorsal fin. From a distance, it may even sometimes be confused with a dugong due to its morphology resembling to it.

Irrawaddy dolphin has a blunt rounded head but no beak. Its body is pale in appearance which closely resembles the beluga whale. However, while the beluga gradually turns white, the Irrawaddy dolphin remains grey – darker above, and paler below. It also possesses a small dorsal fin which lies behind the midpoint of the body. Some unfused neck vertebrae allow the head free movement. The pectoral fins are quite large, with curved leading edges. There are 17-20 peglike teeth in

each tooth row of the upper jaw, and 15-18 in each row of the lower jaw.

Biology of the Irrawaddy dolphin is poorly known. The evidence from captivity suggests that mating occurs in spring and early summer. Gestation period seems to be about 14 months. The size of the dolphin at birth is about 1 m while weigh 90-150 kg. They live in small groups, up to 6; however groups of 15 individuals have been observed. Their diet includes mainly the crustaceans, fishes and other invertebrates (Grill, 2000).

The brackish water-loving Irrawaddy dolphin occurs in in coastal areas in South and Southeast Asia, and in three rivers, namely the Ayeyarwady (Myanmar), the Mahakam (Indonesian Borneo) and the Mekong. They are more localized in the coastal as well as estuarine regions around South and Southeast Asia. Recent investigations suggest that the marine distribution of the species in South and South-east Asia is generally limited to estuarine waters (Minton et al., 2017).

The Irrawaddy dolphin is one of the most endangered among all cetacean species occurring globally. It is facultative freshwater species given its range near shore marine waters of the Indo-Pacific regions. The Irrawaddy dolphins are categorized as Vulnerable globally and Near Threatened in Bangladesh.

The Irrawaddy dolphins are discontinuously distributed to the coastal waters of the Indo-Pacific regions and principally occurred with freshwater zones (Smith, 2017; Stacey and Arnold, 1999). The coastal and estuarine populations occur from Borneo and the central islands of the Indonesian Archipelago north to Palawan, Philippines, and west to the Bay of Bengal, including the Gulf of Thailand (Fig. 9). Three well-reported subpopulations are known to occur in three relatively fresh-water large rivers of the Ayeyarwady in Myanmar, Mahakam in Indonesia, and Mekong in Cambodia and Lao People's Democratic Republic. Three other subpopulations are found in brackish water bodies of the Chilika Lagoon in India, Songkhla Lagoon in Thailand, and Malampaya Sound in the Philippines (Minton et al., 2017). Interestingly, the largest population of the Irrawaddy dolphins have been reported from the open estuarine waters of Bangladesh coasts (Smith, 2017) with a relatively sizable population of 451 individuals from the waterways of the Sundarbans mangrove forest (continuous with the estuarine population) (Smith et al., 2006).

The Irrawaddy dolphins have a rounder head and shorted beak compared to the other saltwater dolphins. They live together in the relatively larger group while their principal food comprising the fish and crustaceans.



Fig. 9. Global range of Irrawaddy dolphin (adapted from IUCN).

1.4. Why it is important to conserve dolphins

Dolphins are one of most remarkable aquatic animals on earth. Like humans, dolphins are mammals. On the taxonomic hierarchy, they belong to a group of marine mammal which comprises whales, dolphins and porpoises. This group of animals are collectively termed as the cetaceans. Until now, a total of 90 species of cetaceans have been known to scientists. Like other mammals, dolphins are warm-blooded and give birth to live young. However, unlike other mammals, dolphins have lost hair, as an adaptation to their aquatic environment (Grill, 2000).

The cetaceans constitute an important component of aquatic biodiversity in the vast wetlands of Bangladesh. Bangladesh supports 10 species of cetaceans, of which Ganges river dolphin and Irrawaddy dolphin are two important aquatic mammals. Considering the overall status of biodiversity and unregulated use of natural resources in the country, the abundance of Ganges river dolphin and Irrawaddy dolphin in the remaining habitats are remarkable. Although there were some levels of previous research and conservation initiatives being done on country's cetaceans, they were mostly confined to the Sundarbans and adjacent coast of Bangladesh. A national stocktaking of the cetaceans of Bangladesh has been completely lacking. To formulate the conservation strategy of any species, the foremost priority is identifying the critical habitat, distribution, population hotspots and anthropogenic pressures. This will follow in-situ conservation of ecosystems and natural habitats and the maintenance and recovery of viable populations of the species.

The Ganges river dolphin is an endemic aquatic mammal found only in the Indian subcontinent including the vast waters of Bangladesh. It is a tertiary organism in the food chain and is an important indicator species of our river ecosystem. Although the species is found almost all major rivers of Bangladesh, north-eastern regions of the Bangladesh Sundarbans including some upstream rivers have been a stronghold of this species. This creates a hope of future of this species in the region. The Ganges river dolphin is a flagship species for river conservation and its conservation can benefit a wider range of aquatic and threatened species including the softshell turtle

(*Aspideretes gangeticus*), gharial (*Gavialis gangeticus*) and smooth-coated otter (*Lutra perspicillata*) (Sinha et al., 2010). At the end, protection and maintenance of this species will ensure better health of our river ecosystem that will ultimately benefit millions of local communities who survive on aquatic resources. The conservation importance of these species is therefore paramount and our greater efforts are needed on the ground to save this charismatic aquatic mammal of Bangladesh before it is upgraded on to the IUCN Red List of threatened species.

CHAPTER II: STATUS AND DISTRIBUTION

2.1. Ganges river dolphin

The Ganges river dolphin is named Shushuk (শুশুক) in Bengali by the wider local communities across Bangladesh. However, it is also named differently in different regions in the country, such as Shishu (শিশু) and Thus (ঠুস) in the Sundarbans, Houmach (হউমাছ) in Bhairab, Shishuk (শিশুক) in Sirajgonj, Shishu (শিশু) in Sylhet, Shushu (শুশু) in Rajshahi, Hochchum mach (হোচ্চুম মাছ) in Chattogram, etc. Although the Ganges river dolphin is wrongly believed to be a fish among many communities, it is however widely recognized inedible. There are lots of stories and myths associated with this 'strange' animal among communities where many people believe this animal as a friend of fishermen in many ways including, forcing fishes to congregate in a particular location, and indicating the presence of large fishes where it lives, etc.

The rivers Padma, Jamuna, Meghna, Brahmaputra and Karnaphuli including their tributaries are the principal habitats of this species in Bangladesh. The Ganges river dolphin is endangered globally as well as in Bangladesh (IUCN Bangladesh, 2015). This species is included in the First Schedule of Bangladesh Wildlife (Protection & Security) Act, 2012 to ensure higher level of protection for their in situ conservation.

Kasuya and Hoque (1972) led the first scientific expedition about a half century ago for documenting the Ganges river dolphins in the present day territory of Bangladesh. They made significant observations on dolphin populations in all major rivers of Bangladesh, including the Brahmaputra, Meghna and Jamuna, and the upper and lower regions of the Sundarbans. Afterwards, observations were made by several workers on the population abundance across Bangladesh (Ahmed, 2000; Smith et al., 2001, 1998), and on assessment of dolphin hotspot and habitat preference in and around the Sundarbans of Bangladesh (Smith et al., 2010, 2006). In other parts of the country, information on population status appeared from segments of the rivers Jamuna-Padma (Khan and Rahman, 2013; Rashid et al., 2015), Bhairab-Atai (IUCN Bangladesh, 2018a), Turag (Baki et al., 2017) and Burigonga (Alam and Sarker, 2012). A population of 225 Ganges river dolphin has been reported from the less saline zones of the Sundarbans whilst a population comprising 125 individuals from the Karnafuli and Sangu river systems (Smith et al., 2001).

In the meantime, a number of hotspots have been identified across the river channels of the Sundarbans and adjacent coasts which are considered as the critical habitats for Ganges river dolphin and Irrawaddy dolphin, including the relatively rare Indo-Pacific Humpback Dolphin in Bangladesh (Khan and Aziz, 2018; Smith et al., 2010).

Alongside these hotspots and wildlife (specifically for dolphins) sanctuaries, a good number of habitats have been identified in this study which are critically important for the protection of the Ganges river dolphins in Bangladesh. These important habitats and protected areas harbour the major populations of Ganges river dolphin in Bangladesh, some of which were proposed for

declaring wildlife sanctuaries (Table 1). Beyond the river networks of the Sundarbans, the Halda appears to be one of the most important habitats for Ganges river dolphin (Fig. 10). In terms of national distribution, although all of the major river systems still have supported the Ganges river dolphins, some of the tributaries of these rivers might have no longer been suitable as their habitat, at least in winter months. These rivers include the rivers Dorla, Teesta and Kushiyara (Fig. 11).



Fig. 10. Natural environmental setting of the River Halda has been an important stronghold for Ganges river dolphin in the southeast region of Bangladesh (5/2/2019).

Table 1. Important habitats of Ganges river dolphin in Bangladesh

Locality	River	District/area	Population status	Remarks
Godagari	Padma	Chapai Nawabganj	High	Potential hotspot
Rajshahi T-band	Padma	Rajshahi	High	Potential hotspot
Bakarali	Padma	Chapai Nawabganj	Low	Need further investigation
Nazirgonj	Padma	Pabna	Medium	Wildlife sanctuary
Nagarbari-Mohongonj	Jamuna	Pabna	High	Wildlife sanctuary
Chilmari	Brahmaputra	Kurigram	High	Potential hotspot
Paikergachha	Dud Kumar	Kurigram	Low	Need seasonal data
Nagderma-Silonda	Baral	Pabna	Low	Wildlife sanctuary
Bhairab bridge	Meghna	Brahmanbaria	High	Potential hotspot
Madunaghat-Sattarghat	Halda	Chattogram	High	Potential hotspot
New bridge-Halda confluence	Karnafuli	Chattogram	Medium	Need further investigation
Jelkhana ghat, Bhairab-Atai confluence	Bhairab-Rupsha	Khulna	High	Potential hotspot
Pankhali	Passur	Khulna	High	Hotspot
Sela-Supati	Sela-Supati	Sundarbans	High	Hotspot
Sibsa	Sibsa	Sundarbans	High	Hotspot
Puntey	Malancha	Sundarbans	High	Hotspot
Passur	Passur	Sundarbans	High	Hotspot

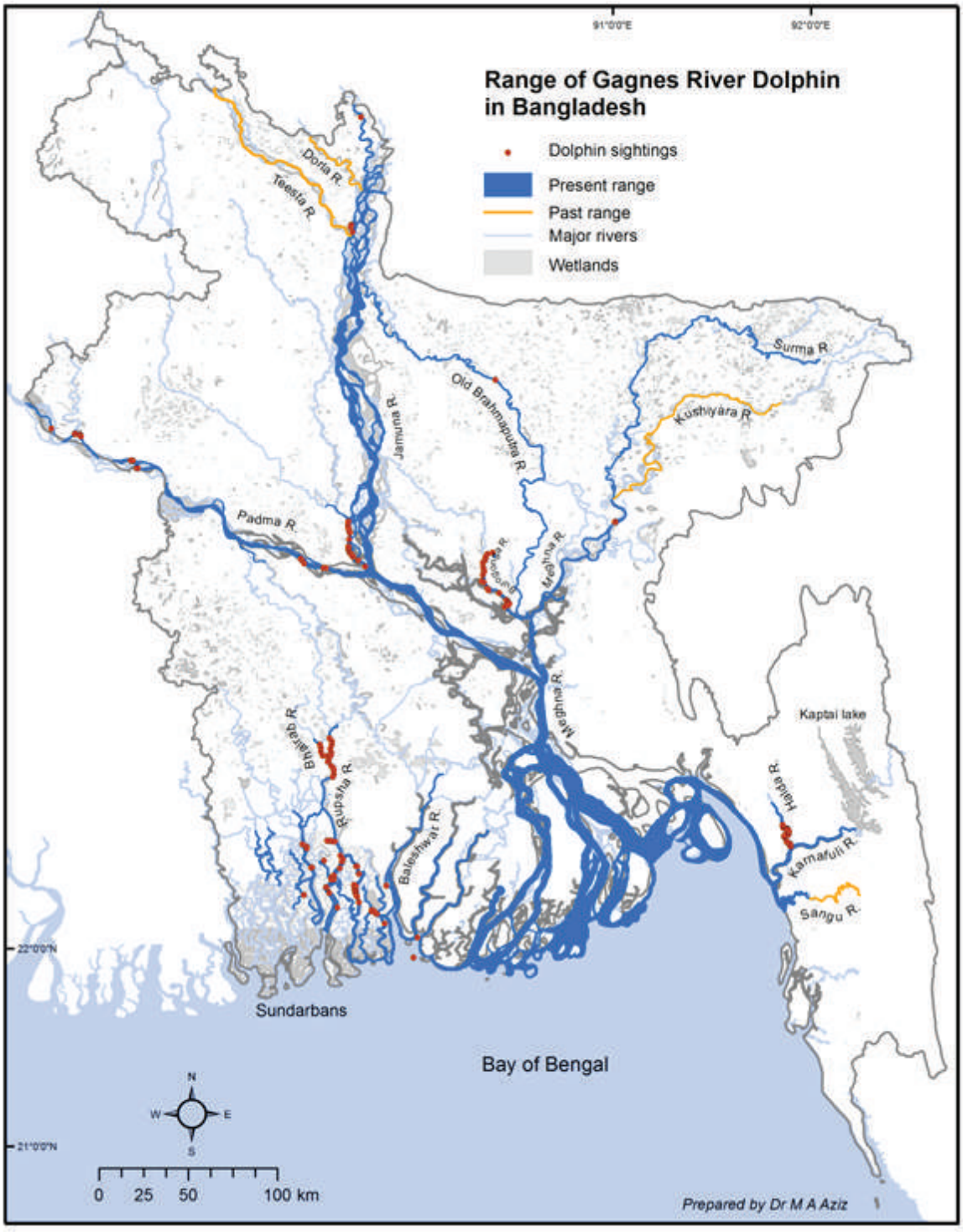


Fig. 11. Distribution of Ganges river dolphin in Bangladesh.

2.2. Irrawaddy dolphin

The Sundarbans and the wide coastal belts have been the stronghold for Irrawaddy dolphins in Bangladesh. A study carried out in 2006 provided an estimates of 451 Irrawaddy dolphins in the Bangladesh Sundarbans (Smith et al., 2006). In Sundarbans, the Irrawaddy population has a relatively wide distribution across the Sundarbans and estuarine areas of the rivers Baleshwar, Bishkhali and Payra (Khan and Aziz, 2018).

From the survey of 1,340 km of rivers within the Sundarbans, a total of 113 Irrawaddy dolphins were directly counted (based on sightings) between January and April 2018. Using the visibility correction factors of 1.75 the total populations (crude) of Irrawaddy dolphin in the Sundarbans were estimated at 198. Besides, 30 individuals of Irrawaddy dolphins were directly counted by surveying 290 km downstream channels of the Baleshwar, Bishkhali and Payra Rivers in the adjacent area east to the Sundarbans (Khan and Aziz, 2018).

The Irrawaddy dolphin population has a wide distribution across the Sundarbans and estuarine areas of the rivers Baleshwar, Bishkhali and Payra. Although a relatively high abundance was observed along the Sibsa River, it was interesting to note that this cetacean species was recorded further north of the Sundarbans, next to Mongla Port (Fig. 13).



Fig. 12. The Sundarbans of Bangladesh has been an important habitat for cetaceans (1/10/2018).

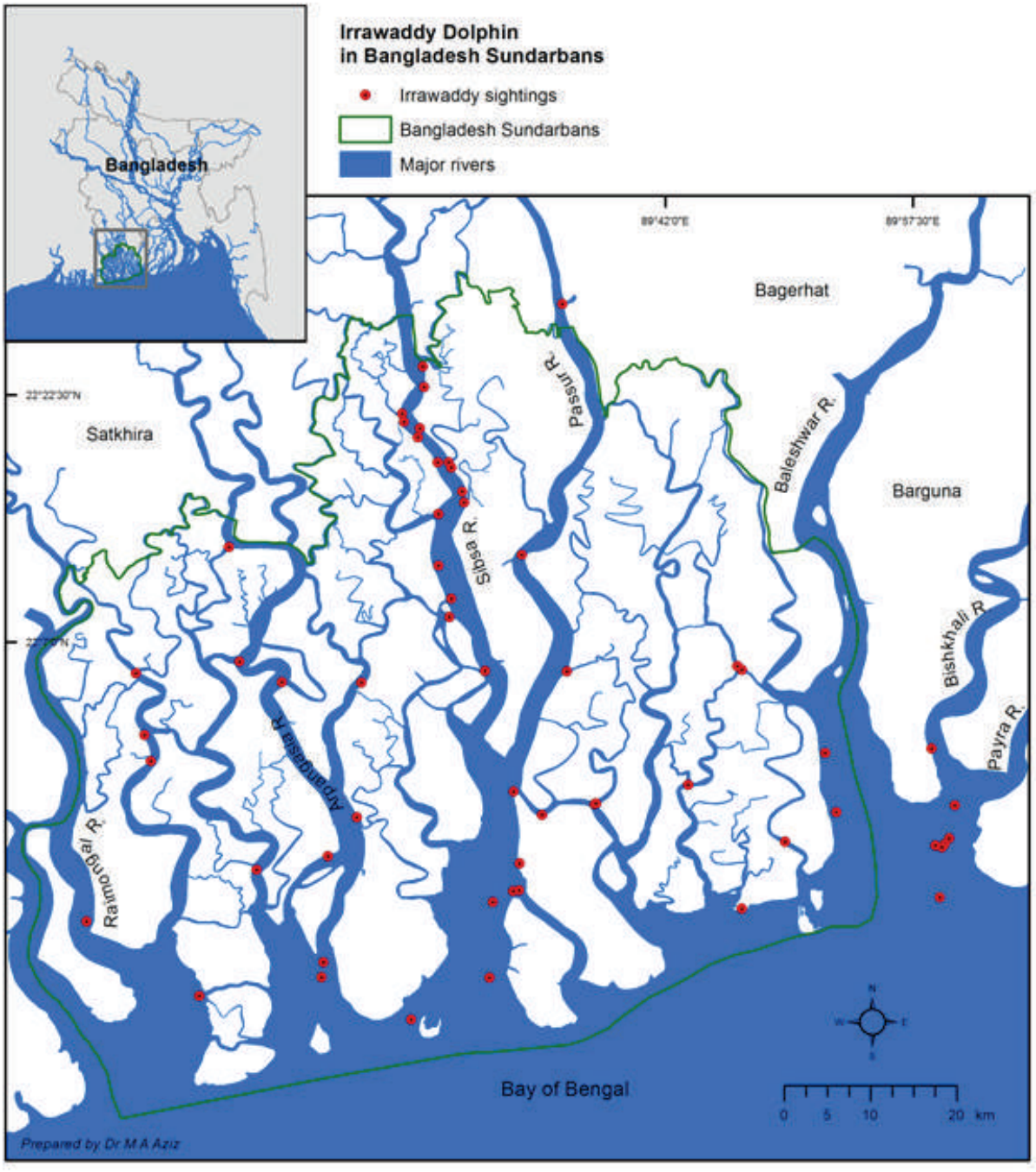


Fig. 13. Distribution of Irrawaddy sightings in the Sundarbans and adjacent cost of Bangladesh.

2.3. Dolphin conservation in Bangladesh

A decade of research and conservation works by the Bangladesh Cetacean Diversity Project (BCDP) of the Wildlife Conservation Society produced a wealth of knowledge on the status and distribution of cetaceans in and around the Sundarbans of Bangladesh, alongside other conservation NGOs and individuals. Recently Bangladesh Forest Department has initiated "Expanding the Protected Areas System to Incorporate Important Aquatic Ecosystems (EPASIIAE)" project with support from United Nations Development Programme. In the meantime, of the 21 wildlife sanctuaries established across the country by the Government of Bangladesh in order to protect wildlife and their habitats (Fig. 1), six sanctuaries were specifically declared for protection of cetaceans including the Ganges river dolphin and Irrawaddy dolphin. The Swatch of no-Ground located about 100 km from the coast of Sundarbans has been established for protecting a diversity of cetaceans and other aquatic resources. On two major river systems of Padma and Jamuna, three wildlife sanctuaries were created for conserving the Ganges river dolphin whilst the remaining three WS within the Sundarbans of Bangladesh.

Three wildlife sanctuaries (WS) within the Bangladesh Sundarbans (Chandpai, 560 ha; Dudhmukhi, 170 ha; Dhangmari, 340 ha) established in 2012 for the protection of freshwater dolphins are particularly effective at encompassing priority habitats for Ganges river dolphins but only marginally effective in encompassing high priority habitat for Irrawaddy dolphins (Smith et al., 2010). The WS established outside of the Bangladesh Sundarbans include the Silonda-Nagderma WS at Boral River (24.17 ha), Nagarbari-Mohonganj WS at Jamuna River (408.11 ha) and Nazirgonj WS at Padma River (146 ha) (BFD, 2017) (Fig. 14).

A number of hotspots have already been identified across the river channels of the Sundarbans and adjacent coasts which are considered as the critical habitats for Ganges river dolphin and Irrawaddy dolphin, including the relatively rare Indo-Pacific Humpback Dolphin in Bangladesh (Khan and Aziz, 2018; Smith et al., 2010).

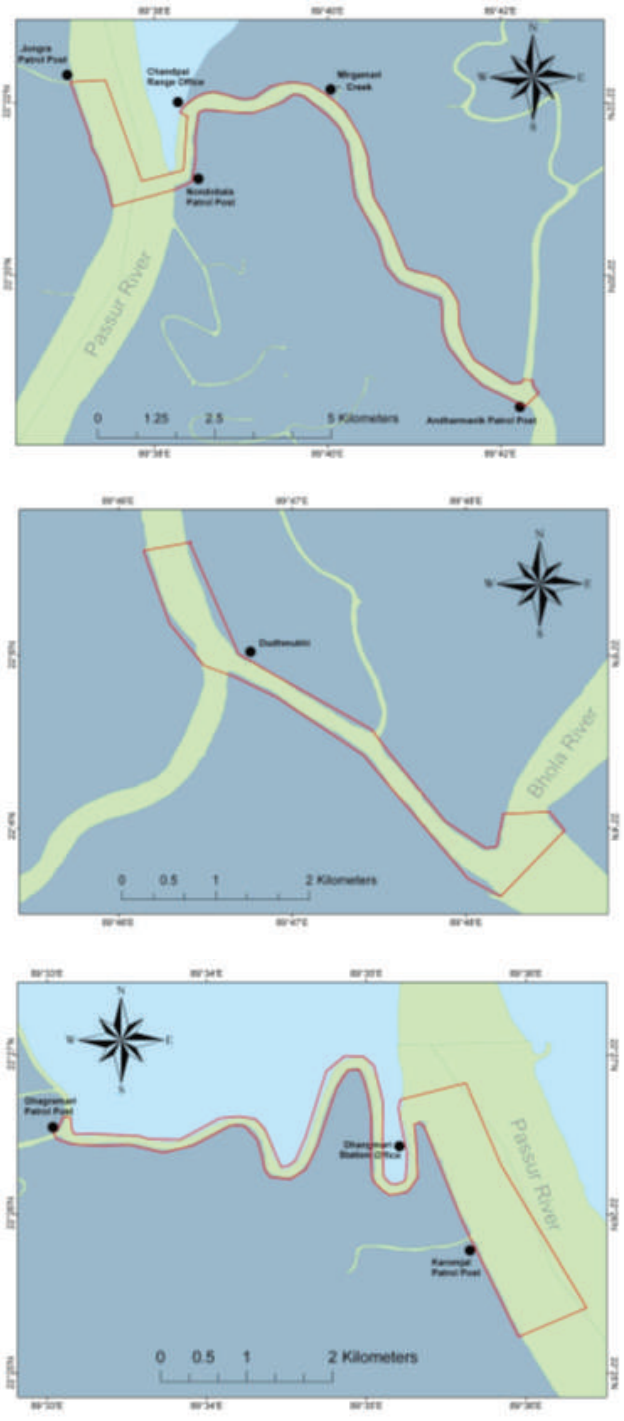


Fig. 14. Three wildlife sanctuaries within the Sundarbans (from top: Chandpai, Dudhmukhi, and Dhangmari) established for the protection of dolphins (BFD, 2017).

CHAPTER III: STATUS AND DISTRIBUTION

3.1. Overview

This action plan focuses two species of dolphins: Ganges river dolphin and Irrawaddy dolphin in Bangladesh. These two species were chosen because they live in almost two different realms of geographic and salinity gradients of our river and coastal waters, therefore this action plan will equally be applicable to other cetaceans living in the same habitats. The period of this action plan is considered for 10 years spanning over from 2020 to 2029 in a view that this time-span is sufficient during which the implementation of the major strategic actions outlined would produce tangible and measurable conservation outcomes. Being a strategic document, the action will only guide the implementing agencies for focused management actions to achieve the goals stated. The successful implementation of this action plan will require adequate resource arrangements, engaging local actors and stakeholders in habitat management and alternative subsistence, and enhancing capacity of BFD at local level around dolphin habitats. Coordinated efforts of all relevant actors, reducing dependencies of 'ecosystem people' on dolphin habitats and unprecedented human interventions to dolphin habitats are paramount challenges to reach the visionary goals of this action plan. The action plan is structured with focusing major threats affecting dolphins and their habitats with brief sections on the importance of dolphins in our aquatic ecosystems. To address each threat as outlined under several goals, a set of priority-based action-oriented activities, but not limited, were identified with tentative implementation timeline, budget and implementing agencies. Given the vast cultural, contextual and unique settings of local communities living around country's dolphin habitats, actions outlined here may require to be tailored to suit to the site-specific threat mitigation strategies. It is imperative that site-based threat prioritization be carried out in order to adopt mitigation actions against each high prioritized threat. A thorough evaluation of implementing this action plan after 10 years will help monitor the progress made during the tenure as well as what needs to be taken forward in future activities.

3.2. Threats to dolphins

The Ganges river dolphin has experienced both population and range decline across its historical habitats. Although several estimates are available, a reasonable global estimate may be 1200-1800 dolphins. The Ganges river dolphin has lost its ranges progressively since the nineteenth century comparing historical distribution (Anderson, 1879). Alarmingly, no dolphins have been reported in recent years in many historical locations in the Ganges of India (Sinha, 2000). For example, dolphins have not been reported in the Yamuna River above the Chambal River confluence during the dry season in the recent years; dolphins have apparently been extirpated from the Son River (Sinha and Sharma, 2003). Although Bangladesh has been an important habitat for dolphins across the region, it is feared that many of its former range might not support any dolphins today. Occasional reports of dolphins in the reservoir behind Kaptai Dam (built in 1961) in southeastern Bangladesh occurred until the mid-1990s (Ahmed, 2000), but later survey had found no evidence that the subspecies survives there (Smith et al., 2001). A recent study concluded no sighting of Ganges river dolphin from the Indian part of the Sundarbans (Mitra and Chowdhury, 2018) whilst a similar situation appearing in the western parts of our Sundarbans. Cetaceans of Bangladesh face a range of threats and challenges. However, Irrawaddy dolphins appear to be better in position than the Ganges river dolphin due to their distributional patterns and level of human use of their habitats. There are fierce competition between dolphins and human communities for resource use of dolphin habitats. Because local communities are highly dependent on the aquatic resource of the country's river systems, Ganges river dolphins are therefore highly threatened with myriad of threats and challenges. The sections below describe the major threats to dolphins of Bangladesh following the standard threat classification of IUCN-CMP guidelines with some adjustments.

3.2.1 Direct loss of dolphins

Incidental killing of dolphins

Incidental killing in fishing nets, particularly gillnets, deployed in the dolphin habitats is the most pressing threat to the long-term survival of the cetacean species across the dolphin habitats of Bangladesh. In most of the cases Ganges river dolphins were entangled to death in gillnets. In particular, the gillnet used to catch the Hilsa Shad in large rivers, estuaries and coastal areas of the Sundarbans and adjacent areas was known to kill dolphins by entanglement (Fig. 15, 16). There are reports that approximately 90 cetaceans were incidentally killed in gillnets between 2007 and 2013. Of these, 63 were Ganges river dolphins, 16 Irrawaddy dolphins, and the remaining other cetaceans. Fifty-two of these (40 Ganges river dolphins and 12 Irrawaddy dolphins) were from the Sundarbans (GoB, 2018).

Intentional killing of dolphins and traditional use of dolphin parts

Local people kill dolphins intentionally for use in fishing and healing pains. From our interviews with local people and fishermen, it is understood that dolphins were killed intentionally by catching with fishing net in several instances for traditional medicinal use. Deliberate killing of river dolphins is reported to occur in the Kalni-Kushiyara River of Bangladesh (Smith et al., 1998), and in the upper reaches of the Brahmaputra River in Assam, India (Mohan et al., 1997). Dolphins are killed by tribal people in the upper Brahmaputra for their meat and by fishermen in the middle reaches of the Ganges for their oil, which is used as a fish attractant. Although there was no report of intentional killing or poaching for meat and fat of dolphins in the Sundarbans, but it is rarely reported in other parts of the country (Khan and Aziz 2018). A specific problem is that, because dolphin oil is highly valued as a fish attractant, fishermen have a strong incentive to kill any animals found alive in their nets and even to set their nets strategically in the hope of capturing dolphins (Sinha, 2000).



Fig. 15. Gillnets (*current jal*) used for catching Hilsha shad are widespread across all major rivers of Bangladesh (16/10/18).



Fig. 16. Carcases of Irrawaddy dolphin in the Sundarbans of Bangladesh, might have died due to entanglement (5/6/2018).

3.2.2. Habitat loss and degradation

Dam construction and extraction of upstream waters

Modifications of river ecosystems as well as extraction of upstream water by constructing dams, barrage, embankments, etc. have been the most pressing threats to dolphins throughout the range in the Indian Subcontinent. Construction of at least 50 dams and dams within the known or suspected historical range of the subspecies (Smith et al. 2000) has dramatically affected its habitat, abundance, and population structure. Numerous studies have shown that dams and water management have a significant impact in changing water flow patterns from their natural range of variation that ultimately affecting all downstream aquatic ecosystems including freshwater dolphins. For example, the Ganga Barrage, built across the River Ganges in Murshidabad district in the Indian state of West Bengal, approximately 16.5 km from the border of Bangladesh, has directly affected the freshwater flow as well as the range of Ganges river dolphins throughout its course and associated distributaries. In particular,, in the northern Ganges tributaries in India, three subpopulations have been extirpated that were isolated above or between barrages (Sinha et al., 2000).

A previous study had estimated 125 individuals of Ganges river dolphins in the river systems of Karnafuli and Sangu (Smith et al., 2001). However, surveys conducted during this work have revealed a very insignificant sighting of dolphins in the downstream of Karnafuli until the point of Halda confluence. Although there were occasional reports of dolphin sightings in the reservoir behind Kaptai Dam until the mid-1990s (Ahmed, 2000), later surveys have found no evidence of their occurrence (Smith et al., 2001). It is very likely that the Kaptai Dam, built in 1961, has significantly reduced the range of this species in the region. A rubber dam established at Bhujpur on the

upstream of Halda river appeared to affect waterflow significantly in winters (Fig. 17).

A dam has been established at Muhuri of Sonagazi Upazila on the Feni River (Feni Regulator) to utilize waters for agriculture on the upstream, resulting in the river being completely dried during low tide (Fig. 18). This has led to a complete blockage of dolphin movement on the upstream from the Meghna estuatry. Key informant interview data show that the last sighting of the Ganges river dolphin on the immediate downstream of the barrage was the two individuals of Ganges river dolphin being stranded and died due to complete lack of water during low tide. Currently, dolphins are no longer found in the Feni river due to limited or no water discharge during winters.



Fig. 17. Rubber Dam at Bhuzpur on the upstream of the Halda River (6/2/2019).

Poison fishing in Sundarbans

Although there is no scientific study on the level of impact of poison fishing on dolphin populations, it is generally perceived that the illegal practice of poison fishing in the Sundarbans have adversely affected the cetacean populations. It is suspected that poison fishing in the Sundarbans that has increased in the recent years which is highly detrimental to the aquatic organisms in general and fisheries in particular. There are numerous reports appeared on the daily newspapers on the scale of poison fishing in the Sundarbans, but no studies have yet been conducted on this critical issue to assess the impact on other aquatic organisms as well as the whole aquatic ecosystem. The reckless fishing practice using poison in river water not only kills the target fish and crustaceans, but also many non-target species and fries. The poison enters to the food chain with long-term and unpredictable consequences.

Pollution

Pollution is a critical threat that was known to degrade river ecosystems across the country. A range of threats includes the introduction of exotic and/or excess materials or energy from point and nonpoint sources, industrial effluents (water-borne pollutants from industrial sources, toxic chemicals and/or sediments). Dolphins in river ecosystems are particularly vulnerable to these

pollutions because most of the pollutants ultimately find their ways directly or indirectly to rivers as well as wetlands. For example, the rivers Burigonga and Turag where dolphins were reported just few years back have been severely polluted with industrial pollutants directly from thousands of tannery and garment industries on the river banks. According to a World Bank study on four major rivers near Dhaka — the Buriganga, Shitalakhya, Turag and Balu concluded that these rivers receive 1.5 million cubic metres of waste water every day from 7,000 industrial units in surrounding areas and another 0.5 million cubic meters from other sources (Fig. 19). During the last two decades, the river has turned up as the most polluted river in the country due to release of enormous domestic and industrial pollutants (IWM, 2004).



Fig. 18. Immediate downstream of Feni Regulator on Feni River no longer supports Ganges river dolphin (14/1/2019).



Fig. 19. Industrial effluent ultimately finds the river and aquatic ecosystems across the country (7/2/2019).

The Rampal Coal Power Plant Project, located only approximately 15 km from the northern boundary of the Sundarbans may cause severe pollution from the discharge of various gases which all may putting the Sundarbans water systems at high risk. The buffer area along the northern boundary of the Sundarbans is undergoing wide range industrializations which are causing, or will cause, the increase of water and air pollution, which will easily reach to the Sundarbans on the downstream. The growing vessel traffic and tourism in the Sundarbans are directly contributing to chemical and sound pollution, of which the most dangerous is accidental sink of cargo vessels with harmful chemicals (Khan and Aziz, 2018).

A number of industries were found on the banks of Halda and Karnafuli rivers which are bound to affect the hydrology as well as aquatic ecosystems of these rivers. One particular concern appears to be the vast level of plastic pollutions in these rivers that may leave a long term impact on river bed and its morphology (Fig. 20). Although plastic pollution may not be a severe threat to dolphins in the immediate term, this may however degrade dolphin habitats significantly in the long-run if plastic pollution remains unabated.



Fig. 20. Plastic entangled on the bank vegetation appears widespread in the Halda River (8/2/2019).

Fishing and harvesting aquatic resources

Fishing and harvesting aquatic resources have been an important subsistence activity across the rivers and coast of Bangladesh. Millions of local communities earn their living through harvesting fish and aquatic resources for generations. This high level of dependency on aquatic resources is a critical challenge to dolphin conservation because these fishermen and dolphins are the two major stakeholders of our river ecosystem (Fig. 21). In addition, high level of harvesting aquatic resources gradually diminishes these aquatic resources, leaving the dolphins in jeopardy over longer term. The fish and crustacean stock in the Sundarbans and adjacent coastal areas are

declining due to overfishing, poison fishing and collection shrimp fries. The rate of fishing in and around the Sundarbans is way beyond the sustainable limit, so the stock is gradually declining (Khan and Aziz, 2018). During the last decade, production of fishery resources has reportedly declined by 23% in the Sundarbans (Shah et al., 2010).



Fig. 21. Fishing is an important activity across the rivers of Sundarbans beside the locality (5/7/2018).

Siltation and sedimentation

More than 125 polders have been constructed in the south-west region along the upper catchment area of the Sundarbans rivers. These polders were constructed mainly to control the saline intrusion into the agricultural fields; unfortunately the impact of intervention has been felt in the rivers of the Sundarbans. For example, a large number of rivers have been silted up, so it is feared that the Bhadra River, which meets the Passur from the northern parts, is undergoing rapid siltation and may cease to connect the part of the Sundarbans with upstream catchment area of the river in near future. In the community meeting held at Lowdobe of Khulna Range, this point has been raised strongly arguing that the Lowdobe River which is continued from Ghagramari – a dolphin hotspot, has been silted up that significantly reduced the depth of the river. As a result, the Ganges river dolphin which was once abundant in this river, has not been seen anymore.

It is reported that the Halda ecosystem might have been gradually degrading due to a number of human interventions including the creation of artificial oxbow bends, massive quarry of sands from river beds, industrial pollution, construction of sluice gates at tributaries, and indiscriminate killing of brood fishes. Similarly, the old Brahmaputra has undergone severe sedimentation and siltation across its larger courses probably due to massive extraction of upstream water. This has led to almost unsuitable dolphin habitats in winter months (Fig. 22).



Fig. 22. Decrease of waterflow and siltation at old Bramaputra River in Mymensingh make it unsuitable for dolphins in winter. (12/11/2018)

Dredging and removal of riverbed sands

Degradation of dolphin habitats might be caused by widespread dredging across the country's major rivers. Dredging has been a long practiced phenomenon and commonplace throughout the course of Ganges-Brahmaputra basins (Smith et al. 1998) including the removal of stones (Shrestha 1989), sand (Mohanet al. 1998), and woody debris (Smith 1993). These activities undermine the ecological integrity of the river health, especially small tributaries where suitable dolphin habitat is limited (Fig. 23).



Fig. 23. Dredging (of majority illegal) is widespread across rivers of Bangladesh (6/2/2019).

Transportation and Service Corridors

This category of threat includes shipping lanes, dredging, wakes from cargo ships, etc. which have negative effect on dolphin population as well as their habitat. It has been reported that collusion between dolphins and water-based engine boats and dredging boats may be fatal to dolphins. This collusion appears to be one of the causes of dolphin deaths in Halda river in 2017-2018. It was reported that vessel traffic was extremely high during the winter in dolphin hotspot segments of the Sundarbans of Bangladesh (77 vessels/day), of which the largest number were used for tourism (58%) (UNDP, 2014).

Climate Change and Severe Weather

This includes long-term climatic changes that may be linked to global warming and other severe climatic or weather events outside the natural range of variation that could wipe out a vulnerable species or habitat. It will ultimately lead to habitat shifting and alteration or major changes in habitat composition thereby location of the species.

Salinity gradients in the Sundarbans are usually determined by the upstream freshwater flows and to a lesser extent by diurnal tides. Freshwater discharges from the Ganges-Brahmaputra-Meghna Rivers remain maximum during the monsoon season (June-September), which coincides with the formation of a counter-clockwise gyre in the coast and the Bay of Bengal. Reduced freshwater flow due to removal of upstream water might result in high rate of siltation, increase of water salinity and ultimately completely degrade the ecosystem of the entire Sundarbans. This might have created unsuitable habitat for the Ganges river dolphin, as suggested by a recent study that reported disappearance of the species from the Indian part of the Sundarbans where the species had occurred (Mitra and Chowdhury, 2018). A recent study noted that the Irrawaddy dolphin moved up to the point of the Mongla port, which is far upstream from the usual range of this species suggesting that salinity might have been intruded gradually upwards from the coast (Khan and Aziz, 2018). This salinity intrusion will undoubtedly obliterate the freshwater loving Ganges river dolphin from the Sundarbans habitat.

3.3. Vision and goals

Vision

Secured river and coastal ecosystems of Bangladesh where dolphins flourish up to the carrying capacity so that they can continue to provide crucial ecological services to human communities.

Goals to address threats

- Reduce dolphin population decline in rivers and coastal waters of Bangladesh
- Ensure protection of existing dolphin habitats of Bangladesh

3.4. Objectives and strategic actions

This section identified 26 action points to mitigate two major categories of threats to dolphins and their habitats (Table 1, 2). All actions identified under these threat categories were evolved around four major themes: (i) research on population, ecology and habitats of dolphins, (ii) investigations on social dimensions of aquatic resource harvest and illegal killing of dolphins by local communities, (iii) engagement of local communities with the management of dolphins and their habitats, and (iv) enforcement and advocacy for the protection of dolphins at local and regional levels. Although the current level of knowledge on dolphins as well as social dimensions of dolphin habitats in the Bangladesh Sundarbans is useful for conservation management, information on status, distribution and threats of dolphins for other parts of the country is extremely lacking.

Therefore the actions outlined for research are needed to be carried out immediately on which many other activities depend.

3.5. Monitoring and evaluation

Monitoring and evaluation of progress against the goals set aside is a prerequisite to measure the success of intended conservation activities. This will allow conservation managers to evaluate the effectiveness of efforts and initiatives undertaken so that necessary adjustment or improvement can be made based on previous failures and new information from scientific investigations. Monitoring of dolphin populations and their habitats can play a vital role in understanding the progress against the goals. This action plan will be updated for additional terms after 10 years, based on completion of activities and progress.



Fig. 24. This Action Plan is equally applicable to other cetaceans like this rare Indo-Pacific Humpback dolphin in the Sundarbans of Bangladesh (3/10/2018).

Table 2. Threat objectives and strategic actions including priority, timeline and implementing agencies.

DIRECT LOSS OF DOLPHINS

Goal: Reduce dolphin killing in rivers and coastal waters of Bangladesh					
Threat objective	**Strategic actions**	**Priority**	**Timeline**	**Estimated cost (million BDT)**	**Implementing agencies**
Increase knowledgebase on dolphins and their habitats	Assess and monitor country-wide population status, distribution and their habitats of dolphins	High	2020-2022	50	BFD, research institutions, NGOs
	Investigate home range, dispersal patterns and movement of dolphins	Medium	2020-2025	30	BFD, research institutions, NGOs
	Understand ecology, feeding and breeding behaviour of dolphins	High	2020-2025	20	BFD, research institutions, NGOs
Reduce incidental and intentional killing of dolphins	Assess and monitor the scale and seasonality of incidental and intentional killing of dolphins	High	2020-2022	30	BFD, research institutions, NGOs
	Train and engage communities in rescue and rehabilitation of entangled dolphins	High	2020-2022	50	BFD, NGOs
	Explore early warning device for gillnet to reduce killing by entanglement	Medium	2020-2025	20	BFD, research institutions, NGOs
	Understand and reduce scale of traditional use of dolphin body parts	High	2022-2029	30	BFD, research institutions, NGOs, Bangladesh Police
Develop skill, capacity and governance for improved protection	Train and orient local BFD staffs on dolphin ecology, human-dolphin interaction and their protection	Medium	2020-2022	50	BFD, research institutions, NGOs
	Enforce Wildlife (Protection & Security) Act 2012 to stop intentional killing of dolphins	High	2020-2029	50	BFD, Bangladesh Police, Local government
	Ensure protection of deep water-pools in winters when upstream waterflow remains critically low	High	2020-2029	20	BFD, NGOs
	Coordinate and sensitize local administration and law enforcing agencies on importance of dolphin protection	Medium	2020-2025	50	BFD, local government, Department of Fisheries, Bangladesh Police
Understand socio-economic dimensions about dolphins	Assess knowledge, attitude and perception of local communities about dolphins and their habitats	Medium	2020-2022	10	BFD, research institutions, NGOs
	Assess nature, scale and economic value of dolphin body parts in local markets	High	2020-2022	10	BFD,research institutions, NGOs
	Raise awareness about ecological importance and legal protection of dolphins and their habitats	High	2020-2029	300	BFD, NGOs

Table 3. Threat objectives and strategic actions with priority, timeline and implementing agencies.

LOSS AND DEGRADATION OF DOLPHIN HABITATS

Goal: Ensure protection of existing dolphin habitats of Bangladesh					
Threat objective	**Strategic actions**	**Priority**	**Timeline**	**Estimated cost (million BDT)**	**Implementing agencies**
Increase knowledgebase on dolphin habitat and threats	Assess country-wide seasonal habitats and range of dolphins	High	2020-2022	50	BFD, research institutions, NGOs
	Identify and prioritize threats to dolphin habitats	High	2020-2022	20	BFD, research institutions, NGOs
	Identify and monitor critical winter habitats of dolphins	High	2020-2022	20	BFD, research institutions, NGOs
Increase protected area network for dolphins	Declare protected areas of identified dolphin hotspots and implement regulations	High	2020-2025	50	BFD
Engage all actors and stakeholders in protection of dolphin habitat	Protect and restore dolphin habitats from the impacts of developmental projects (e.g., dam)	Medium	2020-2029	50	Ministry of Environment, Forest & Climate Change; Ministry of Water Resources; Ministry of Land
	Engage local communities in protection of dolphin habitats through CBOs, CMCs, etc.	High	2020-2029	50	BFD, NGOs
	Advocate with neighbouring countries for ensuring critical level of waterflow from upstream rivers	High	2020-2029	50	Ministry of Environment, Forest & Climate Change; Ministry of Foreign Affairs; Ministry of Water Resources
	Coordinate with relevant government bodies for dolphin habitat protection and management at local level	Medium	2020-2025	20	Ministry of Environment, Forest & Climate Change; Ministry of Water Resources
	Mainstream dolphin and their habitat conservation with national and regional developmental activities	High	2020-2029	20	Ministry of Environment, Forest & Climate Change, Ministry of Water Resources, Ministry of Shipping
Understand and reduce dependency of local communities on dolphin habitats	Assess site-based socio-economic dimensions and dependency of fishermen on dolphin habitats	Medium	2020-2022	10	BFD, research institutions, NGOs
	Assess current patterns of resource harvest and explore mechanism or determine threshold of sustainable resource use of dolphin habitats	Medium	2020-2022	10	BFD, research institutions, NGOs
	Explore and provide AIGAs for heavily dependent fishermen who earn living on dolphin habitats	High	2020-2025	500	BFD, NGOs

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