



EXPANDING THE PROTECTED AREAS SYSTEM TO INCORPORATE IMPORTANT AQUATIC ECOSYSTEMS PROJECT

MANAGEMENT PLAN FOR THE GANGES RIVER DOLPHIN IN HALDA RIVER OF BANGLADESH



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EXECUTIVE SUMMARY

Halda River in the southeast of Bangladesh supports one of the few remaining populations of the globally threatened Ganges River Dolphin (*Platanista gangetica*), so this Management Plan has prepared to ensure the conservation of the species and its habitat. This has developed under Expanding Protected Area System to Incorporate Important Aquatic Ecosystems Project (EPSIIAEP), which is an initiative of the Government of Bangladesh (through Bangladesh Forest Department) with United Nations Development Programme (UNDP) and Global Environment Facility (GEF).

Based on the survey of EPSIIAEP conducted from November 2018 to February 2019, the maximum encounter rate of the Ganges River Dolphin in Halda River (part occupied by dolphins) was 1.55/km and the maximum total population was estimated at 45 individuals. The population size and encounter rate indicate that the population is viable and relatively healthy, and is suitable for long-term conservation of the species. The dolphins were found from Halda River mouth to Sattar Ghat. The average group size in Halda River is 2.43, and 84% of the population are adult individuals. Based on direct sightings of dolphins in Halda River, the 20 km segment from Halda River mouth to Sattar Ghat has identified as the hotspot for dolphins.

The biggest threat to the Ganges River Dolphin in Halda River is illegally set fishing nets. The second biggest threat is high level of pollution from the industries, markets and residential areas along the banks of Halda River and its connecting channels. Mechanized vessel movements along Halda River are blamed to kill and injure dolphins by colliding with propeller. The diversion and withdrawal of freshwater from the river for irrigation and supply in Chittagong City is also a formidable threat.

This Management Plan has produced following a study on dolphins of Halda River that included field survey and consultation with the local people, managers and experts. This will give direction to the management of the Ganges River Dolphin and its habitat in Halda River. The vision of this Management Plan is: 'The Ganges River Dolphin and other aquatic organisms thrive at optimum carrying capacity in unpolluted and safe habitat of Halda River so as to perform their ecological roles and continue to provide essential ecological services to mankind.' A total of four goals have set to achieve the vision, which are: 1) protect and recover the Ganges River Dolphin population and other aquatic organisms in Halda River; 2) protect and recover the ecological characteristics of Halda River; 3) improved and secured life of the local human communities with alternative income generating opportunities and sustainable harvest of the natural resources of Halda River, especially carp eggs and water; and 4) improve the capacity of Wildlife and Nature Conservation Division, Chittagong.

GIS-based modern patrolling (e.g. SMART patrolling) should be conducted regularly by both the Forest Department and the Department of Fisheries in order to implement the Wildlife Act and the Protection and Conservation of Fish Act. Both departments should establish patrol posts along the river in order to ensure regular patrolling and monitoring. The present capacity and logistics of the two departments, however, are not sufficient to do so. Therefore, the capacity building is necessary. Scientific research and monitoring are also needed to follow adaptive management and to understand the management impact. The 20 km segment of the lower reaches of Halda River, i.e. from Halda River mouth to Sattar Ghat, should be declared a sanctuary under the provisions of the Wildlife Act. Managing the sanctuary in a human-dominated landscape of Chittagong District will be difficult for the Forest Department, or even all

Government departments together, so the co-management approach should be adopted involving the local communities, forming Co-management Committees (CMCs), and ensuring the benefit sharing with the local communities.

The industrial and business development along the Halda River basin is going on rapidly and changing the traditional socio-economy of the region, so the local communities must get the priority to get jobs provided that the industries and business companies meet the environmental and social compliances. The river-based eco-tourism can be developed so that the tourists can enjoy the dolphins in the river while having non-mechanized boat rides as well as the local food and cultures by staying in cottages along the banks of the river. Availability of funding in the forms of grant, endowment and loan is necessary to develop alternate livelihoods. The awareness raising for local communities, on the other hand, can be done in many ways like consultation meetings, home-yard based meetings, school programmes, mosque programmes, educational film displays, traditional songs related to conservation, exhibitions, posters, booklets and signboards. These can be conducted by the Government departments, NGOs and local social and cultural organizations as well as sporting clubs and youth clubs.

The Forest Department officials who will be responsible for conducting patrolling and monitoring in Halda River should be motivated and sufficiently trained on field techniques, data recording and using GPS and binoculars. In the office of the Wildlife and Nature Conservation Division – Chittagong, a cell (can be called ‘Halda Dolphin Monitoring Cell’) should be established to enter, analyze and preserve the data, and take adaptive measures on the basis of data. The Government and/or the development partners should provide the necessary funding for these priority developments. A good practice is to develop partnerships with the relevant organizations in order to join forces and learn from each other. Aquatic ecosystem and dolphin management should be included and integrated with the overall syllabus of the training programmes of the Forest Department and with the educational and research organizations. Co-ordination meetings of all stakeholders of Halda River should take place on regular basis (monthly or bi-monthly) in order to ensure that the capacities of different stakeholders are properly utilized and there is no conflict between the stakeholders.

PART 1

BACKGROUND

1. BACKGROUND

1.1 Introduction

Halda River in the southeast of Bangladesh supports one of the few remaining populations of the globally threatened Ganges River Dolphin (*Platanista gangetica*). The importance of Halda River as virtually the only natural spawning ground of carps (*Catla catla*, *Labeo rohita*, *L. calbasu* and *Cirrhinus mrigala*) is widely recognized (Azadi 1985, Kibria *et al.* 2009, Rahman *et al.* 2012), but following the deaths of several dolphins during 2017-2018 the dolphin came to limelight as an important component of the river. The long-term survival of the dolphin metapopulation in Bangladesh is threatened due to various anthropogenic threats and deaths of dolphins are often reported. Therefore, the United Nations Development Programme (UNDP) and the Government of Bangladesh (through Bangladesh Forest Department), with support from the Global Environment Facility (GEF), took up 'Expanding the Protected Area System to Incorporate Important Aquatic Ecosystems Project (EPSIIAEP)'. Under this project there was an initiative to estimate the Ganges River Dolphin population in Halda River and gather necessary information to prepare the Management Plan, which will be followed to ensure scientific management of the species. The Ganges River Dolphin was chosen as a flagship species to conserve the important aquatic ecosystems of Bangladesh.

1.2 Focal Species: Ganges River Dolphin

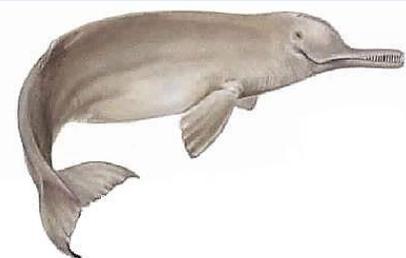
According to the IUCN Red List (Smith *et al.* 2012, IUCN-Bangladesh 2015), this species is globally Endangered and nationally Vulnerable. This is also the sole living representative of its family. It has been estimated that the current range of the Indus subspecies has 843-1,171 individuals and the Ganges subspecies has about 1,200-1,800 individuals, but the actual population is believed to be larger because some potentially important areas have yet to be surveyed and at least some of the counts and estimates were considered negatively biased (Smith *et al.* 2012, Braulik *et al.* 2012). This species is native to Bangladesh, India, Nepal and Pakistan, and occurs in the Indus, Ganges-Brahmaputra-Megna, and Karnaphuli-Sangu River Systems (Smith and Braulik 2012) (Figure 1). It prefers the counter-current pools below channel convergences and sharp meanders and above and below mid-channel islands. It also occurs in the estuarine areas, but are not generally known to occur in salinities greater than 10 ppt (parts per thousand).

The Ganges River Dolphin is deliberately hunted or accidentally killed in the fishing nets and used as food by some people, and extract oil which is used as a fish attractant. Water diversion and withdrawal have dramatically affected the habitat, abundance and population structure of this species throughout its range. In addition to fragmenting populations, dams and barrages have degraded downstream habitat and altered assemblages of fish and invertebrate species. Water pollution due to indiscriminate disposal of waste from industries and households, together with oil-spills from ships and run-off agrochemicals is very common in the rivers of its range. Toxic contaminants like organochlorine and butyltin concentrations in samples from the tissues of the Ganges River Dolphin were high enough to cause concern about effects (Kannan *et al.* 1993, 1994, 1997; Senthilkumar *et al.* 1999). The species, however, is legally protected in all range countries and occurs in a number of protected areas, including dolphin reserves or sanctuaries, where at least nominal enforcement takes place. It is listed on CITES Appendix I, which is ratified by the range countries.

It is assumed that there are several hundred Ganges River Dolphin in the river systems of Bangladesh, of which the majority occur in and around the Sundarbans (Smith *et al.* 2006, Khan and Aziz 2018). The Government of Bangladesh has so far established a total of seven protected areas for the protection of cetaceans, including Ganges River Dolphin and Irrawaddy Dolphin (*Orcaella brevirostris*). Three of these protected areas are situated in the Sundarbans, three in freshwater rivers (Padma-Jamuna) and one in the Bay of Bengal. The Government, with the support from Wildlife Conservation Society, has produced a Management Plan for the three sites of the Sundarbans for the period of 2015-2024 (Bangladesh Forest Department 2015).

The major threats to the Ganges River Dolphin include direct mortality from fisheries interactions (particularly gillnet entanglement), vessel strikes, and habitat loss and degradation. Live captures for aquarium display also have been a conservation issue in some countries, but not in Bangladesh. It is often caught accidentally in fishing nets in almost all areas where they have been studied (Smith *et al.* 2005, 2007; Beasley 2007, Mansur *et al.* 2008, Khan and Aziz 2018). There have been no systematic observer schemes in freshwater or coastal regions, but evidence of bycatch and increased use of gillnets is cause for concern. Moreover, many dams have been constructed or proposed that are degrading or likely to degrade the channels inhabited by dolphins throughout its range.

Ganges River Dolphin (*Platanista gangetica*)



Local name: Nodir Shushuk

Family: Platanistidae

Total length: 240 cm

Distribution in Bangladesh:

Widely distributed in freshwater rivers

Global status: Endangered

National status: Vulnerable

Protected areas for the conservation of multiple species could be a particularly effective conservation tool due to the fidelity of the species in freshwater systems to relatively circumscribed areas, as this can facilitate management. It is listed on CITES Appendix I, which is ratified by the range countries.

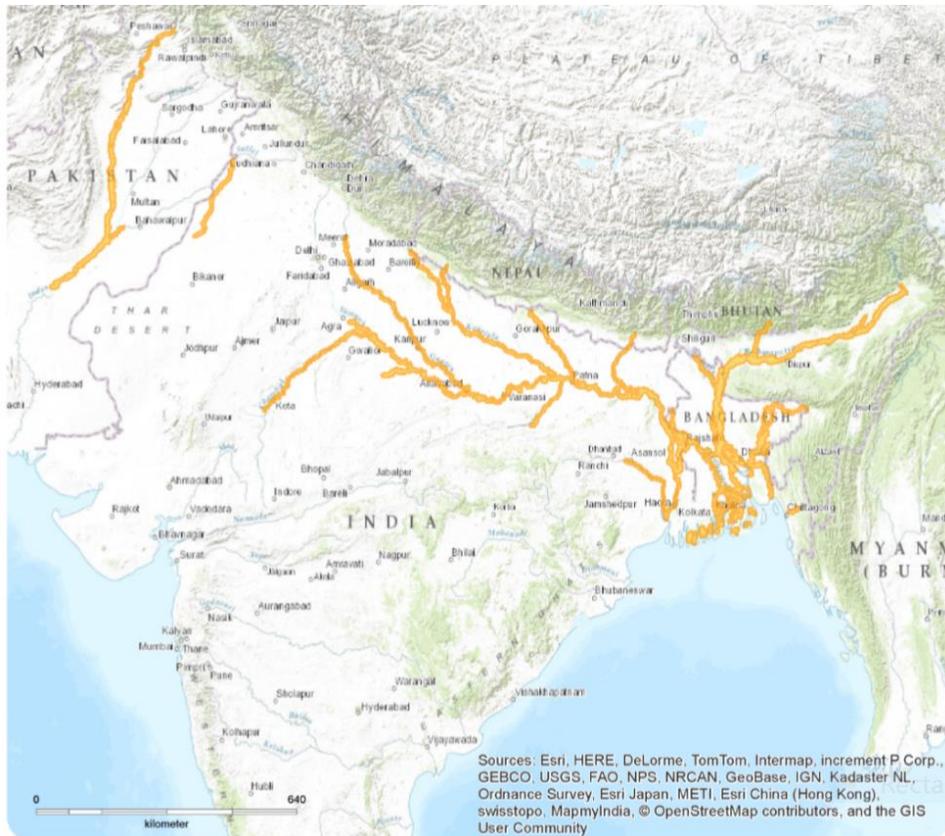


Figure 1. Global distribution of the Ganges River Dolphin (shown in yellow colour).

1.3 Halda River

Halda River is 98 km long and depths in deeper parts are 6-9 m. It has its catchment area along the hills of Chittagong and Chittagong Hill Tracts situated in roughly north-south order, same as Halda River itself. Halda River meets with Karnaphuli River at the downstream and drains to the Bay of Bengal, hence the river is tidal and tidal action reaches up to Nazirhat or even further up. The water level remains highest during the monsoon since bulk of the water it receives are the rain water. The tidal range varies between 2-4 m. There are four main spawning areas of carps along the river (Kibria *et al.* 2009). The total annual rainfall in the region varies from 600 mm to 4,500 mm.

Halda River has originated in the form of hill stream named Haldachara (N 22°55'39.98", E 91°46'16.92") in 2 No. Patachara Union, Ramgarh Sub-district, Khagrachari District, but its catchment area stretches a wider area along its course through Fatikchari, Raujan, Hathazari and Chittagong Proper under Chittagong District, and finally confluences with Karnaphuli River. According to the District Fishery Office, Chittagong, the total length of the river is 98 km (DoF) and there are 4,253 fishermen and 588 fish egg collectors dependant on Halda River, so the Government supported 2,600 fishermen and gave loans (total BDT 2.3 crore) to 2,300 fishermen when fishing was banned under the Protection and Conservation of Fish Act of 1950. The main areas of fish spawning are mainly downwards of the river in areas called Ankurighona, Sipahi Ghat, Binajur, Kagotiartek, Ajimer Ghat, Khalifarghona, Kerantoli (Garduara), Porawalirtek (Machughona), Amtua, Barighonartek and Shahmadari.

Water pollution in Halda River is a big problem and deaths of fishes are often reported, which are probably due to pollution. The factories set up in the area along the river from Kulgao to Oxygen and many release untreated waste into the river through Bamonshahi Canal, Hathazari Picking Power Plant through Chankhali Canal and Asian Paper Mills through Madari Canal. Moreover, some poultry farms have built along the river are contributing to the pollution. As a consequence the dissolved oxygen and food production rate have gone down. From 20 September 2017 to 01 February 2018, a total of 18 dead dolphins were reported in Handa River, of which one carcass was collected. The post-mortem report of one carcass has mentioned infection, haemorrhage and some other abnormalities (Khan *et al.* 2018).

According to Halda River Protection Committee, the pollution must be controlled in order to protect Halda River and has made 11 recommendations to save the river from pollution. These include forcing factories to release waste through effluent treatment plants (ETPs), ensuring regular operation of ETPs, re-excavating Bamonshahi Canal, declaring the Halda as ecologically endangered and declaring it as a national river.

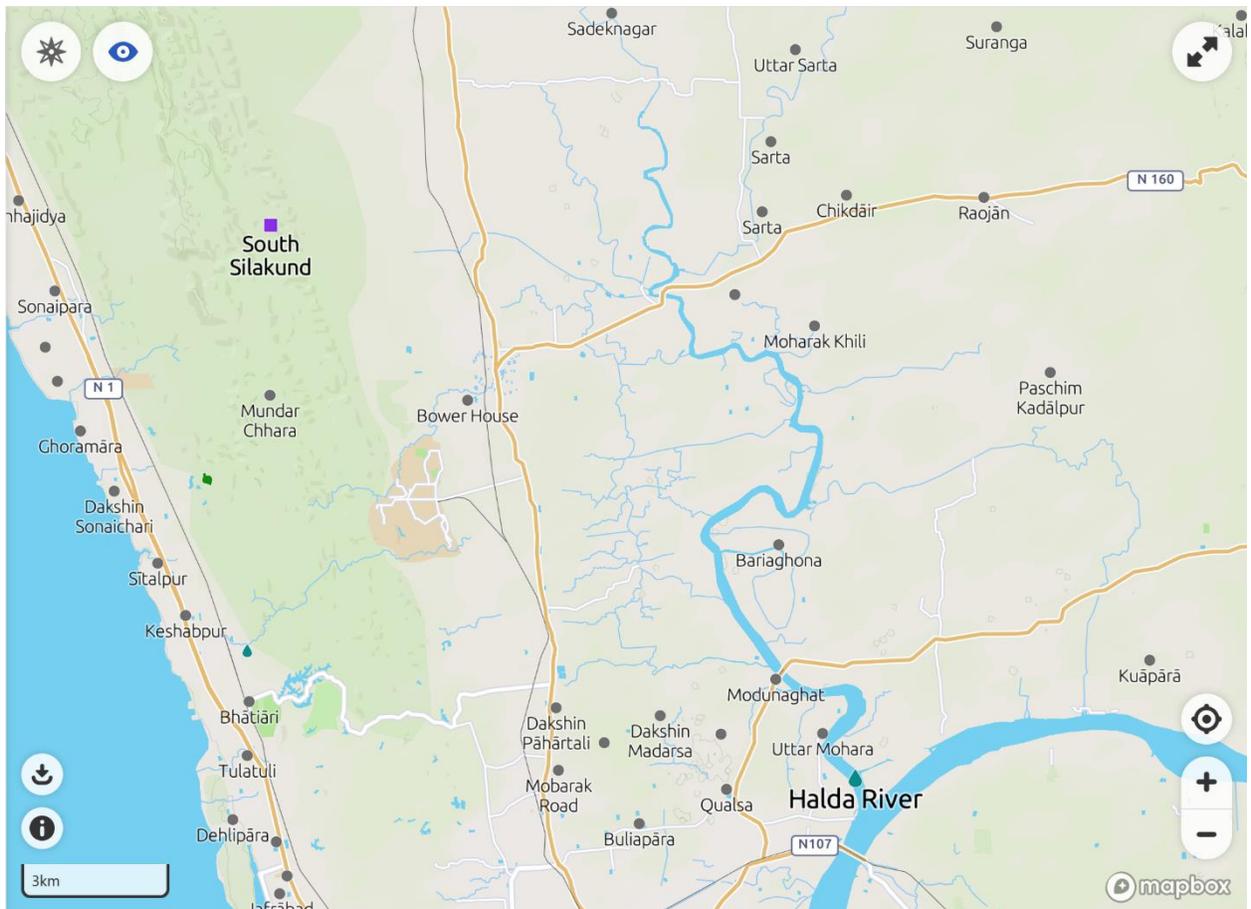


Figure 2. Halda River showing its tributaries.



Halda River near its mouth (Kochukain) is wide and turbulent, making the area suitable habitat for dolphins



Halda River is moderately wide in mid-length (Nazirhat) and can support dolphins only during the wet season



Halda River is narrow in the upstream (Bhujpur) and unable to support dolphins



Consultation meeting at the national level held at BFD Headquarter, Dhaka



Consultation meeting with the local community in Nowapara, east bank of Halda River



Consultation meeting with the officers of Fishery, Wildlife and Forest Departments in Chittagong

1.4 Dolphin Abundance and Population

Based on the survey of EPSIIAEP conducted from November 2018 to February 2019, the maximum encounter rate of the Ganges River Dolphin in Halda River (part occupied by dolphins) was 1.55/km and the maximum total population was estimated at 45. The population size and encounter rate indicate that the the population is viable and relatively healthy, and is suitable for long-term conservation of the species.

The dolphins were found from Halda River mouth up to a few kilometres further up from Sattar Ghat, but based on interviews with the local people it was recorded that during the wet season the dolphins travel up to Mirzarhat of Fatikchari Sub-district, which is 12 km further upstream from Nazirhat. During the wet season, especially during the spawning season (March to June) of carps, many dolphins from Karnaphuli River enter into Halda River to feed on carp fishes. Therefore, the wet season count of dolphins will be higher than the dry season count.

The average group size (not social group, but dolphins seen in one spot) of the Ganges River Dolphin in Halda River is 2.43, and 84% of the population are adult individuals. The remaining 16% were juveniles and no young were seen during the survey. It is likely that some young were there, but could not be detected due to their small sizes.

Prior to EPSIIAEP survey there was only one survey conducted during January-April 1999, but it covered the entire Karnaphuli and Sangu River Systems and Sangu forms a part of Karnaphuli River System (Smith *et al.* 2001). The study estimated a minimum of 125 Ganges River Dolphin in Karnaphuli and Sangu River Systems with an average encounter rate of 0.76 dolphins/km and mentioning that majority of the dolphins recorded in the lower reaches of the rivers. There was no estimate separately for Halda River, but based on the total figure and area coverage it can be concluded that the dolphins in Halda River did not decline over the last 20 years.

The Ganges River Dolphin populations and encounter rates were estimated in the river systems of the Sundarbans (Khan and Aziz 2018, Smith *et al.* 2009) and Pabna (CARINAM 2011, Khan and Rahman 2013, Rashid *et al.* 2015). In relation to the area surveyed, the population and encounter rate of the Ganges River Dolphin in Halda River is high compared to other areas of the country.



Boat-based survey of dolphins in Halda River

1.5 Dolphin Hotspot

Based on direct sightings of the Ganges River Dolphin in Halda River, the 20 km segment from Halda River mouth to Sattar Ghat has identified as the hotspot for dolphins (Figure 3). The adjacent area of Karnaphuli River has good population of the Ganges River Dolphin and there are frequent movements of dolphins from Karnaphuli to Halda and vice versa, making the entire river system of Karnaphuli-Halda an ideal ecosystem for long-term survival of the species. Since the Halda River is nationally important as the main spawning ground of carp fishes, the river gets some protection. Fishing is banned throughout the year from Halda River mouth up to Nazirhat bridge, and banned during February-July in 17 connecting channels or 'khals'. The engine boat movement is banned during March-July. The sand extraction from riverbed has completely banned from May 2018 following the deaths of 18 dolphins since the sand-carrying cargo boats were blamed for dolphin deaths by hitting with propeller. In contrast, the Karnaphuli River does not get such protection despite the fact that it supports the metapopulations of dolphins, fishes and other aquatic fauna and flora of the region. Therefore, it is recommended that both Halda and Karnaphuli Rivers should be brought under special management in order to ensure necessary protection.



Figure 3. Ganges River Dolphin sighting locations (red circles) in Halda River showing that the hotspot is from Halda River mouth to Sattar Ghat.

1.6 Habitat Condition

Halda River is mostly a freshwater river with very small amount of salt (1 ppm) from Halda River mouth up to Khalifaghona, i.e. about 12 km along the length. Relatively high quantity of total dissolved solids (TDS) indicate high level of pollution, which was supported by the visible pollutants and sources of water pollution (e.g., industries, markets and residential areas) along the river and riverbanks. The pH values along the river indicate that in general the water is slightly alkaline, which is not a big problem. The pollution would have been terrible if the river was not tidal. Majority of the pollutants are carried towards the sea by the water during the low tide.

Varieties of fish and crustaceans are commonly found in Halda River, which make the river a good habitat for the Ganges River Dolphin that feeds on fish and crustaceans. The common fishes that are edible to the dolphin are *Labeo rohita* ('Rui'), *L. calbasu* ('Kalibaush'), *L. bata* ('Bhanghan Bata'), *Catla catla* ('Catla'), *Cirrhinus cirrhosis* ('Mrigel'), *Wallago attu* ('Boal'), *Sperata aor* ('Ayre'), *Channa striata* ('Shol') and *Otolithoides pama* ('Poa'). According to a survey conducted during 2015-2016, there are 50 species of freshwater fishes in Halda River belonging to 40 genera and 20 families (Bangladesh Fisheries Research Institute 2016). Majority (50.58%) of the species belongs to the family Clupeidae.

The vegetation along the banks of Halda River was mostly of freshwater areas, but following the salinity gradient there were mangrove vegetation from Halda River mouth up to Khalifaghona or slightly further up. The two most dominant mangrove trees that were seen are Apple Mangrove ('Keora', *Sonneratia apetala*) and Crab-apple Mangrove ('Ora/Chhoila', *S. caseolaris*).



Water salinity testing in Halda River

1.7 Threats

A threat matrix of the Ganges River Dolphin in Halda River is given in Table 1. The biggest threat to the Ganges River Dolphin in Halda River is illegally set fishing nets. This is the biggest threat to dolphins in all dolphin habitats in Bangladesh, but in Halda it is lower than in other dolphin habitats of the country, because fishing is banned throughout the year in 40 km area from the mouth of Halda River up to Nazirhat bridge. The illegal fishing, however, was recorded towards the two ends of the 40 km segment during EPSIIAEP survey (Figure 5). The fishermen use long shore nets, gill nets, lift nets, drag nets and fishing rods to catch fish in Halda River during the day and night.

The second biggest threat was high level of pollution from the industries, markets and residential areas along the banks of Halda River and its connecting channels. It was difficult to quantify the level of pollution and show its impact on dolphins, but the availability of various types of pollutants like industrial effluents, plastic wastes, electronic wastes and pesticides from agricultural fields and tea gardens was obvious. The reason why the river still remained habitable for fish, dolphins and other creatures is because of the tidal activities by which the pollutants are carried towards the sea.

Mechanized vessel movements along Halda River that are blamed to kill and injure dolphins by colliding with propeller. The diversion and withdrawal of freshwater from the river for irrigation and supply in Chittagong City is also a formidable threat. The indiscriminate construction of two rubber dams (in Bhujpur and Harualchhari) and 12 sluice gates are responsible for reduction of freshwater flow, which is the lifeline of the river. As a consequence the saline water intrusion is on the rise. Other threats include cutting of river loops in order to straighten the river, unplanned embankments and over-exploitation of fish and other aquatic resources.

Bangladesh Fisheries Research Institute (2016) has identified several threats to Halda River and its fishes, viz. massive cutting of banks and sand lifting, water flow regulation by rubber dam, dumping of industrial waste, brick kilns on both sides of the river (total 22), indiscriminate catching of mother fishes, unplanned construction of 12 sluice gates, saline water intrusion, daily water lifting by Chittagong WASA, etc.

Bangladesh is the world's fifth in producing fish in closed water, which accounts for 55% of the country's total fish production (DoF 2014). Despite the fact that Halda is virtually the only natural spawning grounds of carp fishes, Bangladesh Fisheries Research Institute (2016) has identified several man-made threats, such as construction of dams, cutting the loops, water pollution, construction of sluice gates, sand quarry, water withdrawal for tea estates and cultivation, and indiscriminate catching and killing of brood fishes. As a consequence, the carp fry production has drastically declined from 2,470 kg in 1945 to only 20 kg in 2004 and 47 kg in 2015 (Kibria *et al.* 2009, Bangladesh Fisheries Research Institute 2016). Moreover, according to the local sources, as many as 15-20 large brood carps are illegally captured from Halda River during the 17pawning season.

Table 1. Threat matrix of the Ganges River Dolphin in Halda River.

LIKELIHOOD	CONSEQUENCES			
	No Long-term Effect	Minor Effect	Moderate Effect	Major Effect
Almost Certain	-	<ul style="list-style-type: none"> Saline water intrusion 	<ul style="list-style-type: none"> Pollution Over-exploitation of fish and crustaceans 	<ul style="list-style-type: none"> Illegal fishing
Likely	-	<ul style="list-style-type: none"> Unplanned embankment Brick kilns along riverbanks 	<ul style="list-style-type: none"> Water regulation and withdrawal 	<ul style="list-style-type: none"> Mechanized vessel movement (collision with dolphin)
Possible	-	<ul style="list-style-type: none"> Cutting of river loops (straightening the river) 	-	-
Unlikely or Unknown	<ul style="list-style-type: none"> Sand lifting 	-	-	-

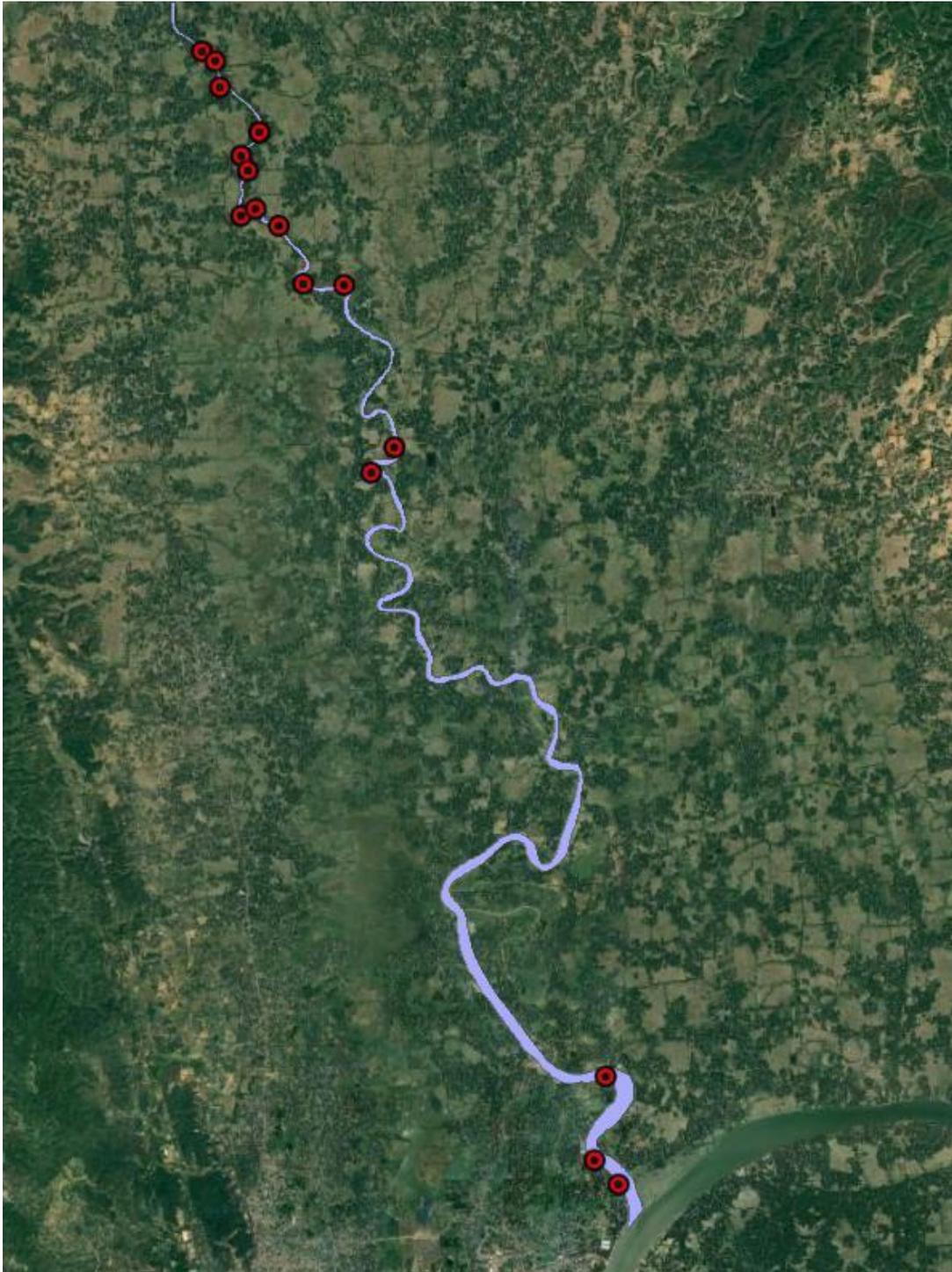


Figure 5. Illegal fishing locations (in red circles) in Halda River.

According to many published (Bangladesh Fisheries Research Institute 2016) and unpublished sources, water withdrawal from Halda River is another threat to dolphins and fishes. A large proportion of water is withdrawn for irrigation and watering in the tea estates. Irrigation in 26,260 ha of crop fields and 13,800 ha of tea gardens may need 350-600 billion litres of water, and part of it is withdrawn from Halda River. About 30% of the people living in the river basin are farmers who use the water. About 50% (90×10^6 lpd) of the treated water supplied to Chittagong City Corporation area are withdrawn from Halda River (Bangladesh Fisheries Research Institute 2016). Two rubber dams were constructed in Bhujpur (in Halda River) and Harualchhari (in a major branch of Halda River) in the upstream in order to supply water for agriculture during the dry season. These dams are blamed for dramatically reducing the water flow down to the dams (Bangladesh Fisheries Research Institute 2016). These came to operation during 2012-2013 and the water discharge dropped to about one-fourth during the dry season. As a result, there are more sedimentation on River. The rubber dams operate during December-April, i.e. during the pre-spawning migration of carps, and hence severely affect the aquatic biodiversity and breeding.

In order to control flood during wet season and provide irrigation to agricultural fields during the dry season, a total of 22 sluice gates were constructed by Bangladesh Water Development Board in the feeder channels of Halda River during 1975-1976 and 1982-1983 (Bangladesh Fisheries Research Institute 2016). As a consequence, the water flow in Halda River has dropped and the free movements of aquatic organisms to the feeder channels were blocked.

Sand lifting from Halda River is another formidable threat to Halda River and its biodiversity. Sand lifting and transport involve many large mechanized boats and increase the risk of clash of the Ganges River Dolphin with the propeller of the boat. The four main areas where sands are piled to sell out are Ramdas Munshir Hat (Hathazari), Moduna Ghat west (Hathazari), Moduna Ghat east (Rauzan), and Kalurghat (Chittagong Proper). It has estimated that around 1,29,000 cubic ft of sand are lifted from Halda Riverbed daily (Bangladesh Fisheries Research Institute 2016).

In order to reduce the distance of waterway journey and to protect riverbank erosion, a total of 11 loops were cut and straightened during 1905-2002, reducing a total of 25 km of the river (Kibria *et al.* 2009, Bangladesh Fisheries Research Institute 2016). This process, however, has proved to be detrimental to the river and its resources since the spawning of carps mainly takes place in bends. Moreover, the riverbank erosion has increased due to forceful water flow through straighter river.



Illegal fishing, especially by gill net, is the biggest threat to dolphins in Halda River



Pollution is the second biggest threat to Halda River and its dolphins



Mechanized vessels run in Halda River are blamed to kill dolphins by collision with propeller



Bhujpur rubber dam in the upstream of Halda River drastically reduces the water supply in the downstream during the dry season

PART 2

MANAGEMENT PLAN

2. MANAGEMENT PLAN

2.1 Rationale

This Management Plan for the conservation of the Ganges River Dolphin (*Platanista gangetica*) in Halda River, Chittagong, has produced following a study on dolphins of Halda River that included field survey and consultation with the local people, managers and experts. This will give direction to the management of the Ganges River Dolphin and its habitat in Halda River, Chittagong, Bangladesh.

Bangladesh is committed to conserve biodiversity and this Management Plan is in line with the Clause 18A of the constitution of Bangladesh where it is mentioned: 'The State shall endeavour to protect and improve the environment and to preserve and safeguard the natural resources, biodiversity, wetlands, forests and wildlife for the present and future citizens'. Moreover, as a party to the Convention on Biological Diversity (CBD), Bangladesh is working with the international community to ensure the conservation and sustainable use of biodiversity, and the implementation of this Management Plan will contribute to that.

In order to protect the biodiversity, especially the wildlife, in the natural habitats, Bangladesh has a network of designated protected areas declared under the Wildlife (Conservation and Security) Act of 2012. Although the country is dominated by various kinds of perennial and seasonal wetlands, the protected area network includes only a few wetland sites and the wetland habitats are very much under-represented in the protected area network. Many of the wetlands harbor globally and nationally threatened species of animals and plants including dolphins and Halda River is one of such areas, which is not only rich in biodiversity but also the country's biggest natural spawning ground for carp fishes. Implementation of this Management Plan will contribute to the implementation of the Wildlife Act through biodiversity and ecosystem conservation as well as public participation through co-management.

This Management Plan is in line with the Bangladesh Wildlife Conservation Master Plan 2015-2035. Among the several strategies of the Bangladesh Wildlife Conservation Master Plan 2015-2035, the strategies that are relevant to this Management Plan are species programmes, habitat management, institutional development and capacity building, supporting communities in wildlife zones, and awareness and education.

A management action matrix proposed under this Management Plan has given in Table 2. Implementation of this Management Plan will not only ensure the survival of the Ganges River Dolphin in Halda River, but offers a lot of opportunities for the fishery sector by increasing the carp egg production, protecting mother fishes, reducing water pollution, improving the food security and quality of life of the local communities, and securing stronger support from the local communities for biodiversity conservation.

This Management Plan should be reviewed and updated in every ten years at the latest on the basis of accomplishments, local development and the aspiration of the nation as well as the changing practices and livelihoods of the local communities. Adaptive measures should be taken on the basis of emerging challenges, the learning experience of the Management Plan implementation as well as the updates of the country's acts and policies regarding biodiversity conservation and management.

Table 2. Management action matrix for the Ganges River Dolphin in Halda River.

Sector	Action Area	Priority Level	Threat Addressed	Implementing Agency
Management of the Ganges River Dolphin	Conduct modern patrolling	High	Illegal fishing	BFD, DoF
	Control mechanized vessels	High	Excessive vessel traffic	DoF, BFD, district administration
	Conduct research and monitoring	Medium	Lack of research and monitoring	Research organizations, universities and Govt departments
Management of Halda River	Declare Halda Dolphin Sanctuary	High	Illegal fishing, excessive vessel traffic, pollution, water withdrawal	BFD
	Introduce co-management	Medium	Illegal fishing, excessive vessel traffic, pollution, water withdrawal	BFD, CBOs
Community development and awareness	Give priority to local communities in local jobs	Medium	Conflict between development and conservation, illegal fishing	Local business and other offices
	Develop eco-tourism	Low	Conflict between development and conservation, illegal fishing	BFD, CBOs, Bangladesh Parjatan Corporation
	Ensure funding	High	Conflict between development and conservation, illegal fishing	Govt, NGOs, international development partners
	Ensure community participation	Medium	Conflict between development and conservation, lack of awareness	CBOs
	Raise awareness	Low	Conflict between development and conservation, illegal fishing, lack of awareness	BFD, DoF, NGOs, CBOs

Capacity Building	Provide training and equipment	High	Lack of capacity, lack of aquatic ecosystem managers	Govt, NGOs, international development partners, training institutes
	Establish Halda Dolphin Monitoring Cell	High	Lack of capacity, lack of scientific research and monitoring	BFD
	Develop partnership	Low	Lack of capacity, lack of aquatic ecosystem managers	Govt departments, local Govt, NGOs, CBOs, international development partners
	Include dolphin management in syllabus	Medium	Lack of capacity, lack of aquatic ecosystem managers	Training institutes, universities
	Conduct co-ordination meetings	Medium	Lack of capacity, pollution, water withdrawal	Govt departments, local Govt, NGOs, CBOs, international development partners

Note: Three levels of threat priority was considered: High, Medium and Low.

Abbreviation: BFD – Bangladesh Forest Department, DoF – Department of Fisheries, NGOs – Non-government Organizations, CBOs – Community-based Organizations

2.2 Vision, Goals and Outputs

Vision: The Ganges River Dolphin and other aquatic organisms thrive at optimum carrying capacity in unpolluted and safe habitat of Halda River so as to perform their ecological roles and continue to provide essential ecological services to mankind.

A total of four goals have set to achieve the vision, which are given below, together with the respective outputs –

Goal 1: Protect and recover the Ganges River Dolphin population and other aquatic organisms in Halda River.

Output 1: Protected viable population of the Ganges River Dolphin and other aquatic organisms continue to survive in Halda River.

Goal 2: Protect and recover the ecological characteristics of Halda River.

Output 2: Halda River is declared a wildlife sanctuary and serves as an ideal habitat for the Ganges River Dolphin and other aquatic organisms, and provides the ecological services to the local resident people.

Goal 3: Improved and secured life of the local human communities with alternative income generating opportunities and sustainable harvest of the natural resources of Halda River, especially carp eggs and water.

Output 3: Life of the local human communities improved and secured in a way so that the Ganges River Dolphin will not die by entangling with illegal fishing nets, mother fishes will not be captured illegally, water will not be polluted and will be withdrawn in sustainable level.

Goal 4: Improve the capacity of Wildlife and Nature Conservation Division, Chittagong.

Output 4: Trained manpower and logistics able to perform modern patrolling (e.g., SMART patrolling), dedicated for the monitoring and protection of the Ganges River Dolphin and its habitat, are permanently deployed in Halda River.

2.3 Management of the Ganges River Dolphin

Objectives

The objectives of managing the Ganges River Dolphin are to ensure the survival of this threatened species and use it as a flagship species to conserve the fish and other aquatic organisms that are vital components in terms of their ecological and economic values.

Challenges

- **Illegal Fishing**

All kinds of fishing is already banned in Halda River (40 km segment of the lower reaches, i.e. from Halda River mouth to Nazirhat) under the Protection and Conservation of Fish Act of 1950, but fishing is done illegally during the day and night, especially towards the two ends of the restricted area. Long shore nets, gill nets, drag nets, lift nets and fishing rods are illegally used to catch fish. The fishing nets, especially the gill nets, are the biggest direct threat to dolphins, because the dolphins often entangle with the net and die in suffocation. If it is found alive in fishing net, the fishermen occasionally kill it in order to free the net and sale the dead dolphin. The oil extracted from dolphin is believed to have the power to heal pain when it is applied

externally. The meat of dolphin is used as the bait for big fishes, prawns and crabs. Controlling illegal fishing will be greatly beneficial for the majority of local people since this will help increase the carp egg collection and will increase the fish and crustacean stock of the entire region.

- **Excessive Vessel Traffic**

Another direct threat to dolphins is excessive vessel traffic, because dolphins accidentally hit with the moving vessel propeller and die instantly or suffer from injuries. Following the deaths of several dolphins from October 2017 to February 2018, the mechanized vessel movement was banned in Halda River for the period of March to July, but still many large cargo vessels move through the river throughout the year. Majority of the vessels are used to carry sands dredged from the river, others mainly carry the construction material.

- **Lack of Research and Monitoring**

Currently there is no regular research and monitoring on the Ganges River Dolphin in Halda River. As a result, it is not possible to know the population trend or take any adaptive management system. The scattered and sectoral information only show isolated status without any trend.

Prescriptions

- **Conduct Modern Patrolling**

GIS-based modern patrolling (e.g. SMART patrolling) should be conducted regularly by both the Forest Department and the Department of Fisheries in order to implement the Wildlife Act and the Protection and Conservation of Fish Act. Both departments should establish patrol posts along the river in order to ensure regular patrolling and monitoring. The protected part of the river should be patrolled at least five days a week or 20 days a month. The time and day of patrolling should be random so that the miscreants cannot predict the presence of patrol team. The present capacity and logistics of the two departments, however, are not sufficient to do so. Therefore, the capacity building is necessary, which has discussed in section 2.6 of this document. The 20 km (i.e. from Halda River mouth to Sattar Ghat) of the lower reaches of the river should be declared a sanctuary in order to ensure full protection to the species and habitat, which has discussed in section 2.4 of this document.

Clause 37 of the Wildlife Act clearly mentions the penalties for killing dolphins, selling it and keeping any part of it. If any person kills any dolphin he shall be deemed to have committed an offence and for such offence, be punished with imprisonment for a term not exceeding three years or with a fine of Taka not exceeding three lac (one lac = 100,000) or with both, and in case of his repetition of the same offence, he shall be punished with imprisonment for a term not exceeding five years or with a fine of Taka not exceeding five lac or with both. If any person collects, acquires, purchases, sells or

transports any trophy, uncured trophy, meat or parts of body of dolphin he shall be deemed to have committed an offence and for such offence, be punished with imprisonment for a term not exceeding two years or with a fine of Taka not exceeding one lac or with both, and in case of his repetition of the same offence, he shall be punished with imprisonment for a term not exceeding four years or with a fine of Taka not exceeding two lac or with both.

Under the provisions of the Protection and Conservation of Fish Rules of 1985, the monofilament gill nets ('Karent Jal') or any nets with mesh size below 4.5 cm are banned all over Bangladesh. In reality, however, the banned fishing nets are illegally used in many rivers including the Halda River. This ban, together with the special ban imposed for fishing in Halda River, is necessary to conserve the species in long-term.

Regular patrolling and establishment of patrol posts along the river are also needed to control the vessel traffic according to the prescribed vessel traffic laws and rules of Bangladesh. The local community should be involved through co-management in order to check the illegal fishing and vessel traffic, which are the two direct threats to dolphins. The local community involvement has discussed in details in section 2.5 of this document.

- **Control Mechanized Vessels**

During the season when mechanized vessels are allowed to run, i.e. from August to February, a speed limit (e.g. 10 km/hr) should be imposed so that there is less risk of accidental clash of dolphins with the propeller. Moreover, in the light of the Wildlife Act and the Inland Shipping Ordinance of 1976, no commercial vessel should anchor, must maintain one kilometer distance from each other while running, and should not navigate at night in the wildlife sanctuaries.

- **Conduct Research and Monitoring**

Scientific research and monitoring are also needed to follow adaptive management and to understand the management impact. Therefore, the involvement of researchers and research students from the educational and research institutions are necessary. There should be allocation of funding from the Government for conducting research and monitoring and the management practices should be revised regularly on the basis of research and monitoring reports.

2.4 Management of Halda River

Objectives

The objectives of managing Halda River are to ensure safe and unpolluted habitat for the Ganges River Dolphin and other aquatic organisms, which will contribute to the food security, water security, employment and quality of life of the local communities.

Challenges

- **Pollution**

Despite the fact that Halda River is very important as the country's largest natural spawning ground of carp fishes, the aquatic habitat of the river is facing serious crisis due to increasing pollution (by both soluble and insoluble pollutants) from industries, markets and residential areas along the banks of the river and its tributaries.

- **Water Withdrawal**

The water withdrawal for irrigation, watering the tea gardens and supply in Chittagong City not only reduces the water in the river, but also reduces the water current and is responsible for saline water intrusion from the sea. The problem is so severe, especially in dry season, that dolphins cannot live in major part of upper reaches of the river where they used to occur before the withdrawal of water. Therefore, the best remaining habitat must be strictly protected by declaring a sanctuary.

Prescriptions

- **Establish Halda Dolphin Sanctuary**

The 20 km segment of the lower reaches of Halda River, i.e. from Halda River mouth to Sattar Ghat, should be declared a sanctuary under the provisions of Clause 13 of the Wildlife Act where, in Sub-clause 13(1) says that the Government may, by notification in the official Gazette, in the light of national forest policy and forest master plan, and considering natural, geomorphological features, biodiversity and environmental significance, declare any Government forests or part of such forests or any Government land or wetland or any specified area as sanctuary, specifying the demarcation, for the conservation of forest and habitat of wildlife. Once the river is declared a sanctuary it will be unlawful to disturb or threaten any wildlife, introduce any exotic plant or animal, dump any material detrimental to wildlife, divert or pollute watercourse, establish industry and carry fire arms without permission of the authority. The boundaries of sanctuary, especially in two ends, should be demarcated by buoys on water and signboards in the bank. Moreover, the prohibition of brick fields within two kilometers under the provisions of Brick Making and Brick Field Establishment (Control Act, 2013; Rules 3b and 8) will be useful to control the brick fields along the riverbanks.

The declaration of Halda River as a sanctuary will not block the legal rights of the local communities in sustainably harvesting the resources, as the Sub-clause 13(3) says that when a wetland is declared as sanctuary, measures shall be taken to protect the occupational, traditional or the right of livelihood of local community of the area such as – fishermen, boatmen, etc. Notably, the catching of fish in the 40 km segment of the lower reaches of Halda River, i.e. from Halda River mouth to Najirhat, is banned under

the Protection and Conservation of Fish Act, so the local people are habituated with the protected status of the river.

Regarding the management of sanctuary the Clause 16 of Wildlife Act has a few Sub-clauses, viz. Sub-clause 16(1) mentions that the Government may, for each sanctuary, prepare a management plan in accordance with the manner prescribed by rules. This Management Plan will fulfill that requirement for the geographic area it covers. The Sub-clause 16(2) mentions that the Chief Warden shall bear all responsibilities of implementation and management of management plan and may for this purpose, in limited scale inside the sanctuary, take necessary steps, in consultation with the co-management committee, for the protection of fresh water or salt water aquatic animals such as tortoise, crocodile, dolphin, whale, porpoise, etc. through control or prohibition of fishing activities or movement of watercrafts. Therefore, there is a lot of flexibility in implementing the Management Plan.

- **Introduce Co-management**

Managing the sanctuary in a human-dominated landscape of Chittagong District will be difficult for the Forest Department, or even all Government departments together, so the co-management approach should be adopted involving the local communities, forming Co-management Committees (CMCs), and ensuring the benefit sharing with the local communities. The Clause 21 of the Wildlife Act has the provision and mentions that the Government may introduce co-management system for proper utilization, conservation and management of natural resources of the sanctuary involving Forest Department, minor ethnic-community living in the forests or local community on participatory basis to ensure active participation of all the parties therein. The Forest Department should open and circulate a hotline so that anyone can share information about the illegal activities in Halda River.

2.5 Community Development and Awareness

Objectives

The objectives of community development and awareness are to ensure food security and employment, support the socio-economic development of the locality, and increase public support and participation for conservation through awareness. These will lead to reduced anthropogenic pressure on the resources of Halda River.

Challenges

- **Conflict Between Development and Conservation**

Harmonizing the local development and conservation of the Ganges River Dolphin and its habitat is a big challenge, because part of the local communities are largely

dependant on the resources of Halda River, so the local development and conservation are often conflicting. Thankfully, however, another part of the local communities, especially the carp egg collectors, will be benefitted from the conservation. The local challenges include land crisis, poor infrastructures, limited access to health and sanitation, scarcity of alternate resources, and religious and social structures including the gender issues. People of Halda River basin are mostly Muslims and more conservative than the people of other parts of the country, so empowering women and involving them will be very challenging.

- **Lack of Awareness**

The awareness raising will be less challenging since the the Department of Fisheries and the local NGOs are already working on this sector with positive results. The communities should be involved in the decision-making process in promoting sustainable use, developing alternative livelihoods and raising awareness so that the decisions are realistic.

Prescriptions

- **Give Priority to Local Communities in Local Jobs**

The industrial and business development along the Halda River basin is going on rapidly and changing the traditional socio-economy of the region, so the local communities must get the priority to get jobs provided that the industries and business companies meet the environmental and social compliances. The Forest Department and the Department of Fisheries should approach the Government to impose quota, including quota for women, in jobs in local industries and business companies for the local communities. This will secure alternate livelihoods for the local communities and will discourage immigration of people from other areas seeking jobs.

- **Develop Eco-tourism**

The river-based eco-tourism can be developed so that the tourists can enjoy the dolphins in the river while having non-mechanized boat rides as well as the local food and cultures by staying in cottages along the banks of the river. This can be an additional site to visit, or a good stop-over, for visitors going to Katpai National Park in Kaptai, Rangamati. Notably, Kaptai is about one hour's journey from Halda River and tourists have to cross Halda River anyway on the way to Kaptai. Eco-tourism development can be integrated with the development of Co-management Committees (CMCs), which will also collaborate with the Bangladesh Tourism Board to ensure proper development of eco-tourism.

- **Ensure Funding**

Availability of funding in the forms of grant, endowment and loan is necessary to develop alternate livelihoods like fish/poultry/cattle farming, fish/poultry/cattle feed

industry, fish processing, plant nursery, homestead farming, honeybee rearing, small business, cottage industries and tourism related services. Therefore, the Government should consider providing endowment fund to the CMCs or local cooperatives and low interest or interest free loans to the local people. The 'Palli Sanchai Bank' or Rural Savings Bank can play a vital role in providing small funding. Bangladesh Small and Cottage Industries Corporation (BSCIC) can be approached to get support for the development of small and cottage industries. Moreover, the CMCs should seek funding on their own from the NGOs and the development partners. The local organizations, with the help of Government departments and NGOs, should develop and maintain welfare funds and insurance schemes.

- **Ensure Community Participation**

The community participation in Halda River management should follow the Community Management Organization (CMO) guidelines of the Government, which includes community involvement in patrols with Forest Department staffs, protecting the identity of the local informants, strengthening collaboration with the local community leaders to impose the sanctuary regulations, training (outreach, monitoring and capacity building) and supporting alternative livelihoods.

- **Raise Awareness**

The awareness raising for local communities can be done in many ways like consultation meetings, home-yard based meetings, school programmes, mosque programmes, educational film displays, traditional songs related to conservation, exhibitions, posters, booklets and signboards. These can be conducted by the Government departments, NGOs and local social and cultural organizations as well as sporting clubs and youth clubs. Moreover, the national and local electronic and print media can play a vital role in raising public awareness and increasing the local support for conservation.

2.6 Capacity Building

Objectives

The objectives of capacity building is to ensure sufficiently motivated, trained and equipped resource managers in the Forest Department and other necessary skilled people like scientists, law enforcement officers and community leaders for successful management of Halda River and its resources including the Ganges River Dolphin.

Challenges

- **Lack of Management Capacity**

The present capacity of the Forest Department is limited and unable to conduct effective patrolling, monitoring and enforcement of laws. Similar scenario is in other relevant professional groups. This, however, cannot be changed in a short period of time, because it requires time to motivate and train people, and money to conduct training programmes and buy necessary equipment.

- **Lack of Aquatic Ecosystem Managers**

The Forest Department officials are trained and experienced in managing the forests and other terrestrial ecosystems, so there is a lack of proper manpower to manage the aquatic ecosystems like Halda River.

Prescriptions

- **Provide Training and Equipment**

The Forest Department officials who will be responsible for conducting patrolling and monitoring in Halda River should be motivated and sufficiently trained on field techniques, data recording and using GPS and binoculars. Moreover, there should be some educational visits in wetland ecosystems where the Ganges River Dolphin and other aquatic resources are successfully managed. Training manuals and handbooks will be provided to the field officials so that they can take instant guidance from the manuals and handbooks.

- **Establish Halda Dolphin Monitoring Cell**

In the office of the Wildlife and Nature Conservation Division – Chittagong, a cell (can be called 'Halda Dolphin Monitoring Cell') should be established to enter, analyze and preserve the data, and take adaptive measures on the basis of data. An officer should be in charge of the cell and oversee the management of Halda River. The Government and/or the development partners should provide the necessary funding for these priority developments.

- **Develop Partnerships**

A good practice is to develop partnerships with the relevant organizations (such as between manging authority, educational and research institutions, and the local NGOs and committees) in order to join forces and learn from each other, which will instantly fulfill the needs. This practice also ensures optimum use of the equipment and other resources.

- **Include Dolphin Management in Syllabus**

Aquatic ecosystem and dolphin management should be included and integrated with the overall syllabus of the training programmes of the Forest Department and with the educational and research organizations. There should be scope for interny and volunteering in the Forest Department's Halda River management and dolphin conservation initiatives so that motivated and trained manpower can be formed and eventually added to the pool.

- **Conduct Co-ordination Meetings**

Co-ordination meetings of all stakeholders of Halda River should take place on regular basis (monthly or bi-monthly) in order to ensure that the capacities of different stakeholders are properly utilized and there is no conflict between the stakeholders. The national leaders and policymakers as well as the national experts on the relevant field can be invited in the co-ordination meetings so that they can contribute in successful management and can integrate and support the local initiatives with the national and international initiatives and resources.

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