

INDIVIDUAL ASSIGNMENT

MODULE -5

SEMINAR PAPER

ON

**PADMA MULTIPURPOSE BRIDGE PROJECT: IMPACTS ON
BIODIVERSITY**

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Padma Multipurpose Bridge Project: Impacts on Biodiversity

Executive summary

Bangladesh Bridge Authority (BBA) under the Ministry of Road Transport and Bridges (MoRTB) is implementing the Padma Multipurpose Bridge Project (PMBP). BBA/PMBP conducted an Environmental Impact Assessment (EIA), prepared an Environment Management Plan and Environmental Action Plan (EAP) at the design stage during 2009-2010, which laid out the biodiversity coverage of the project area and established the baseline condition. The EIA estimated that due to the implementation of PMBP activities (river training works, construction yards at Mawa and Janjira, and the main bridge) approximately 1,300 ha of the river and wetlands habitats will be affected. The impacts on biodiversity at its ecosystem, species, and genome-level will be in the form of displacement and loss of habitat, which would be more or less temporary and to some extent permanent in nature. As such, to compensate for these impacts it was decided to declare a protected area (PA) that will retain the ecosystems and provide sanctuary to the species of conservation significance. The conservation of biodiversity is a global responsibility. Each country has a vital role to manage its biological resources. As part of this responsibility, it is essential to know about biodiversity and the means that will be required to increase and disseminate the knowledge gained. The monitoring of the biological resources, biodiversity in particular, under the BBA/PBMP/Biodiversity Conservation Programme (BCP) is one such important activity that not only will enhance knowledge but will allow BBA/PMBP to conserve, protect and manage the biodiversity in its entirety – habitat, species, and genes. The rightful decision to create a PA as the Padma Bridge Wildlife Sanctuary (PBWS) is a testament to the commitment of the government to fulfill the obligations of the Convention of Biological Diversity (CBD) and to achieve the Sustainable Development Goal (SDG) targets - Target 13: Climate Action, Target 14: Life Below Water, and Target 15: Life On Land. The government already declared the PBWS to monitoring the biodiversity within the delineated area. The total area of the sanctuary is 11,772.608 hectares, of which 8142.576 hectares comprise core area and encompassed by 3,630.032 hectares of buffer area. In this connection, the PBWS approved, and GO was notified. Biodiversity monitoring is the primary activity of the BCP. The project area

represented ecosystems that covered various habitats. Each of these ecosystems supported species adapted to that particular ecological niche while some opportunistic species were widespread and inhabited several ecosystems. To monitor the flora and fauna species diversity and assess the impacts several locations and species were selected based on the recommendations of the Biodiversity Baseline Survey (2015-16) and later approved during the Milestone meeting on 10th March 2019. A total of 63 locations were selected covering different ecosystems like garlands, grasslands, homesteads, roadsides, cultivated and fallow land, the main river and floodplains, and other lentic wetlands to monitor the biodiversity. Among these 33 sites were to monitor flora Annual Report 2020, Biodiversity Conservation Programme/Padma Multi-purpose Bridge Project, 23 sites for wildlife monitoring and for fisheries various sites were grouped into clusters and 7 such clusters were demarcated for monitoring fish diversity to monitor the impacts due to the construction of the Padma Bridge on the biodiversity (habitats and species) 22 species representing flora/plants, wildlife and fishes were selected. The five selected plants included two grass species (kash, *Saccharum spontaneum*, and hola, *Typha domingensis*) that were widespread in the area, one reed species (nal, *Phragmites karka*), one naturally growing wetland tree species (panibaj, *Salix tetrasperma*), and one widely distributed tree species (Monaghan, *Tamarix gallica* var. *indica*). Among the 11 fauna species representing wildlife, 6 species were birds (Little Cormorant, Pied Kingfisher, Bank Myna, Red-wattled Lapwing, Black-winged Kite, and Zitting Cisticola), 2 reptiles (Roofed Turtle, Bengal Monitor), 1 amphibian (Bull Frog), and 2 mammalian species (Golden Jackal, Gangetic Dolphin) and 6 were fish species (Hilsa, Chital, Aor, Rui, Baila, and Baim). Disturbances due to dredging, noise, and vibration from the construction activities, and movement of heavy-duty transports significantly affected the biodiversity till the 2nd and 3rd quarters of 2019. Landfilling using the dredged materials destroyed the habitats in many of the chars and river banks. As acquiring land is a lengthy process as well as expensive, the dredged materials were dumped on the chars in phases which increased the vertical height of the area. These land-filled areas will presumably never be affected by the floods and will be deprived of annual replenishment by the fertile silt that the floods brought in and gradually reducing the fertility of the char land. Physical alteration of the river morphology by artificially making transitways for transporting equipment also had an impact on the hydrology of the river affecting the movement of aquatic animals like the Gangetic Dolphins and migratory routes of the hilsa. In some sections of the river, accretion was accelerated due to the deposition of the sand from dredging just south of the main bridge at Noadoba, Choto Saigon. Due to the alternation or in some cases disturbances and degradation of ecosystems, species

composition of flora and fauna might have possibly changed. Some species that could not adapt to the new or changed ecosystem may have withered in the case of flora and fauna may have migrated to other locations. Similarly, some other or resilient species may have filled the vacuum in the changed ecosystems to get a better opportunity to survive.

1.0 Introduction

1.1 Background -The Padma Multipurpose Bridge(PMBP) is the Bridge of Pride. It is a very important large scale infrastructure project in the transport sector of Bangladesh. The Bridge will provide a vital missing link in the national road network of Bangladesh, particularly for the southwest part of the country. The Bridge will provide a missing link on National Highway 8 (N8) at Mawa – Janjira points. The Project is financed by the Government of Bangladesh (GOB). Bangladesh Bridge Authority (BBA) is the executing agency of the Project. The bridge is a 6.15 km long, fixed crossing double-deck composite steel truss bridge over the Padma river with provisions for a four-lane highway on the upper deck, and a rail line, gas pipeline, optic fiber cable, and power transmission lines on the lower deck(**PMBP, EAP2011**).

The construction of the bridge has brought in some permanent changes in the landscape at the cost of the loss of ecosystems like wetlands and the ecological services thereof. To counterbalance the loss and to arrest further changes in the land use, a biodiversity monitoring program was launched within the PMBP to gather information on the ecological and environmental impacts and to restore ecological services, conserve natural resources for the sustainability of the livelihoods of residents, protect biological diversity and mitigate impacts within the Padma bridge impact area. This formed the basis of the biodiversity monitoring program within the PMBP. Moreover, the proposal to create Padma Bridge Wildlife Sanctuary (PBWS) is a landmark decision for the PMBP to compensate for the loss of habitat and facilitate initiatives to protect biodiversity, associated ecosystems, and ecological services(**PMBP, Annual Report,2020**).

BBA/PMBP conducted an Environmental Impact Assessment (EIA), prepared an Environment Management Plan and Environmental Action Plan (EAP) at the design stage during 2009-2010, which laid out the biodiversity coverage of the project area and established the baseline condition. The EIA estimated that due to the implementation of PMBP activities (river training works, construction yards at Mawa and Janjira, and the main bridge) approximately 1,300 ha of the river

and wetlands habitats will be affected. The impacts on biodiversity at its ecosystem, species, and genome-level will be in the form of displacement and loss of habitat, which would be more or less temporary and to some extent permanent in nature. As such, to compensate for these impacts it was decided to declare a protected area (PA) that will retain the ecosystems and provide sanctuary to the species of conservation significance. The conservation of biodiversity is a global responsibility. Each country has a vital role to manage its biological resources. As part of this responsibility, it is essential to know about biodiversity and the means that will be required to increase and disseminate the knowledge gained. The monitoring of the biological resources, biodiversity in particular, under the BBA/PBMP/Biodiversity Conservation Programme (BCP) is one such important activity that not only will enhance knowledge but will allow BBA/PMBP to conserve, protect and manage the biodiversity in its entirety – habitat, species, and genes. The rightful decision to create a PA is the Padma Bridge Wildlife Sanctuary.

Table- 1: Biodiversity Monitoring Sites.

Biodiversity Type	No. of Sites	Name of Locations
Flora	33	Bhagyakul, Char Gobaranda, Majikandi, Bhagyakul (BWDB), Kathalbari, Louhajong, Char Janajat, Painpara, Tarpasha, Shimuliya Char, Teotia Char, Panch Char, Jalsen, Dogachi Tower House, Majhikandi, Matbarer Char, Shatghoria (Graveyard adjacent), Mawa-Louhajong Road, Shimuliya Hospital, Khan Bari, SingherHati, Bateshwar, Kawlipara, Ranjit Khan, Shabaznagar, Karali, ChotoSatgaon, Arial Kha Mukh, Chitra Char, Bagra, Khalpar, Mawa (Kandipara), Char Chandra, Jhaotia. Rangoon, Shower, Brahmongaon, and Kazirhat
Fisheries	7	River channel, wetlands, distributaries along Bagra, BhagyakulTeotia, Arial Off Take, Char Janajat, Tarpasha-Painpara, and Mawa.
Wildlife	23	Bagra, Bhagyakul, Char Janajat, Char Rusra, Char Chandra, Chitarchar, DiaraNaodoba, Dotara, Goborando, Hokiatur, Karali, Kathalbari, Louhajong, Majerkandi, Matbarer Char, Mawa, Narikelbaria, Painpara, Ranjit Khan, Shimuliya, Tarpasha, Teutia and Raghunathpur.

(PBWS) is a testament to the commitment of the government to fulfill the obligations of the Convention of Biological Diversity (CBD) and to achieve the Sustainable Development Goal

(SDG) targets - Target 13: Climate Action, Target 14: Life Below Water, and Target 15: Life On Land(SODEV/PMBP, Annual Report,2020).

Table- 2. Classification of the proposed Padma Bridge Wildlife Sanctuary (PBWS) area.

District	Upazilla	Land (ha)		River Area (ha)	TOTAL AREA (ha)
		Acquired	Khas		
Madaripur	Shibchar	866.870	-	2,587.18	3,454.050
Shariatpur	Jajira	-	1,401.708	1,959.72	3,361.428
Munshiganj	Lohajang	-	-	1,174.83	1,174.830
Faridpur	Sadarpur	-	-	4.89	4.890
SUB-TOTAL (Core Area)		2,268.578		5,726.62	7,995.198
Madaripur	Shibchar	488.510	131.923	1,037.323	1,657.756
Shariatpur	Jajira	422.020	-	476.880	898.900
Munshiganj	Lohajang	-	-	416.780	416.780
Faridpur	Sadarpur	-	-	657.150	657.150
SUB-TOTAL(Buffer Area)		1,042.453		2,588.133	3,630.586
GRAND TOTAL		3630.032		8,142.576	11,772.608

The study covers detailed baseline information on the biodiversity of the Project area, including biodiversity of avifauna, fish, amphibians, reptiles, mammals, and invertebrates. Charland and riverbank in the Padma within the project boundary provide habitat for a wide range of fauna species and are of high conservation significance for birds, amphibians, reptiles, mammals, and grassland-dwelling avifauna species including migratory birds. Charland with its reeds, mudflats, and sandy beaches are the major staging grounds for migratory birds. Chars act as breeding grounds for endangered species such as freshwater turtles. The Charland, main channels, and banks in the Project area are under stress by human encroachment and activities and will be temporarily or permanently disturbed due to construction works of the Project. A conservation plan is proposed to support the wildlife in the project affected area as a measure of environmental compensation under the Project. The plan will cover the following:

- Wildlife monitoring for the continued baseline establishment and monitor the changes during the construction and operation stages.

- Establish a protected sanctuary to support breeding grounds of wildlife and aquatic habitats including fish to compensate for the habitat loss by the implementation of the project.
- Develop a visitor center in the bridge end facilities from where tourists and day-trippers can visit the protected sanctuary.
- Create awareness among the surrounding people about the protection of wildlife.
- Implement appropriate mitigation measures for the protection of fauna during construction activities.
- Study and monitor both the resident and migratory species of wildlife during construction and O/M stages. The report also presents the results of bi-monthly wildlife monitoring data carried out under the Project (**PMBP, EAP2011**).

The project is situated in deltaic plains which are characterized by some ecological zones, each with its associated flora and fauna. The proposed bridge alignment traverses two of the bioecological zones described for Bangladesh (**Nishat et al. 2002**), namely the 'Ganges Floodplains' and the 'Major Rivers' (in this case the Padma River).

Bangladesh is endowed with rich biological diversity. It is, however, noticed that there is a declining trend in species diversity in general and megafauna in particular. This alarming trend is mainly due to tremendous anthropogenic pressure and the adverse impacts of climate change. (**Biodiversity National Assessment 2015**).

1.2.Problem Identification

***A very few studies were carried out**

***A comprehensive study to be needed**

1. 3.Rational/Justification

- a) It will bridge the knowledge gap
- b) For policy initiatives
- c) It helps other researchers

1. 4. Objective

***To Identification of flora and fauna including fish, amphibians, reptiles, birds, and mammals, in the PMBP impact area and compare the present status with baseline condition.**

* To compare the indicator species of flora, fauna, fish amphibians, reptiles, bird, etc of the project area during the preconstruction and construction period and to make some recommendations for operational stages of the project.

•To way forward

1.5. Limitation

a) Time constraint: This study is to be carried out for the requirement of 130th ACAD courses in a very short time.

b)No manpower: No manpower is engaged in this study.

c)No budget: No budget is to be allocated for this study.

d) pandemic situation: The study is carried out through the pandemic situation. so it is not possible to research widely.

2.0 Methodology: The study was utilized in both primary and secondary data. The primary data was collected from the surrounding area of the project. The data collection period was from 1st December to 3rd December/2020. Secondary data collected from the concerned website, journal, books, periodicals, web portals, official documents, etc. The study was followed by personal interviews, focus group discussion, telephonic interview, key informant interviews (KIIs).Before hand a questionnaire was prepared. A valid comparison between present biodiversity status with baseline situation will have to be monitored and data was collected from concerned people and focus group of the project area by this study to achieve the objectives set forth above.

3.0 Results and Discussion: The main source of primary data was collected from the FGDs, in-depth case studies and KIIs were conducted with relevant stakeholders such as community leaders, project team, government officials and line departments, etc. The secondary data sources such as BBS, Project office both for PMB and partners, different government ministries/departments, newspapers, internet were reviewed.

A total of 5 focus group discussions (FGDs)was conducted to collect information on the ground level information on the different components under PMBP and then look for the effective and appropriate way forward/solutions for improving the overall situation. FGD considered 15 to 20 members and took one and-a-half-hours time. The study considered a total of 10 KIIs from

The main source of primary data was collected from the FGDs, in-depth case studies, and KIIs were conducted with relevant stakeholders such as community leaders, project team, government officials and line departments, etc. The secondary data sources such as BBS, Project office both for PMB and partners, different government ministries/departments, newspapers, internet were reviewed.

Padma Multipurpose Bridge construction is underway, and it is assumed that due to its huge activities, there is a possibility to affect ecosystems and biodiversity, and to compensate for this happening establishment of a Protected Area (PA) is essential. Government already approved the PBWS to monitoring the biodiversity within the delineated area and GO has issued.

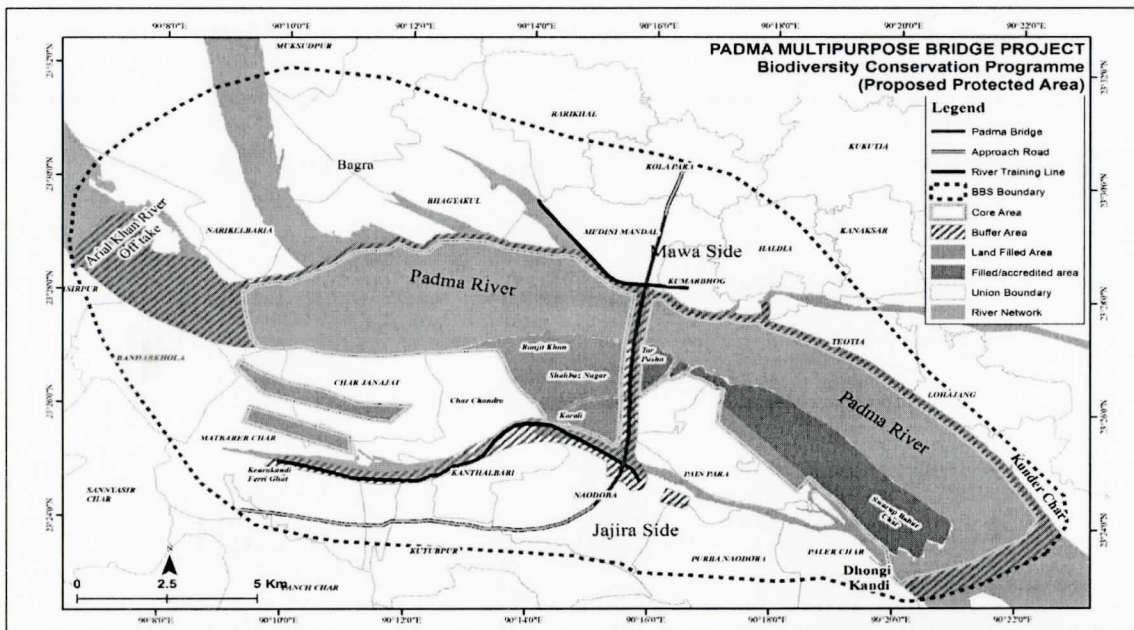


Fig.1-Protected Area declared as Sanctuary Padma Bridge Wildlife

Biodiversity monitoring helps us to define specific targets for nature conservation policy and to establish whether the measures that have been implemented are enabling us to reach these targets. Monitoring, in the sense used here, is a repeated survey using a standard methodology undertaken to provide a series of observations over time. A biodiversity monitoring plan has been prepared based on biodiversity baseline study to support managing the Padma Bridge Wildlife Sanctuary (Fig. 1), to monitor its biological diversity, and monitor

human and natural impacts during and after the construction of the Padma Multipurpose Bridge, and to ensure sustainable use and protection of resources. The outcome of this biodiversity monitoring plan will be designed and is intended for the managers who will be implementing the plan, i.e. the Environment Unit (EU) of the Padma Multipurpose Bridge Project (PMBP) of the Bangladesh Bridge Authority (BBA).

Hence, monitoring biodiversity is very essential to observe the status and undertake remedy if needed for improvement of biodiversity including the population of flora and fauna within the PMBP impact area.

The PMBP physical footprint includes several components, i.e. river training works, construction yards at Mawa and Janjira, the main bridge, approach roads, and bridge end facilities, services areas, and dredging for access/transit channels in the char land (sand bars), and is expected to affect approximately 1,300 ha of aquatic or wetlands habitat. Loss of aquatic habitat includes the Padma River, floodplains, char land, and ponds; and habitat loss is expected to have significant effects on the river bank and char land ecology and the feeding grounds and food chains of mollusks, fishes, crustaceans, reptiles, and dolphins. The proposed Padma Bridge area is of high biological diversity and habitat for many important and endangered aquatic and wetland-dependent species. Floral and faunal diversity is one of the major components of the natural ecosystem. It provides goods and services to mankind in the form of provisioning, recreation, food, and transportation. Currently, human population pressure, anthropogenic and developmental activities, climate change and biological invasion is making the ecosystems very fragile. Padma Multipurpose Bridge Project is one of the first-truck projects of the Government of Bangladesh. Due to multifarious project activities, biodiversity may endure some threats which may make them more vulnerable. Habitat loss will be more or less permanent, so has to be compensated by establishing an area that could receive protected area status. Substantial ecological information of the area is required to monitor potential biological indicators and developing such a sanctuary. So that, all aspects of ecology, biodiversity, habitats, and associated flora and fauna should be understood and identified to prepare protected area management and biodiversity monitoring plan during the construction and post-construction periods.

Biodiversity monitoring includes primary data collection, secondary data analysis, and identification of important threats to ecosystem and indicator species due to proposed interventions through public consultation. The findings and results of a current survey (BCP 2019) were compared with Biodiversity Baseline Survey (BBS 2015-16) and Ecological Study (2009-10).

A biodiversity survey was conducted in char lands, mudflats, rivers, and in other habitats of the influence areas (Table 1.2). It is to be noted that the monitoring locations covered all the ecosystems within the project area such as the Padma River and its tributaries, floodplains, bays, char lands, wetlands, cultivated lands, homesteads, and roadsides. The monitoring also covered areas that are not influenced by construction activities (impact areas) to monitor the natural changes during project implementation.

Table-3: Biodiversity Monitoring Sites surveyed during January-December 2019.

Biodiversity Type	No. of Sites	Name of Locations	Remarks
Flora	33	Bhagyakul, Char Gobaranda, Majikandi, Bhagyakul (BWDB), Kathalbari, Louhajong, Char Janajat, Painpara, Tarpasha, Shimuliya Char, Teotia Char, Panch Char, Jalsen, Dogachi Tower House, Majhikandi, Matbarer Char, Shatghoria (Graveyard adjacent), Mawa- Louhajong Road, Shimuliya Hospital, Khan Bari, Singher Hati, Bateshwar, Kawlipara, Ranjit Khan, Shabaznagar, Karali, Choto Satgaon, Arial Kha Mukh, Chitar Char, Bagra, Khalpar, Mawa (Kandipara), Char Chandra, Jhaotia. Rangoon, Shower, Brahmongaon, and Kazirhat	Same locations as of BBS (2015-16). In addition, other adjoining areas as well.

Fisheries	7	River channel, wetlands, distributaries along Bagra, Bhagyakul Teotia, Arial Off Take, Char Janajat, Tarpasha-Painpara, and Mawa.	Same locations as of BBS (2015-16). In addition, other adjoining areas as well. Fish landing areas of both the bank of the river within PMBP influence area
Wildlife	23	Bagra, Bhagyakul, Char Janajat, Char Rusra, Char Chandra, Chitarchar, Diara Naodoba, Dotara, Goborando, Hokiapur, Karali, Kathalbari, Louhajong, Majerkandi, Matbarer Char, Mawa, Narikelbaria, Painpara, Ranjit Khan, Shimuliya, Tarpasha, Teutia and Raghunathpur.	Same locations as of BBS (2015-16). In addition, other adjoining areas as well.

Indicator Species: Indicator Species (IS) were identified from different ecological strata of the diverse ecosystems. IS needed to have a wide distribution and be abundant enough for it to have wide potential application. Observation of the selected species should preferably be easy to observe and identify which reduces identification problems (taxonomic errors) and also enables non-specialists to use the technique. Based on these fundamental criteria a total of twenty-two (22) IS were selected: five (5) plant species, two (2) mammals (1 terrestrial and 1 aquatic), six (6) birds, two (2) reptiles, one (1) amphibian, and six (6) fish species that are listed in Table- 4.

Table- 4: Indicator Species of the PMBP Influence Area

Sl. No.	Class/ Category	Indicator Species			Justification for indicator species selection
		Local Name	English Name	Scientific Name	
FLORA					
1	Flora	Kash	Wild Sugarcane, Thatch grass	<i>Saccharum spontaneum</i>	Kash is used as thatching material and ecologically important. Indiscriminate exploitation is declining its abundance
2	Flora	Nal	Tall Reed	<i>Phragmites karka</i>	Nal/reed is commercially important, serves as a refuge for small animals and breeding and feeding ground of fish and birds
3	Fl	Panijoma/ Panibaj	Indian Willow	<i>Salix tetrasperma</i>	Common naturally growing tree species. Least Concern (IUCN 2019)
4	Flora	Hola	Elephant Grass	<i>Typha domingensis</i>	Commercial species declining indiscriminate extraction. Least Concern (IUCN 2011)
5	Flora	Nona Jha	Indian Tamarix	<i>Tamarix indica</i>	Common naturally growing tree species, soil binder
MAMMAL					

6	Mammal	Shishu (Shunsuke)	Ganges River Dolphin	<i>Platanista gangetica</i>	The species is critically endangered as per IUCN RedList (2015). This species is a bio-indicator of the health of the river ecosystem
7	Mammal	Shia	Golden Jackal	<i>Canis aureus</i>	A carnivore controlling pest species and acts as a scavenger. The species is vulnerable as per IUCN RedList (2015)

BIRD					
8	Bird	Sada Chil	Black-winged Kite	<i>Elanus caeruleus</i>	Mainly inhabited in the riverine floodplains/char lands and the species is vulnerable in the study area. This bird of prey is the biological controller of the rodent population. Least Concern (IUCN 2019)
9	Bird	Gang Shalik	Bank Myna	<i>Acridotheres gingianus</i>	Ecologically important indicator species and have conservation value, make hole nest at river banks only
10	Bird	Parka Machranga	Pied Kingfisher	<i>Ceryle Rudis</i>	Mainly inhabited in the riverine floodplains and the species is vulnerable in the study area. This species is an indicator of water quality and fish abundance
11	Bird	Hot-titi	Red-wattled Lapwing	<i>Vanellus indicus</i>	Mainly inhabits in the riverine floodplains/char lands and the species is vulnerable in the study area. Indicator of the ecosystem health of grasslands/reed lands ecosystems

12	Bird	Photo Pankowri	Little Cormorant	<i>Micro carbon niger</i>	Ecologically important indicator species and have conservation value as a piscivore
13	Bird	Bhomra Soton	Zitting Cisticola	<i>Cisticola suicides</i>	Ecologically important indicator species inhabits grassland and Freedland habitats and have conservation value as an insectivore
REPTILE					

14	Reptile/Turtle	Kori Kaittha	Indian Roofed Turtle	<i>Pangshura tecta</i>	A bio-indicator of a lentic ecosystem (pond/canal/ditch/wetlands). The species is rare in the project area. Threatened due to commercial exploitation and habitat loss. Least Concern (IUCN 2016)
15	Reptile/Lizard	Guishap	Bengal Monitor	<i>Varanus bengalensis</i>	Ecologically important as a predator and controller of rodents, snakes. Commercially important for leather goods. Near Threatened (IUCN 2015)

AMPHIBIA

16	Amphibia	Bhempu Bang	Bull Frog	<i>Hoplobatrachus tigerinus</i>	Least Concern (IUCN RedList 2015). This frog is an indicator of water quality because of its permeable skin. Edible; commercially and ecologically important. Least Concern (IUCN 2015)
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FISH

	Fish	Hilsa (Ilishmach)	Hilsa Shad	<i>Tenualosa Alisha</i>	Hilsa has high economic value, species dominance, and delicious taste. Due to their indiscriminate catching, the species population has been reducing gradually. Least Concern (IUCN 2015)
	Fish	Rui	Rohu Carp	<i>Labeo rohita</i>	A representative of Carps. Apart from Hilsa fish, this is one of the important contributors in a fish catch of the Padma River

	Fish	Baim	Lesser Spiny Eel	<i>Macrogathus aculeatus</i>	Bottom feeder species and important for using river-canal/Khal-beel benthic habitat. Not evaluated IUCN (2015)
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	Fish	Chital	Humped Featherback	<i>Chitala chital</i>	Commercially sought-after species; comparatively rare, an indicator of pesticide pollution in river water; endangered in Bangladesh (IUCN 2015); great conservation value. Also related to climate change impact due to rise in temperature and decrease of rainfall affects the breeding perspective.
	Fish	Aor (Boal)	Long-whiskered Cat Fish	<i>Mystus aor</i> (<i>Wallago Attu</i>)	Commercially important, representative of catfishes, bottom-living fish, predominantly piscivorous with predacious nature; Vulnerable due to habitat loss (IUCN 2015)
	Fish	Baila	Tank Goby	<i>Glossogobius giuris</i>	Early breeder and starter of the food chain in lotic (riverine-flowing water) ecosystems. Widely consumed. Least Concern (IUCN 2015)

Comparison of Biodiversity Monitoring Findings (January to December 2019) with Biodiversity Baseline Survey (2015-16) and Ecological Study (2009-10):

Flora

The Padma Multipurpose Bridge Project influence area covered different habitats including homestead areas, cultivated lands, char lands, roadsides, and wetlands. All such areas supported plants favorable to that particular habitat type. The summary of the findings is presented in the following table below. Also, note that eleven new species previously not recorded are also reported here.

Findings of current vegetation and flora survey (BCP 2019) shows that the project area supports diverse floral species due to the existence of different habitats/ecosystems as mentioned in earlier sections. As shown in the table below (Table-5) the current survey found 317 floral species among them 124 were trees, 37 shrubs, 145 herbs, and 11 climber species (among them 2 were epiphyte, 2 algae, 3 pteridophytes, and 2 parasitic species). The BBS 2015-16 found 311 floral species among them 95 are trees, 35 are shrubs, 173 are herbs and 10

are climber species (including parasite, algae and epiphyte). Whereas the baseline study of 2009-10 mentioned 123 flora species among them 54 were trees, 24 shrubs, and 45 were herbs.

Table-5: Comparison of monitoring findings of Flora of Current survey (BCP 2019) with BBS (2015-16) and Ecological Baseline study (2009-10)

Sl No	Particulars	Current Survey BCP 2019	BBS (2015-16)	Baseline study (2009-10)	Comments
1	Total number of flora species identified	317	311	71	
2	Habitats/ Ecosystem types	5 Types	5 Types	5 Types	
		a. Charland	a. Charland	a. Charland	
		b. Homestead	b. Homestead	b. Homestead	
		c. Roadside	c. Roadside	c. Roadside	
		d. Wetland	d. Wetland	d. Wetland	
		e. Agricultural land	e. Agricultural land	e. Agricultural land	
3	Habit				
	a. Tree	124	95	54	
	b. Shrub	37	33	24	
	c. Herb	145(2 epiphytes, 2 algae, 3 pteridophytes and 2 parasite)	173 (including parasite, algae and epiphyte)	45	
	d. Climber	11	10	-	
	Total	317	311	123	

FAUNA in general and Indicator species:

Twenty-three (23) locations were surveyed for the monitoring of wildlife (see Table 1), particularly the indicator species. The monitoring locations covered all the ecosystems

/ habitat types of the project area. Monitoring was emphasized on field data collection of 11 indicator species of wildlife (2 mammals, 6 birds, 2 reptiles, and 1 amphibian species). Besides, the overall wildlife species diversity was also noted. As such, several



other locations within the impact zone were regularly visited. Occasional nocturnal surveys were carried out to record nocturnal animals.

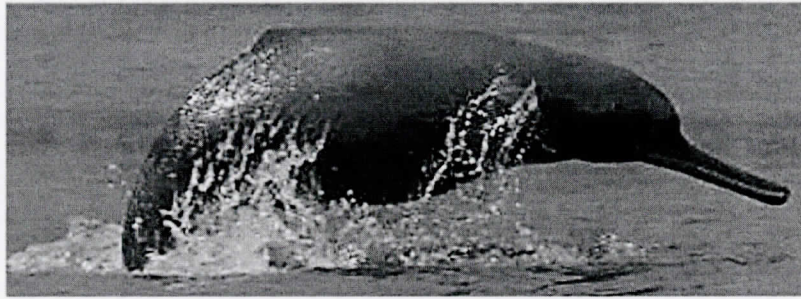


Fig. 2. Mammalian indicator species representing terrestrial species (A) – Golden Jackal (top); and aquatic species (B) – Gangetic Dolphin (bottom). Photos: Internet.

A total of 213 species of wildlife were recorded during 2019, of which 13 amphibians, 28 reptiles, 150 birds, and 22 species were mammals. The 2009-2010 Ecological Survey (Vol. 4) reported 178 species of wildlife of which, 6 amphibians, 16 reptiles, 147 birds, and 9 species of mammals, and BBS (2015-16) reported 188 species of wildlife, of which 16 were amphibians, 35 reptiles, 112 birds and 25 were mammals. The difference in the numbers of species observed with the previous two studies was insignificant. Species diversity of wildlife was found in this annual monitoring period comparing to the previous reports [Ecological Survey (2009-10: Vol 4) and Biodiversity Baseline Survey (2015)]. It was predicted that species diversity should be decreased due to the increase of disturbances of bridge construction activities. No big difference in species diversity was found, probably due to the year-long regular monitoring in all selected locations by the BCP members. Some new species were identified in this period that was not reported in any previous reports.

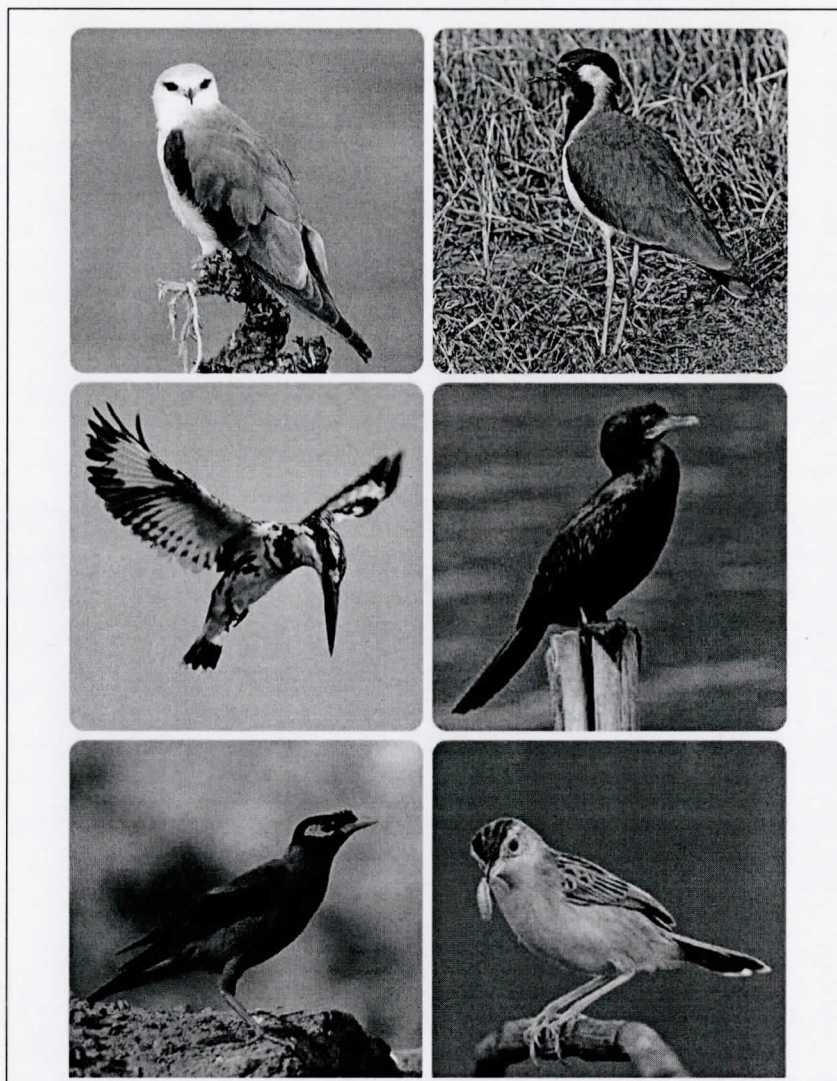


Fig. 3. Faunal indicator species representing different strata/habitats of the ecosystems - Birds. From top left: Black-winged Kite, Red-wattled Lapwing, Pied Kingfisher, Little Cormorant, Bank Myna, and Zitting Cisticola. (All photos from the internet).

All indicator species of birds were recorded during this period (Jan – Dec 2019), of which Bank Mynas were the most common species followed by Little Cormorant, Zitting Cisticola, Pied Kingfisher, Red-wattled Lapwing, and Black-winged Kite. A large variation in the numbers of species and diversity was found among the four quarters of the monitoring period. It was noted that species diversity gradually increased from the 1st quarter (98 species) to the 4th quarter (198). This may be due to the reduction of noise pollution, increase in monitoring frequency, reformation of some new habitats, and the arrival of some species of migratory birds.

Out of 150 species, only 44 species of migratory birds were recorded during 2019. Important migratory species were Black Stork (3), Little Stint (536), Little Egret (94), Common Sandpiper (524), Greater Sand Plover (456), Gadwall (285), Pacific Golden Plover (325), Temmink's Stint

(250), Kentish Plover, Greenshank, Ruddy Shelduck (201), Pintail (186), Common Teal (150 indiv.), Grey-headed Lapwing (+500), Black-headed Gull (+50), Yellow Wagtail (64), and Osprey (5). The birds were seen mostly in the mudflats and shoal, sand bars of the newly accreted low-lying char lands within the study sites.

The remaining 106 species of birds were resident, including the six indicator species. Some of the important species include Spot-billed Duck (642), Brown-headed Gull, Openbill Stork (258), Bank Myna (1033), Blue Rock Pigeon (1015), Common Myna (751), Plain Prinia (147), Little Ringed Plover (131), Pond Heron (127), House Crow (126), Little Cormorant (84), Cattle Egret, Black Kite, Pied Myna, Jungle Myna, Pied Kingfisher, and White-breasted Kingfisher. The abundance and density of water birds were the highest around Dhongikandi riverside wetlands. The abundance of egrets is a good indicator of fish population health in the area. Mixed colonies of Little Cormorants, Little Egrets, Openbill Stork, and Pond Herons were seen in the mudflats at Srinagar (outside project impact area). Among the birds of prey, the Black-winged Kite - an indicator species - was uncommon and often observed on roadside trees, cultivated land, and along the periphery of the project area, while Black Kites were seen in good numbers in almost all the habitat types. Pied Kingfisher, though observed regularly the frequency of sightings was comparatively less than Little Cormorants.

It may be noted that some of the species mentioned in the Ecological Survey (2009-10) and Biodiversity Baseline Survey (2015-16) like White Stork (*Ciconia ciconia*), Crested Kingfisher (*Megaceryle lugubris*), Indian Cormorant (*Phalacrocorax fuscicollis*), and Hen Harrier (*Circus cyaneus*) were most probably misidentified. Other than these six species (Rosy Pipit, Bar-tailed Godwit, Red-crested Pochard, Wood Sandpiper, Comb Duck, and Eurasian Stonechat) were not observed during the 2019 monitoring survey. On the other hand, twenty-eight species observed during the 2019 monitoring survey were not mentioned in either of the previous reports. The

reasons for these differences may be attributed to a) lack of capacity for proper identification of the species, b) disturbances due to the construction work, particularly intense noise during the period of previous surveys, c) changes in the habitat and comparatively less disturbance, and d) long-term and regular monitoring survey covering all seasons.

Among the herpetofauna, 13 species were amphibians and 28 species of reptiles were sighted during the 2019 biodiversity monitoring survey. The reptilian indicator species were rarely observed (Fig. 6.10). The Roofed Turtle (*Pangshura tecta*) usually inhabits the lentic aquatic ecosystems like the stagnant waters mainly in the homestead ponds and other aquatic habitats. The loss of habitat due to changes in the lentic ecosystems like conversion of aquatic habitats along the Padma Bridge approach road, the introduction of culture fisheries, and this species has lost the majority of its occupancy. The other indicator species – the Bengal monitor (*Varanus bengalensis*) was also uncommon due to habitat loss and human-induced disturbances. The homesteads within the project influence area do have a habitat suitable for the existence of Bengal monitor but disturbances due to human presence are some of the major factors for their rarity. Moreover, both the turtle and lizard are commercially important and are locally hunted and traded by some for consumption as food.

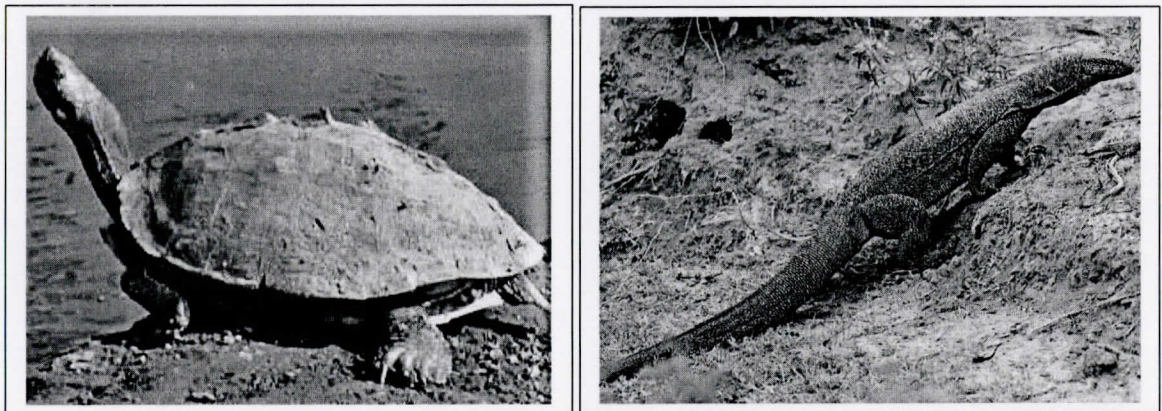


Fig. 4. Reptilian indicator species. A- (left) Roofed Turtle (*Pangshura tecta*) representing lentic aquatic habitat and B- (right) Bengal monitor lizard (*Varanus bengalensis*) representing terrestrial habitat.



Fig. 5. The lone representative of the amphibian indicator species – Bull Frog (*Hoplobatrachus tigerinus*).

The amphibian indicator species, Bull Frog (*Hoplobatrachus tigerinus*) (Fig. 4.10) was quite common in the homestead ponds and other aquatic habitats, including floodplains where there was stagnant water. The population of Asian Toads (*Duttaphrynus melanostictus*) was common, observed near most of the homestead ponds, stagnant water pools in the chars, and cultivated lands. Another common amphibian species occupying similar habitats was Skipper Frog (*Euphlyctis cyanophlyctis*). Overall, the reptiles being secretive were observed on a few occasions. Among other herptiles commonly observed include Garden lizards (*Calotes Versicolor*) and skinks (*Eutropis carinata*) at Srinagar. An individual of water monitor (*Varanus salvator*) was also sighted at Sreenagar area. A carapace of Roofed Turtle

(*Pangshura tecta*) was found at Bagra in a fishing village. Interview with the gypsy community revealed that during monsoon they hunt turtles in both the river and wetlands (Ariah Beel) for consumption as food. Snakes including Checkered Keelback (*Xenochrophis piscator*), Smooth Water snake (*Enhydryis enhydryis*) and Rat Snake (*Ptyas mucosus*) were also recorded.

Among other snakes were the venomous Monocled Cobra (*Naja kaouthia*), and Common Krait (*Bungarus caeruleus*). Interestingly a Russell's Viper (*Daboia russelii*) – primarily a terrestrial venomous species, that mostly avoids aquatic habitat like marshes and is usually found in open, grassy or bushy areas or in scrub jungles - was also observed swimming in the inundated floodplain, probably washed down during the monsoon flood.

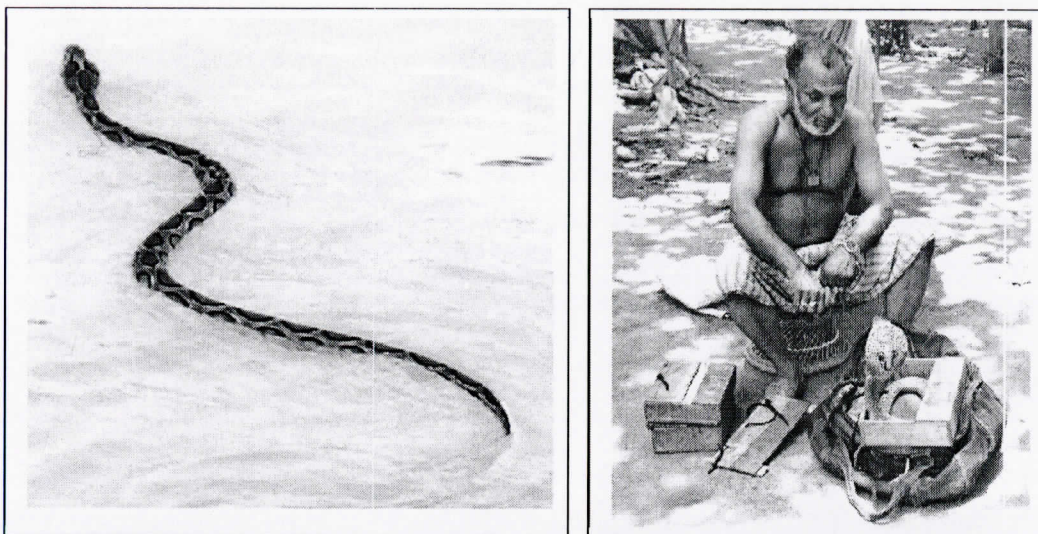


Fig. 6. An unusual find – left: Russell’s viper (*Daboia russelii*); right: snake charmer playing with binucleate/spectacled cobra (*Naja naja*) at the local Bhaggyakul market.

All indicator species of wildlife were recorded during January – December 2019, of which Bank Mynas were commonly followed by Little Cormorant, Zitting Cisticola, and Pied Kingfisher. Among the population of indicator bird species, the number of individuals of Bank Myna was significantly higher compared to other wildlife species found in different quarters. The numbers of individuals were less for most of the species compared to the findings of BBS (2015 – 16) and Ecological study (2009-10) even though the time spent in previous surveys was significantly less. This may be a result of the damages done to the habitats/ ecosystems due to bridge construction activities such as the increase of sound due to piling and dumping of dredging materials, movement of water vehicles carrying passengers, and transporting bridge construction materials. Other indicator species of wildlife sighted were also recorded in fewer numbers than the findings of all other previous studies.

A total of 22 species of mammals were recorded in 2019. Among them, Golden Jackal (*Canis aureus*) was common and observed in all river islands/chars. Only 27 sightings of Gangetic Dolphins (*Platanista gangetica*) were made during this one-year survey period (Table - Indicator species). Two large colonies of bats (Flying Fox – *Pteropus giganteus*) were spotted within the project influence area at

Kanakshar of Lauhojong Upazila. Jungle Cats, fishing cats

and mongooses were rarely found. However, tracks of fishing cats were seen on the chars indicating their presence.

Status: FISH Indicator species:

Common fish species observed in 2019 were Hilsa (*Terualosa Elisha*), Rui (*Labeo rohita*) Catla (*Catla Catla*), Aor (*Sperata aor*), Boal (*Wallago Attu*) Rita (*Rita Rita*), Pangas (*Pangasius pungasius*), Tankini (*Cirrhinus Reba*), Baila/Bele (*Glossogobius girls*), Kajuli (*Aila punctata*), Baim (*Macrogathus aculeatus*), Gharua (*Clupisoma garua*), Chapila (*Gudusia Chapra*), Tara Baim (*Magrogathus aculeatus*), Tangra (*Mystus tenure*), and shrimps. Other species observed were Peali (*Aspidoparia morar*), Chela (*Chela cadius*), Chital (*Notopterus chitala*), Foli (*Notopterus notopterus*), Tengra (*Batasio batasio*), Taki (*Channa punctatus*), Poa, Khalla, etc.

Table -6: Indicator Species of Fish in the PMBP Influence Area

Sl. No.	Indicator Species (Local name)	Indicator Species (English name)	Indicator Species (Scientific name)	Remarks
1	Hilsa (Ilishmach)	Hilsa Shad	<i>Tenualosa Elisha</i>	Hilsa has high economic value, species dominance, and delicious taste. Due to their indiscriminate catching, the species population has been reducing gradually
2	Rui	Carp	<i>Labeo Ruta</i>	A representative of Carps. Apart from Hilsa fish, this is one of the important contributors in a fish catch of the Padma River
3	Baim	Eel	<i>Macrogathus aculeatus</i>	Bottom Feeder species and the importance of using river-canal/Khal- beel habitat
4	Chital	Feather Fish	<i>Chitala chital</i>	Commercially important and sought-after species; comparatively rare species
5	Aor (Boal)	Cat Fish	<i>Separate (Aorichthys) aor (Wallago Attu)</i>	A representative of catfishes; commercially and ecologically important species
6	Baila/Bele	Tank Gobby	<i>Glosoglobius girls</i>	Early breeder and starter of the food chain in a lotic (riverine) ecosystem

Indicator species are part of the species composition and biodiversity. Brief status of fish indicator species throughout 2019 is mentioned below (overall abundance not in quantity but estimated based on interviews and market survey):

1. Hilsa (*Tenualosa Elisha*) Hilsa Shad
 - Observed and reported in most of the clusters. In some quarter (Quarter 3 very high (except banning period)
2. Rui (*Labeo rohita*) Indian Major Carp
 - Observed and reported relatively low level throughout the year but in some Quarter, it is moderately available
3. Aor (*Sperata (Aorichthys) aor*) Long-whiskered catfish
 - Observed, higher in Quarter 1 and 4 mainly but low in other quarters
4. Chital (*Notopterus/Chitala chital*) Humped Featherback
 - Observed low in all Quarters but in some clusters, it was moderately available
5. Baim (*Macrogathus aculeatus*)
 - Observed in high quantities in Quarter 1, 3 and 4
6. Baila (*Glossogobius giuris*) Gobby: Bele / Tank Gobi
 - Observed moderately in all Quarters but high in Quarters 1, 2, and 4.

Quarter 1: Hilsa was moderately found and reported during this quarter. Rui was occasionally found and its availability was reported from the Arial Kha Offtake. Baim was not observed but reported

Quarter 2: Hilsa was moderately found and an increasing trend of hilsa was observed in June compared to May. Rui was occasionally found and not observed frequently in a catch. Catfish (aor) was observed in April, May, and June. Chital fish was not observed in the first quarter but its availability was reported during the second quarter. Baim was not observed in the previous quarter but was observed from April and the catch increased throughout the quarter and increased in May compared to April and abundant in June.

Quarter 3: Information gathered on Indicator Species and their availability in different locations (clusters). Furthermore, data of September is presented whether fish that was found was small, medium, or big size. Hilsa was reported from all the seven clusters during the 3rd Quarter.

Quarter 4: Hilsa was found moderately high in October and decreased thereafter. Few Rui was observed throughout the quarter (three months). Aor was

observed, more in October and less during the subsequent two months. Chital was observed at less during all the three months. Baim was observed higher in October and Baila was observed moderately in all three months.

In all quarters Ilish, kajuli, baila, baim were observed. Bagha aor was common in Quarter 4, similarly, Rita in Quarters 1 and 3, and Gharua was common in Quarter 2.

Variation in the numbers of species observed among the four quarters of the year 2019 is presented in Table 7, while Table 8 gives a summary of the availability of indicator species throughout the year.

Table -7: Numbers of fish species observed during Year 1 (2019) monitoring.

Number of Species Observed 1 st Quarter	Number of Species Observed 2 nd Quarter	Number of Species Observed 3 rd Quarter	Number of Species Observed 4 th Quarter
11	34	51	57

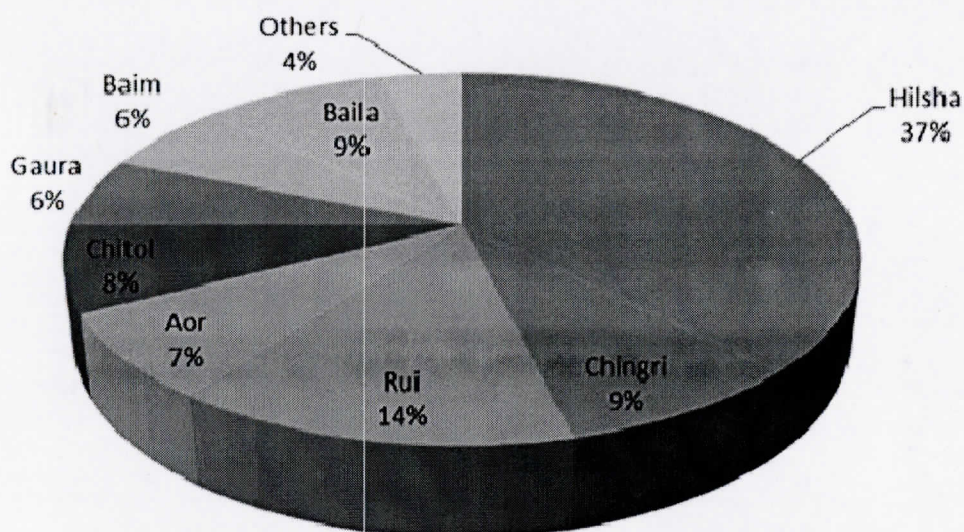


Fig.7. The annual average of fish species composition in 2019, including the indicator species observed during the year 2019 within the Padma Bridge Wildlife Sanctuary area.

Based on field visits and discussion with the fishers, it was evident that fisheries resources in terms of the number of species, population, and pattern vary with seasons (monsoon, dry, pre-and post-monsoon) and location, especially whether it was the main channel, second ‘Kole’, inundated Charland, lateral connecting river/Khal, seasonal floodplain/ connectivity and as well as other aspects like water quality, primary productivity, etc.

Fig. 8. Fishing at the Arial Kha Mukh using the longline net.

On an annual basis, hilsa composition was about 37 percent but it was more than the annual average in the pre-monsoon season, with nearly 50 percent in monsoon and nearly half of it in post-monsoon with a little increase during the dry season. Variation in the species abundance is presented in the following also includes the Indicator Species (hilsa, rui, chital, aor/boal, baim and baila) that has been selected for monitoring fish diversity. As a result, species composition varied in Fig.7. It may be mentioned that although this figure is about the general species composition it different seasons depending on the level of disturbances, fishing gears, hydrology, weather, etc. (Fig. 9).

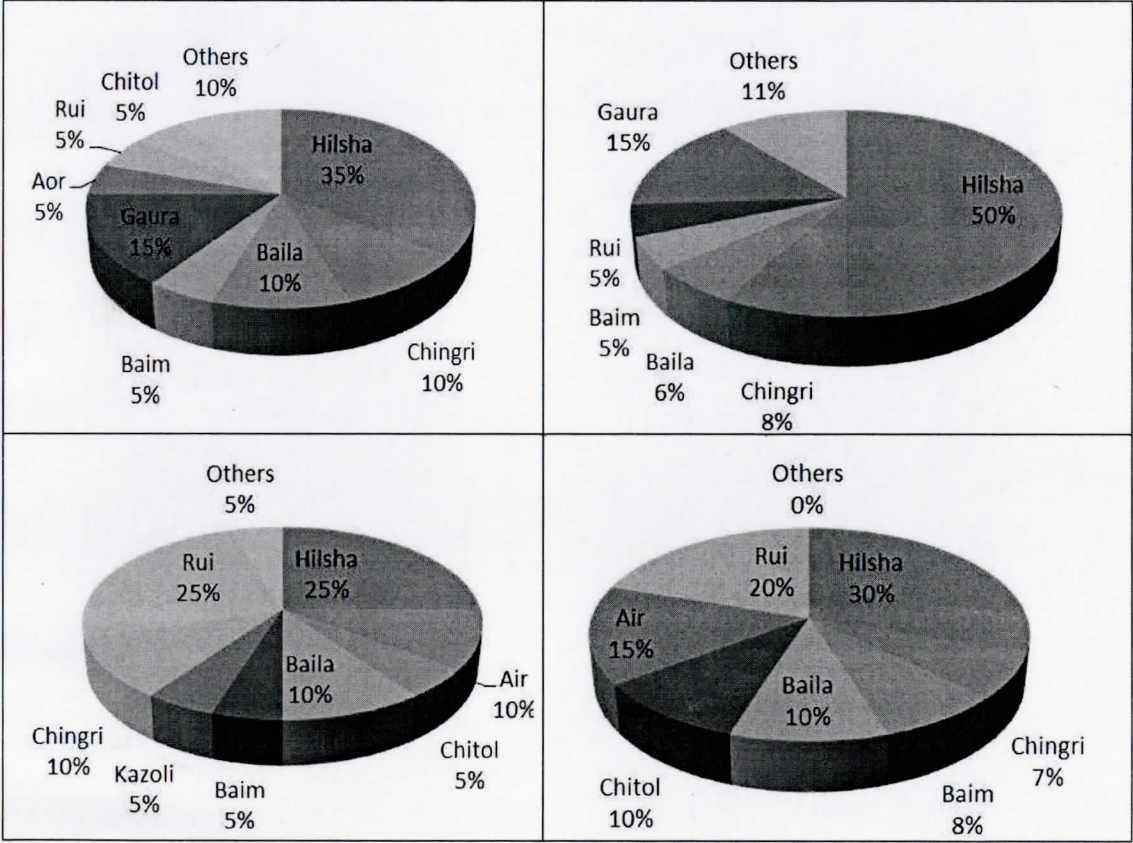


Fig. 9. Seasonal variation in the composition of fish species, including indicator species observed during the year 2019 within the proposed Padma Bridge Wildlife Sanctuary area; A – Pre-Monsoon; B – Monsoon; C – Post-Monsoon, and D – Dry season.

Table -8: Information on Hilsa and other Fish Landing in Mawa during September 2019.

SL	Month	Total	Hilsa (MT)	Others (MT)	Remarks
1	October	391	31	360	Hilsa Study area 6.2 MT, Others 24.8 MT
2	November	438	92	346	Hilsa Study area 18.4 MT, Others 73.6 MT
3	December	397	75	322	Hilsa Study area 15 MT, Others 60 MT

Source: Interview with Aratders of Mawa Fish Landing Spot.

It is seen from Table 4.7 that hilsa landing in Mawa ghat was 31, 92 and 75 mt in October, November and December respectively. When compared with the baseline data (Table 30, page 65 of BBS Baseline Final Report of 2017) it was 75, 225 and 210 mt, which was higher than the present reporting period but the trend was similar.

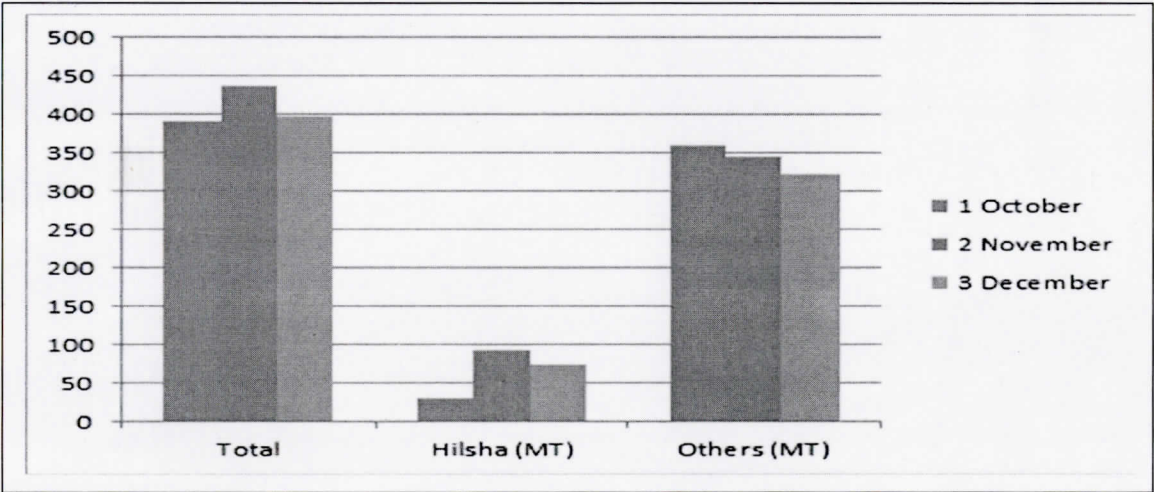


Fig. 10. Hilsa and other fish landing data in Oct-Nov-Dec 2019 for Mawa Landing Centre.

Hilsa is an important economic fishery both in the national economy as well as in the study area. During the monitoring in 2019 hilsa was observed in most of the cluster areas as well as in the fish catch. There has been a shift in the Padma River main channel from previous years. During the last year due to erosion in the right bank the main channel shifted southward near Char Janajat and downstream near

Teotia moved northward due to sediment deposition in the left bank. Thus, the main hilsa migration path/route followed this trend of the shifting river (Fig.). There are several submerged and new chars north of Dhongikandi area created due to the dumping of the dredged material as well as creating waterways by dredging of the existing chars which is also pushing the migration path of hilsa northward into the main river channel. However, as per information of fisher community, jatka still uses part of the southern channel through Pallerchar and Painpara. It looks like that jatka also uses shallow water channels while the adults prefer deeper channels.

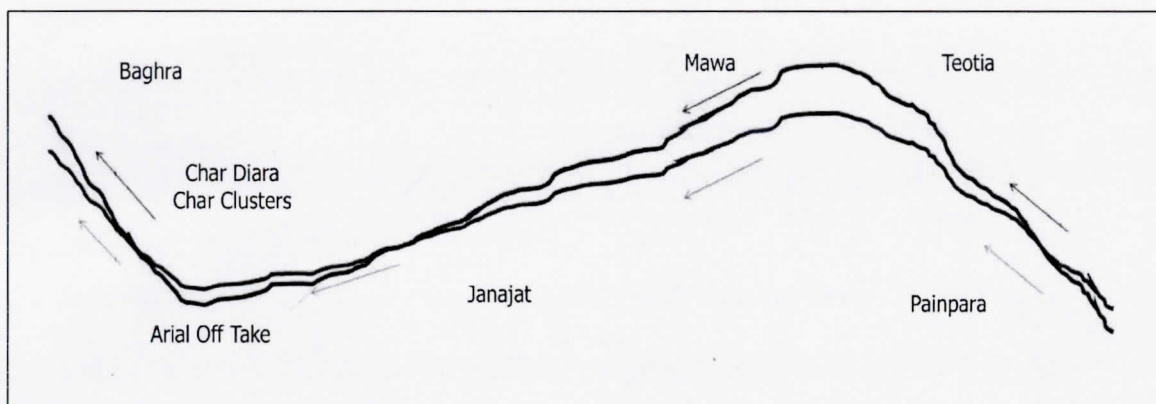


Fig. 11. Generalized migratory route of hilsa during baseline (2009: blue line) and in 2019 (red line) due to the shifting of the deepest part (=thalweg) of the Padma River over the last ten years.

The pattern of hilsa migration during the baseline study was conducted horizontally as well as vertically through several consultations with the community. During the 4th Quarter (and partly in 3rd Quarter) direct sampling was conducted across the main river channel (shore to the midline) using a long seine net (ber jal) with the help of local fishermen. Most of the hilsa were caught between pillar numbers 7 and 14 (shown in the following Fig.12 in red circle) in the vertical mid-region, less along the shore and in the deeper areas. This finding was in conformity with local knowledge of the fishermen. Similar direct sampling is planned to be repeated during next monsoon to observe any changes in the migration route. The catch-based primary observation is important baseline information on the movement of hilsa and is shown in the figure below (Fig.12).

Further, information on hilsa migration and availability over the last five-year period from the fisher community is shown in Table 4.6. It indicates that hilsa production was more in 2018 but jatka was more abundant in 2015.

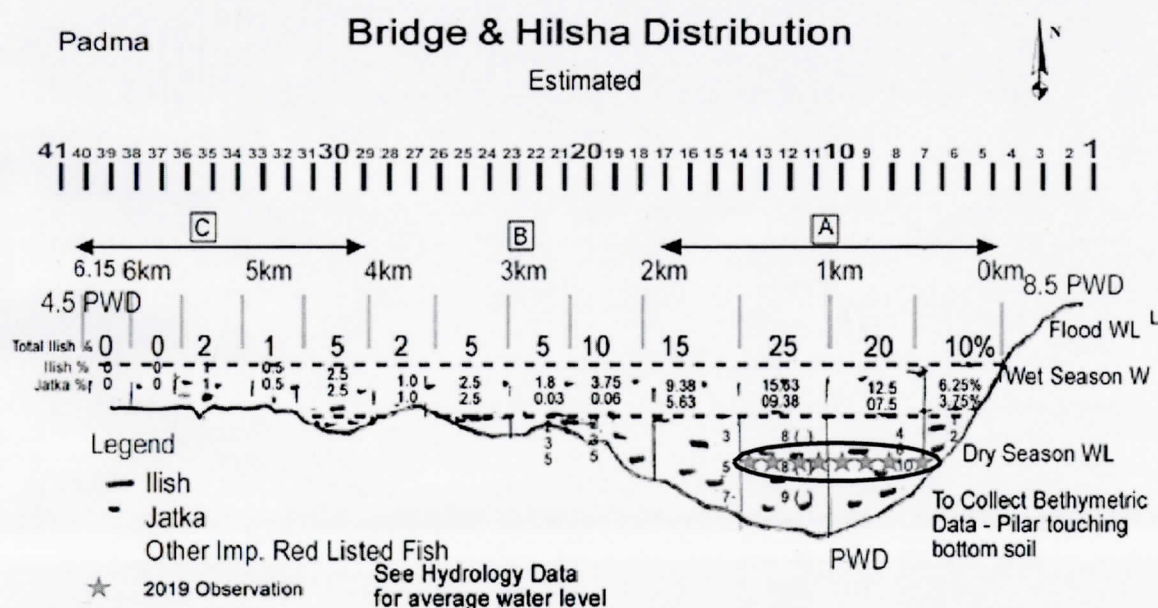
Table -9: Information on Hilsa catch from the proposed Padma Bridge Wildlife Sanctuary area.

Year	Hilsa (Total)	Hilsa (Big Size)	Jatka (Small Size/ Jatka)
2019	+++	+++	++
2018	++++	++++	++
2017	+++	+++	+++
2016	+++	+++	+++
2015	+++	+++	++++

Source: Interview with the local community

Fig. 12. The red circle shows most of the hilsa catch in vertical mid-section between Pillars 7 and 14 which complemented the knowledge of the local fishermen.

The estimated total fish landing of Mawa in October 2019 was 391 mt where hilsa was 31 mt. See Table 4.7 and Fig. 4.19 for information in the months of 4th quarter of the year 2019. While collecting information on Indicator Species from 7 different clusters, it was observed and reported that hilsa was found in most of the cluster areas and in the fish catch. As per information from Upazila Fisheries Offices (Jajira, Sibchar and Lauhajang) for July 2018 to June 2019 (1 year) hilsa catch from the Padma River was 1,820 mt. Hilsa landing in October was quite low. This may be due to ban on hilsa catch like elsewhere in the country from 09th October to 30th October 2019.



December 2019

Changes and Impacts on Ecosystem

The areas were under vegetation cover of tall grasses like *Saccharum*, *Imperata*, and *Phragmites*; *Kolmi*, *Dholkolmi*, *Liptia*; and of some tree species like *Tamarix*, *Salix*, *Babla*, *Khoi-babla*, *Bon-boron*, etc., and they were very common in the area before dumping of dredged materials at the dumping sites. But at present all these have been buried under the sand. Some fruit trees and timber trees were also damaged.

Habitats have been temporarily damaged and some wildlife species may have moved elsewhere; overall biodiversity has suffered to some extent. Due to the dumping of dredging materials the char land, floodplain and ditches have been filled and habitats of resident and migratory birds may have been lost permanently.

The interventions like dredging, artificially creating transit channels, alteration in the physical landscape and waterways may have affected the fish populations due to changes in habitat quality for fishes and other aquatic fauna, which may include abundance and species composition.

The main dumping sites are practically exposed and virtually bare sandy areas. This poses a health hazard due to the blowing of sand and increasing particulate matter in the air causing respiratory problems during the dry season.

Among the char lands some are completely or partially eroded or have been washed away by the river; it may be due to interventions for construction of the bridge (dredging operations, river training, revetments, embankment, regulators, approach road, piling operation, and bridge landing construction) or due to normal process of accretion-erosion. The erosion process has affected the normal growth of biodiversity in the chars, homesteads, and cultivated lands of the area.

Unregulated use of the natural resources and habitat destruction like clearing of grassland by putting on fire, exploiting grasslands, practicing cultivation at any place available, use of chemical fertilizers, putting on barriers for catching fish and use of illegal fishing gears and encroachment poses a serious threat to the biodiversity of the area.

Dredging operations, river training, revetments, embankment, regulators, approach road, piling operation, and bridge landing construction may have some negative impacts on

ecosystem and might affect natural drainage system, aquatic habitat, char land ecosystem, feeding ground, and food chains of mollusks, fish, crustaceans, reptiles, and dolphins. Moreover, it is well known that dredging severely impacts the benthic biodiversity. All these construction interventions are suspected to damage the floral ecosystem, as vegetation provides habitat, food, nesting, roosting, and breeding ground of wildlife and ultimately it will affect the ecosystem as well.

Table-10. Changes and impacts on the ecosystem compared with the baseline survey.

Changes and Impacts on Ecosystem and Species	Baseline (2015-2016, BBS)	Present Condition (2019, BCP)
Ecosystem	- The char lands on the right bank of the river, viz; Tarpasha, Ranjit Kha, Painpara, and Naodoba was near natural and the erosion and accretion dynamics was functional - Natural ecosystem function was intact - Minimal human intervention and human-induced changes noticed - Upper areas of char land were under winter crops like cereals, peanuts, bitter gourd, mustard, and sweet gourd.	- Dredged materials dumped and filled the land - Land raised to a degree of 3 to 5 meters in height from the channel water level - Natural swamp, grass, and red lands are damaged. - The land became uniform in physiography - Diversity in wetlands ecological niche (grassland, reeds, water pools, canals, inter-tidal foreshore areas, dunes, accreted land) are lost under the landfilled area - Biophysical characteristics of the site have changed enormously. A prominent one is the huge newly accreted char land at Khalpar, Palar char, Pain para, Majer Char, and Dhoni Kandi area. Erosion was noticed at Char Janajat and Dhoni Khandi bank area. - The land filled with dredged materials is massive at Char Tarpasha, Char Painpara, Char Chandra. All reed lands flora and invertebrates of this landfilled area are buried. At Painpara char lands the foreshore area extends to nearly 500 meters on average, forms new mudflats through both natural sedimentation and dredged material runoff. The density of reed lands degraded as a result of the dumping of dredge material. Mixed vegetation of grass and reed land species prevailed as noted in BBS (2015). At Char Teutia there are good indications of an ecological succession of reed land and swamp. <i>Salix tetrasperma</i> and its associated plant communities are seen in good abundance which enhanced the habitat of wildlife.

Flora and fauna species	- The rich natural vegetation of the swamp - Diverse species of herbs and shrubs were in good abundance - Resting and roosting place of water birds - The breeding ground of reed land birds - The breeding ground of mollusk, crabs, prawns, and indigenous fish - Breeding ground of freshwater turtles	- Species of wild flora (+40 species) just buried under the dredged materials in the char land. - Species like Akonda, Tamarix, Saccharum recolonized. - Few juveniles of toads were noticed in stagnant water pools. - Species of wild fauna seen recolonized are: butterflies (three species); dragonfly (one species); Bank Myna, Sand Lark, Green Bee-eater, Black Kite, Spotted dove were common. - Nests of Bank Myna and Bee-eaters were observed on the embankments and steep sandy riverbanks.
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Changes and Impacts on Ecosystem and Species	Baseline (2015-2016, BBS)	Present Condition (2019, BCP)
	- Wintering ground of migratory birds.	- Redland birds like Munia, Prinia, Baya, Bunting, Cisticola, Warblers were uncommon due to habitat destruction. - Few Jackals are seen outside the landfilled area where remnant reeds are present along the bank of the river channel.
Socio-economic	- People harvest a huge quantity of biomass in the form of cattle fodders, thatching materials, and fire fuels from the wetland's vegetation.	Along the raised embankment of the land-filled chars observed encroached by new settlers. - Cattle grazing on a small scale. - No fishers, cattle grazers, and char land cultivators were seen on the barren sand-filled char land. - Slash burn of reed lands observed at some chars like Pain Para area.
Hydrology	Add from previous data.	- The Arial Kha Mukh confluence which was dried in the winter season (2015-2016) is now navigable as a result of dredging - New canals forms at Char Janajat - Villages at Char Janajat eroded. - Thalweg (deepest part) of the river moved northward
Fisheries	- Natural nursery of fishes in the shallow pools, canals, and low-lying depression in the char land. - Important beds of mollusks.	- Char land and floodplain fisheries are badly affected due to landfills. - Benthic fauna affected due to dredging as a result primary productivity was affected.
Proposed PA locations	The sites qualified for PA based on biodiversity richness and naturalness.	- Ecological features changed; damage was caused to a greater extent.

Aquatic mammals	Dolphins were common on the main channel.	- None is sighted at the construction site recently. - Disturbances due to the movement of speed boats, ferries, dredgers, and other heavy vessels onsite - Few dolphins were observed surfacing within the proposed protected area at Khalpar, Arial Kha, Char Janajat area.
Erosion and Accretion	No erosion or accretion at the bridge alignment.	- Massive erosion is noticed at Char Janajat on the right bank of the river upstream of the bridge. - New char lands accreted along Khalpar area in the mid-channel of the river. - Areas downstream of the bridge, close to Char Painpara the channel silted up.

4.0 Recommendation:

Ensure contractor's adherence and compliance: Ensure contractor's adherence and compliance to the recommendations of BBA's vision on river environment protection and biodiversity conservation based on the mitigation measures mentioned in the Environment Management Plan (EMP) and Biodiversity Baseline Survey reports.

Wildlife Sanctuary: For conservation of the river biological diversity, the establishment of the adma Bridge Wildlife Sanctuary is a good opportunity. Through this initiative, local people's living conditions and livelihoods will be improved through co-management of the sanctuary and benefit-sharing of the biological resources and development of eco-tourism. It is expected that stock and productivity of fisheries resources of the area will also increase manifold. Measures for the sanctuary declaration have been initiated by BBA, inter-ministerial stakeholder meetings held, awaiting responses from the respective ministries. Once approved and the sanctuary is notified through a gazette notification, co-management protocols will be formulated.

biodiversity conservation awareness: Delineation of the proposed Padma Bridge Wildlife Sanctuary area and install markings, signposts to make the people aware of the proposed sanctuary and biodiversity conservation awareness messages.

Restoration and protection of the habitats: Restoration of the habitat that has already been physically altered should be done through facilitating natural regeneration of vegetation and plantation of indigenous species favorable to support wildlife. Besides, protection of habitats,

particularly the vegetation of the newly accreted chars through community involvement may enhance recovery of the habitat suitable for the wildlife to re-establish their presence.

Strengthen its institutional capacity: The Bangladesh Bridge Authority should take initiatives to strengthen its institutional capacity. At the end of the PMBP, the BBA will be managing the PBWS, hence it is the prime time that BBA/PMBP should start thinking of an exit strategy.

Economic importance: As part of the process of establishing protected areas for biological conservation, the government should undertake an evaluation outlining the economic importance of conserving these areas for activities such as fisheries, forestry, water supply, tourism, recreation, agriculture, or soil conservation. Additionally, to complement conservation initiatives, facilities for captive breeding of endangered fauna and nurseries for the propagation of flora may be worthy. This is a key consideration in the decision-making process, as the protection of the site is likely to be more successful when economic benefits can be demonstrated.

5.0 Reference:

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Annexure-A: Questionnaires

(Project Related Officials)

Questionnaire for a survey of the biodiversity of the Padma Multipurpose Bridge project

- 1.Name:.....
- 2.Designation:.....
- 3.Address:.....
- 4.Do you have monitor environmental issues regularly? If yes, please describe briefly.
- 5.Do you have to monitor the biodiversity elements of the project areas? If yes, please describe briefly.
- 6.Do you think dredged materials plays a negative impact on biodiversity? If yes, how could you manage the situation?
- 7.What are the impacts on birds of the project areas due to construction activities of the bridge?
- 8.What is the present situation of fishes of the Padma river due to ongoing construction activities? Have you any Baseline survey of biodiversity before construction activities started?
- 9.Please say something about flora and fauna in the surroundings of project areas. what are the impacts on these species due to construction?
- 10.Have you any survey on wildlife at the project? What is the present situation?
- 11.Have you any plan to establish a sanctuary in the project affected areas?
12. What do you recommend to mitigates the negative impacts on Biodiversity of the project areas?

Data collected

by:.....
.....