ADB

Regional Flyway Initiative · Site Study

May 2026

RFI Priority Site · Eastern Meghna Delta

Prepared by Ding Li Yong & Mike Crosby, with additional input from Billy Fairburn, Kelvin Peh, Evelyn Pina-Covarrubias, Stefano Barchiesi and Radhika Bhargava

BirdLife International, University of Southampton, University of Singapore

Asian Development Bank

General Site Information

Country	Bangladesh			
RFI Site Name	Eastern Meghna Delta			ID002
City/ Municipality, Province, Region	Barisal, Chattogram			
Geographical coordinates	22.47ºN, 91.27ºE		Area (has)	140,639 ha
Key species	Indian Skimmer, Spoon-billed Sandpiper, Irrawaddy Dolphin			
Key habitats (biomes)	intertidal mudflats, sandflats and salt-flats, mangroves (at an early successional stage), coastal brackish and saline lagoons, estuarine waters and shallow marine waters			
Key ecosystem services	Provisioning services (fisheries), coastal protection			
Key drivers of change	Expansion of residential and industrial areas. Agricultural expansion and intensification.			
Conservation status (mark all that applies)		Protected Area		Flyway Network Site
		Ramsar Site		Others _____
IBA/ KBA name (and number) and other designations	Ganges-Brahmaputra-Meghna delta. Ganguirar Char is recognised as an EAAFP Flyway Network Site			
Management Stakeholders	Forest Department, Department of Fisheries, local government administrations			
With management plan?	No management plan or guidelines have been prepared yet, but Forest Department staff monitor the site.			
Project concept themes	Sustainable fisheries, improved wetland management. Potentially eco-compensation schemes			
Length of project	5 years			
Sector/s	To be confirmed			
No. of potential beneficiaries				
Indigenous Peoples		No		Yes _____
Anticipated Implementation Risks	Climate vulnerability and high population in areas of high conservation priority for migratory waterbirds, reduced livelihoods for fishers impacted by restrictions and bans on fishing, disturbance of wildlife with ecotourism development, and conservation priorities and capacity of wetland management stakeholders			
Estimated Project Budget (US$)	15,900,000 over five years			
Potential Source/s of Financing		Loan (to be identified)		Private Sector
		Grant (to be identified)		Public-Private Partnership

Table of Contents

General Site Information 3
Abbreviations 5
Executive Summary 6
1. Background of the Regional Flyway Initiative 7
2. Site profile of Eastern Meghna Delta 8
3. Biodiversity value of Eastern Meghna Delta 9
3.1. Key Habitats 9
3.2 Importance of the Eastern Meghna Delta for migratory waterbirds 9
3.3 Other notable biodiversity 10
4. Ecosystem services 11
4.1. Ecosystem services provided by Eastern Meghna Delta 11
4.2. Global climate regulating services 12
4.3. Coastal protection services 13
5. Drivers of change and their potential impacts on Eastern Meghna Delta 14
5.1. Current drivers of change and their level of impact 14
5.2. Potential alternative state of Eastern Meghna Delta under current drivers of change 15
5.3. Expected changes in the ecosystem services of Eastern Meghna Delta 16
6. Capacity needs in the Eastern Meghna Delta 17
7. Opportunities for RFI interventions 19
7.1 Recommended Interventions 19
7.2 Potential Financing 22
7.3 Proposed Institutional Arrangements 22
7.4 Project Beneficiaries 22
7.5 Anticipated Implementation Risks 23
References 24
Annex 1. Supplementary information on coastal protection services 25

Abbreviations

ADB	Asian Development Bank
AWC	Asian Waterbird Census
BEZA	Bangladesh Economic Zones Authority
BDT	Bangladesh Taka
CREL	Climate Resilient Ecosystems and Livelihoods
CSR	Conservation Status Review
DMC	Developing Member Country
EAAFP	East Asian-Australasian Flyway Partnership
ECA	Ecologically Critical Area
ESA	European Space Agency
IBA	Important Bird and Biodiversity Area
IUCN	International Union for the Conservation of Nature
NGO	Non-governmental Organisation
PES	Payments for ecosystem services
RFI	Regional Flyway Initiative
TESSA	Toolkit for Ecosystem Services Assessment
USAID	United States Agency for International Development
USD	United States Dollars
VCG	Village Conservation Group

Executive Summary

The Eastern Meghna Delta (22.47ºN, 91.27ºE) is characterized by several small, low-lying islands or *chars,* as well as the associated intertidal wetlands, and is located to the east of the main Meghna River channel, spanning across Noakhali and Chattogram Districts. Here, the main wetland habitats are essentially intertidal mudflats and sandflats, mangroves (at an early successional stage), coastal lagoons, and shallow marine waters, with new islands constantly being formed or eroded away. The mudflats and sandflats of Ganguirar Char, one of the most important part of the Delta for migratory species, provide rich feeding grounds for waterbirds, and high-tide roosts for shorebirds; Ganguirar is recognised to be globally important for the Indian Skimmer (EN) and about 1% of the global population of Spoon-billed Sandpiper (CR) on a regular basis. In 2018, Ganguirar Char became recognised as an EAAFP Flyway Network Site. Ganguirar Char also overlaps to some extent with the boundary of one of the six sanctuaries established for the Hilsha shad *Tenulosa Ilisha*, a commercially valuable and important fish in eastern India and Bangladesh, which has been the focus of extensive fishery management work in the country.

As a whole, the Eastern Meghna Delta and its associated wetlands provide valuable provisioning, regulating, and cultural ecosystem services, including supporting among the most important Hilsha fisheries in Bangladesh, whilst storing significant amounts of coastal marine carbon. Yet, the wetlands of the Delta as a whole are under immense pressure from unsustainable use, ranging from unsustainable grazing, which increases erosion and leads to vegetation degradation and sedimentation, which impacts fisheries, whilst damaging wildlife habitat. Coastal fisheries are impacted by overfishing, while expanding human populations drive habitat loss and increased pollution, both upstream of the Delta and on the inhabited *chars*. Local communities generally have limited livelihood opportunities besides fishing and small-scale businesses.

Strengthening access to fishing rights and credit, especially for underrepresented fishing communities, is thus an important step towards more sustainable use of declining fisheries, and in accordance with management plans developed for the coastal and estuarine waters of the delta. Addressing these livelihood challenges, which affect a large proportion of local communities in the Meghna Delta, will be critical to strengthen frameworks promoting sustainable use of fishing resources, while ensuring the livelihoods. There is also a need for sustained protection of valuable fish stocks, which involves a combination of establishing new fish sanctuaries and targeted dredging of water channels to benefit the movement of fish species. In the intertidal zone of many of the chars, there is a need for strengthened wetland management and restoration, as well as the establishment of biodiversity management frameworks and initiatives focusing on threatened species, such as the Irrawaddy Dolphin, skimmer, and several shorebird species.

1. Background of the Regional Flyway Initiative

In July 2021, the Asian Development Bank made a commitment to develop a long-term Regional Flyway Initiative (RFI) in the East-Asian Australasian Flyway (EAAF) (Sovereign Project 55056-001) to protect and restore priority wetland ecosystems and the associated ecosystem services they provide in the EAAF, the most threatened migratory bird flyway globally. The Initiative is slated for implementation in nine ADB developing member countries (DMCs) in East, South and Southeast Asia: Mongolia, People's Republic of China (PRC), Bangladesh, Viet Nam, Cambodia, Philippines, Thailand, Malaysia and Indonesia. In 2023, the geographic scope of the RFI was further extended to two DMCs in Southeast Asia and the Pacific respectively, Lao PDR and Papua New Guinea.

The primary aim of the RFI is to enhance and expand the existing efforts in conserving and managing wetlands of the highest priority for migratory birds within the EAAF through innovative loan and grant financing, and at scale. Consultations and analyses over the development period help identify key interventions to strengthen the management of wetlands, enabling the implementation of nature-based solutions while strengthening biodiversity protection. Over time, the RFI seeks to leverage collaborative opportunities by developing partnerships among important stakeholders including national governments, civil society organizations, communities, regional organizations like the East Asian-Australasian Flyway Partnership (EAAFP), development agencies, the private sector, and other relevant entities.

Through the RFI Technical Assistance (TA) implemented over the RFI's development phase from 2021 to 2024, BirdLife International takes the lead in providing and coordinating technical support for development of the RFI. This is carried out in collaboration with the EAAFP and a consortium of international non-governmental organizations including Wetlands International and the Paulson Institute, as well as two universities, namely the University of Southampton, UK and the National University of Singapore. Over the development phase, the TA team undertook a site selection analysis to identify priority wetland sites in all 10 countries based on recent bird data benchmarked against internationally accepted criteria under the Convention on Wetlands of International Importance (or Ramsar Convention), EAAFP Flyway Network Sites and Important Bird and Biodiversity Areas (IBAs). The team further developed ecosystem services profiles for prioritised wetlands using a multi-pronged approach used the TESSA ecosystem services assessment tool, and data-driven modelling of water-based ecosystem services and stored carbon.

In Bangladesh, a total of 20 wetland sites, including many Asian Waterbird Census (AWC) count sites, were initially assessed through data analysis and expert consultation, of which eight(8) were defined and identified to be RFI priority sites on the basis that they support more than 1% the flyway population of at least one EAAF migratory waterbird species. Five of the RFI sites identified in Bangladesh are coastal wetlands, a consequence of the country's long coastline and its estuarine geography, with the largest cluster of priority sites being the Sundarbans and the Meghna Delta, which consist of a cluster of three sites. 17 EAAF species exceeded the 1% threshold at the site level in Bangladesh, with species such as Masked Finfoot reaching in excess of 50% of its flyway (and global) population (eastern Sundarbans) and the Spoon-billed Sandpipe. Other species with important non-breeding populations in the Bangladesh include the Indian Skimmer *Rynchops albicollis* and the Baer's Pochard *Aythya baeri*.

2. Site profile of Eastern Meghna Delta

Location: This site comprises several small islands (known as *chars*) and the associated intertidal wetlands in the southeast of the Meghna Delta. It is located to the east of the mouth of the main Meghna River channel, in eastern Hatia Upazila, Noakhali District, and western Sandwip upazila, Chattogram District.

Area: The Eastern Meghna Delta has an area of 140,639 ha.

Altitude: 0-1 m asl.

Geographical coordinates: 22.47 N, 91.27 E

Description of site: The main habitats are intertidal mudflats, sandflats and salt-flats, mangroves (at an early successional stage), coastal brackish and saline lagoons, estuarine waters and shallow marine waters. This part of the Meghna Delta is very dynamic, and new islands are constantly being formed, through erosion and redistribution of the of sediments by the waves and tides to form new sand bars and lagoons. The mudflats and sandflats provide rich feeding grounds for waterbirds, and high-tide roosts for shorebirds. The AWC counting locations at the Eastern Meghna Delta are Ganguirar Char (currently the most important island for migratory waterbirds), Jaijjar Char South and Jaijjar North.

Site administration, management and land tenure: The Bangladesh Forest Department approved the establishment of Ganguirar Char as an East Asian-Australasian Flyway Partnership (EAAFP) Flyway Network Site in 2018. A "Proposal to establish Ganguirar Char Bird Sanctuary" had been prepared by the Spoon-billed Sandpiper Task Force, EAAFP, and Bangladesh Spoon-billed Sandpiper Conservation Project and submitted to the Forest Department earlier that year. It is possible that Ganguirar Char may also overlap with the boundary of one of the six sanctuaries established for the fish, Hilsa shad *Tenulosa ilisha* (Islam *et al.* 2014). The Forest Department has land tenure/ ownership within the Flyway Network Site, and in the surrounding area ownership is shared between the Forest Department and the Deputy Commissioner of the District. The Forest Department is also the management authority for the site, and the Ministry of Environment, Forests, and Climate Change has functional jurisdiction there. No management plan or guidelines have been prepared yet, but Forest Department staff monitor the site.

Social and economic values: The small islands in the Eastern Meghna Delta do not yet have any human settlement, and there is currently minimal disturbance. This is an important fish spawning ground and fishermen from the adjacent areas visit during their fishing trips. The frequent tidal surges, erosion and cyclones are constantly affecting the ecological character of the site. Some small islands (named Bhashan Char, Thengar Char and Jailar Char) about 5km northeast of Ganguirar Char have been selected to relocate Rohingya people, which could negatively affect the local biodiversity if this leads to increased exploitation of natural resources. It is therefore critically important to protect the islands in the Eastern Meghna Delta for biodiversity and local livelihoods.

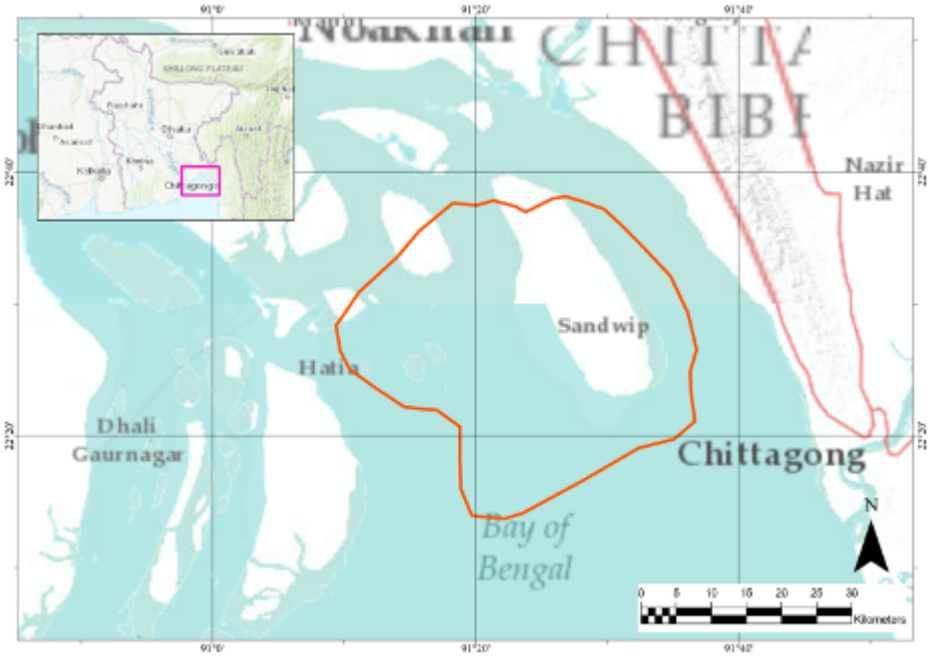

Figure 1 Map of the eastern Meghna Delta, showing the location of Sandwip.

3. Biodiversity value of Eastern Meghna Delta

3.1. Key Habitats

The main habitats are intertidal mudflats, sandflats and salt-flats, mangroves (at an early successional stage), coastal brackish and saline lagoons, estuarine waters and shallow marine waters. This part of the Meghna Delta is very dynamic, and new islands are constantly being formed, through erosion and redistribution of the of sediments by the waves and tides to form new sand bars and lagoons.

3.2 Importance of the Eastern Meghna Delta for migratory waterbirds

The rapidly accreting intertidal wetlands in the Eastern Meghna Delta are important feeding and roosting habitats for migratory waterbirds. Count data from the 2016-2020 Asian Waterbird Census (AWC) was used in the RFI priority sites analysis for this site. Several counts were conducted there annually during 2018-2020 and single counts in 2016 and 2017, and the results were averaged over this five-year period, and then compared to the Conservation Status Review (CSR1) 1% population estimates to calculate a score for each species. The four migratory waterbird species in Table 1 were found to regularly exceed the 1% population thresholds during these five years, and the CSR1 scores for these species were summed to produce the overall site score.

The Eastern Meghna Delta is of outstanding importance for the Indian Skimmer (EN), with the CSR1 score indicating that this site regularly supports almost one-quarter of the flyway (and global) population of this species. It also supports around 1% of the global population of Spoon-billed Sandpiper (CR), and there was an exceptionally high count of 48 individuals of this species, together with two Spotted Greenshank *Tringa guttifer* (EN), in February 2016 (Chowdhury *et al.* 2018). In addition to these highly threatened species, the AWC recorded small numbers of four near-threatened species at the Eastern Meghna Delta during 2016-2020, namely Curlew Sandpiper *Calidris ferruginea*, Black-tailed Godwit *Limosa limosa*, Black-headed Ibis *Threskiornis melanocephalus,* and Eurasian Curlew *Numenius arquata*.

Table 1 List of migratory species (based on the EAAFP list of species) with globally significant congregations in the Eastern Meghna Delta.

Species name	IUCN	Average count	CSR1	CSR1 score
Indian Skimmer *Rynchops albicollis*	EN	950	40	23.8
Lesser Sandplover *Charadrius mongolus*	LC	1,210	300	4
Broad-billed Sandpiper *Calidris falcinellus*	LC	448	300	1.5
Spoon-billed Sandpiper *Calidris pygmaea*	CR	8	8	1

3.3 Other notable biodiversity

The Eastern Meghna Delta is an important fish breeding ground and wildlife habitat. The globally threatened Irrawaddy Dolphin, *Orcaella brevirostris* (EN), has been recorded in the area during recent surveys, and the coastal waters here are now known to support a globally significant population of this cetacean (Aziz 2019).

4. Ecosystem services

4.1. Ecosystem services provided by Eastern Meghna Delta

The Eastern Meghna Delta encompasses diverse habitats that provide valuable provisioning, regulating, and cultural ecosystem services (Figure 2). The results from the RFI workshop[1] highlight the top ecosystem services provided by the site, emphasising their essential and non-substitutable nature (Table 2). Provisioning services, particularly those related to cultivated food, are crucial for communities across all distances. Essential regulating services such as flood hazard regulation, storm hazard regulation, and erosion regulation are vital for the area, also benefiting communities at all distances.

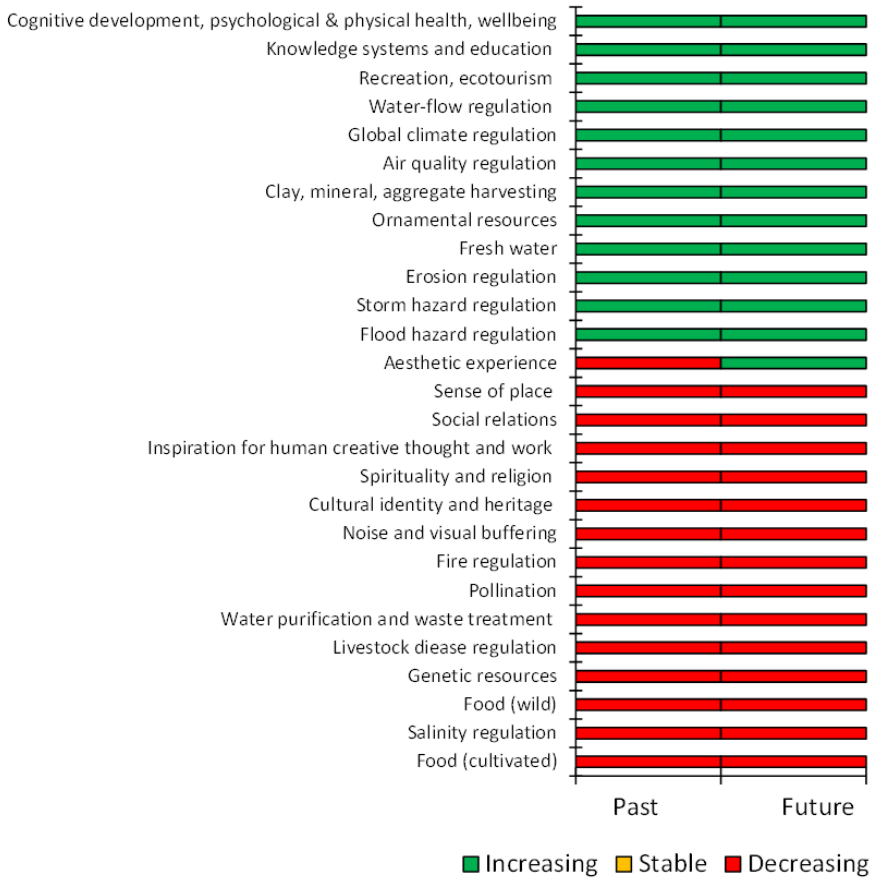

Figure 2 List of ecosystem services provided by Eastern Meghna Delta, as identified through stakeholder consultation at the Regional Flyway Initiative workshop.

[1] Asian Development Bank. (2024, May 27–29). *Bangladesh: Wetland Ecosystem Services Workshop* [Workshop]. Srimangal, Moulvibazar, Bangladesh. https://events.development.asia/learning-events/bangladesh-wetland-ecosystem-services-workshop

Table 2 List of top ecosystem services provided by Eastern Meghna Delta wetlands.

Ecosystem services	Essential or non-substitutable	Benefits to communities			Change	
		Within the site	Adjacent to the site	Distant to the site	Past	Future
Provisioning services						
Food (cultivated)	Yes	✓	✓	✓	Decrease	Decrease
Regulating services						
Flood hazard regulation		✓	✓	✓	Increase	Increase
Storm hazard regulation		✓	✓	✓	Increase	Increase
Erosion regulation	Yes	✓	✓		Increase	Increase
Salinity regulation	Yes	✓	✓		Decrease	Decrease

Currently, fishing communities across the Meghna Delta face various challenges, which include low incomes, fishing rights, limited access to credit, and fishing equipment (Sultana et al. 2024) and declining fisheries of commercially valuable species such as Hilsha (Haldar & Ali 2014; Hasan et al. 2015), while current fishery cooperatives are too limited to ensure that the needs of fishermen are adequately represented.

4.2. Global climate regulating services

Using remote sensing data based on ESA maps that are open access, we estimated the stored carbon in the central Meghna Delta at 7,622,700 tonnes. Based on systematic reviews (Chen and Lee, 2022; Stankovic et al., 2023), the amount of carbon stored in Eastern Meghna Delta is estimated to range from 2,640,000 to 8,160,000 tonnes and is comparable with our remote sensing-based estimates, while the annual carbon sequestration rate is estimated to range between 50,800 and 56,100 tonnes per year.

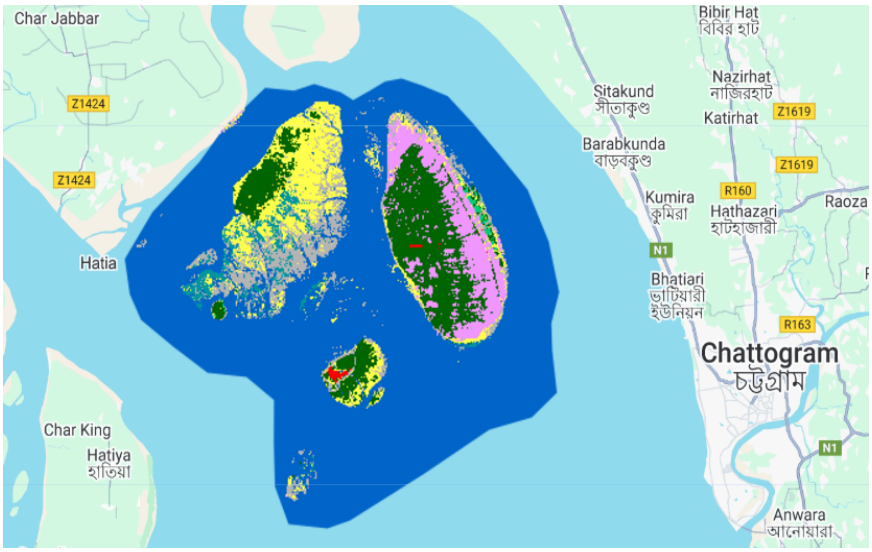

Figure 3 Map of the chars of the Eastern Meghna Delta, showing the relative distribution of different land cover types (map: Radhika Bhargava).

4.3. Coastal protection services

The coastal protection services provided by the Eastern Meghna Delta were assessed using both biophysical indices and monetary values (see Tables A1 and A2, and Annex 1 for details). While the Eastern Meghna Delta shows relatively low exposure to coastal hazards compared to other coastal areas in Bangladesh, its contribution to reducing coastal risk is minimal based on biophysical indices (Table A3 in Annex 1), with no measurable reduction in risk from mangrove cover. This is consistent with the monetary valuation (Table A4 in Annex 1), which ranks the site well below both RFI and national averages in terms of annual benefits per hectare and expected protection during a 100-year storm.

When compared to both the average of the five RFI coastal sites and the average of all other coastal areas in Bangladesh, the potential exposure to coastal hazards of the Eastern Meghna Delta is below (index: 3.09 vs. 3.13) and above (index: 3.09 vs. 2.97) average, respectively. The contribution of the Eastern Meghna Delta to both reducing coastal risk as a proportion of population density within 2.5 km of the coast or as a percentage of the maximum potential exposure should also be considered below these averages because it was estimated as zero.

In monetary terms, the Eastern Meghna Delta ranks well below both the national RFI and overall country averages in terms of total annual benefits per ha of mangroves (1,050 vs. 165,936 or 18,638 USD/ha). Moreover, the Central Meghna Delta is also below the average of all RFI coastal sites in Bangladesh regarding benefits against 100-year return period storms (54 vs. 544 billion USD).

5. Drivers of change and their potential impacts on Eastern Meghna Delta

5.1. Current drivers of change and their level of impact

Stakeholders at the RFI workshop[2] identified at least 53 drivers of change impacting the Eastern Meghna Delta, and their corresponding levels of impact on the wetland site (Table 3). High-impact drivers include housing and settlement developments, which significantly alter the landscape and lead to habitat fragmentation. Commercial and industrial areas further contribute to habitat loss and pollution. Other high-impact activities include tourism and recreation infrastructure, non-timber crop production, livestock farming and grazing, marine and freshwater aquaculture, and the operation of shipping lanes and canals. Biological resource use, such as fishing, killing, and harvesting of aquatic resources, poses substantial threats to biodiversity. Additionally, household sewage and urban wastewater, agricultural and forestry effluents, garbage and solid waste, and natural events like earthquakes, tsunamis, temperature extremes, and storms all pose high-impact threats to the wetland.

Medium-impact drivers consist of activities such as oil and gas drilling, sand extraction, utility and service lines, and the operation of ports for large-scale loading and unloading of goods. Hunting, logging, recreational activities, habitat clearing, and dams for hydrological modification also moderately modify the site. Additional medium-level impacts come from increased fragmentation, loss of keystone species, erosion, siltation, and other 'edge effects' that degrade the wetland's values.

[2] Asian Development Bank. (2024, May 27–29). *Bangladesh: Wetland Ecosystem Services Workshop* [Workshop]. Srimangal, Moulvibazar, Bangladesh. https://events.development.asia/learning-events/bangladesh-wetland-ecosystem-services-workshop

Table 3 Drivers of change and their potential impact on the integrity of Eastern Meghna Delta based on consultations with stakeholders.

Driver of change	Impact
Housing and settlement	High
Commercial and industrial areas	
Tourism and recreation infrastructure	
Annual and perennial non-timber crop production	
Livestock farming and grazing	
Marine and freshwater aquaculture	
Shipping lanes and canals	
Fishing, killing and harvesting of aquatic resources	
Household sewage and urban wastewater from outside the wetland site	
Agricultural and forestry effluents	
Garbage and solid waste	
Earthquakes/tsunamis	
Temperature extremes	
Storm and flooding	
Wood pulp and plantations	Medium
Oil and gas drilling; extraction of sand	
Utility and service lines	
Ports with large scale loading and unloading of goods	
Hunting, killing and collecting of terrestrial animals	
Collecting terrestrial plants or plant products (non-timber)	
Logging and timber harvesting	
Recreational activities and tourism	
War, civil unrest and military exercises	
Habitat clearing	
Dams, hydrological modification and water management/use	
Increased fragmentation within the wetland site	
Other 'edge effects' that degrade the wetland site values	
Loss of keystone species	
Excess ponding of water onsite	
Loss of hydrological connectivity	
Sewage and wastewater from wetland site facilities	
Industrial, mining and military effluents	
Erosion and siltation/deposition	
Habitat shifting and alteration	
Loss of cultural links, traditional knowledge and/or management practices	
Natural deterioration of important cultural wetland site values	
Destruction of cultural heritage buildings, gardens, sites, etc.	
Research, education and other work-related activities	Low
Activities of site managers	
Vandalism, destructive activities or threats to staff and visitors	
Fire and fire suppression	
Isolation from other natural habitats	
Restoration for conservation	
Dams within or upstream of the wetland site, which alter the hydrological regime	
Water extraction/diversion within the wetland site or catchment	
Drought conditions	
Desertification	
Invasive plant species	
Pathogens	
Air-borne pollutants	
Excess energy	
Avalanches/landslides	
Droughts	

5.2. Potential alternative state of Eastern Meghna Delta under current drivers of change

Stakeholders at the RFI workshop[3] defined the most plausible future alternative state (to 2035), and how this will translate to a net change in the cover of different types of wetland habitat types within this site

[3] Asian Development Bank. (2024, May 27–29). *Bangladesh: Wetland Ecosystem Services Workshop* [Workshop]. Srimangal, Moulvibazar, Bangladesh. https://events.development.asia/learning-events/bangladesh-wetland-ecosystem-services-workshop

(current habitat cover vs future alternative cover; Figure 4). The alternative state of the site assumes there will be no changes in the current drivers of change impacting the site, and the current management regime.

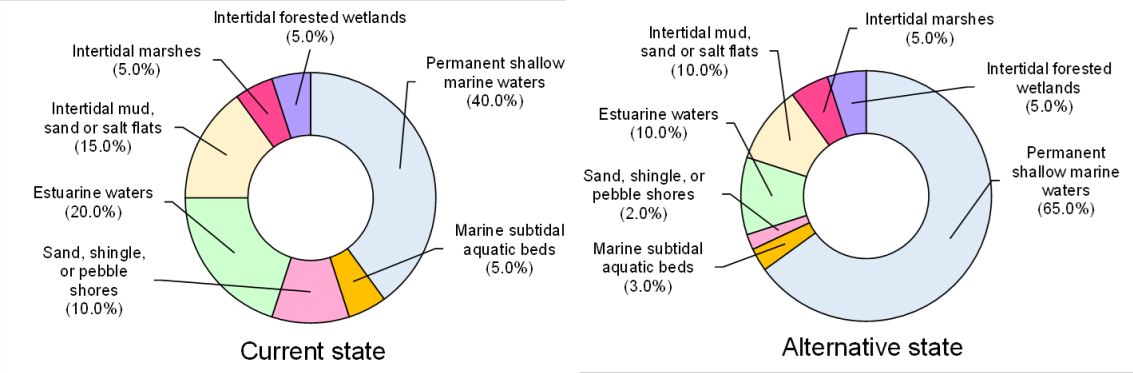

Figure 4 The proportional change in the extent of different habitat types between the current and alternative states of Eastern Meghna Delta.

5.3. Expected changes in the ecosystem services of Eastern Meghna Delta

Stakeholders at the RFI workshop[4] documented the future trends in the provision of ecosystem services in Eastern Meghna Delta, indicating if the ecosystem services provided by this site (to 2035) will increase, decrease, or will remain stable if the current drivers of change impacting this site will continue in their present condition, with the intervention remains unchanged.

Figure 2 and Table 2 highlight that the provisioning service for cultivated food has experienced a decline in the past and is projected to continue decreasing in the future. Regulating services such as flood hazard regulation, storm hazard regulation, and erosion regulation have shown an increase in the past and are expected to continue increasing in the future. In contrast, salinity regulation has decreased in the past and is expected to continue decreasing.

In the alternative state, the loss of 33% of intertidal mudflat will result in a loss of stored carbon, estimated to be between 632,000 and 1,470,000 tonnes, and a decrease in carbon sequestration rate (carbon accumulation) by approximately 9,211 to 9,214 tonnes per year.

A loss of 0 ha of mangroves as presented in Table A5, is not expected to result in any reduction in coastal protection as estimated in 4.3. Those results in 4.3 suggest that the current extent, condition, or placement of mangroves in the Eastern Meghna Delta may not be sufficient to deliver meaningful coastal protection benefits under present conditions. However, this also highlights potential for strategic

[4] Asian Development Bank. (2024, May 27–29). *Bangladesh: Wetland Ecosystem Services Workshop* [Workshop]. Srimangal, Moulvibazar, Bangladesh. https://events.development.asia/learning-events/bangladesh-wetland-ecosystem-services-workshop

restoration to improve functionality in areas where exposure is moderate, but protection services are currently underperforming.

6. Capacity needs in the Eastern Meghna Delta

The stakeholder consultation and analyses with stakeholders representing government and civil society identified at least nine major groups of stakeholders with clear roles in the long-term sustainable management of wetlands in the wider Meghna Delta landscape. Major gaps exist for government stakeholders in relation to strengthening the management and restoration of wetland landscapes, biodiversity and agricultural landscapes. The Bangladesh Forest Department (BFD), a major stakeholder, for instance, currently (and is expected to play) a key role in ensuring that the protected areas within the wider Meghna landscape are well managed. However, it faces capacity gaps as a result of resource and organisational constraints.

Table 4 Stakeholder groups and their corresponding capacity gaps and needs with respect to the eastern Meghna Delta.

Stakeholder group	Current role and impact in wetland management	Possible future role in wetland management	Current capacity for sustainable wetland management	Form of capacity development (e.g., training, organizational strengthening etc.)
Bangladesh Forest Department	Management of protected areas. Management of forestry resources and plantations. Protection and conservation of wildlife.	Management of protected areas Plantation raising Protection and conservation of wildlife.	Inadequate, with major gaps	Strengthening organizational structures; improve logistical capacity; policy capacity
Local district administration	Management of local community. Creating awareness of wetland issues but currently little awareness of conservation.	Management of local community. Strengthen work to creating awareness of wetland issues.	Inadequate, with major gaps	Strengthening organisational structures; improve logistical capacity

Stakeholder group	Current role and impact in wetland management	Possible future role in wetland management	Current capacity for sustainable wetland management	Form of capacity development (e.g., training, organizational strengthening etc.)
Local government bodies	Land litigation and ownership/lease of land. Management of local communities.	Stronger engagement and management of communities for wetland protection	Inadequate, with major gaps	Strengthening organisational structures; improve logistical capacity; policy capacity
Fishers and boat owners	Benefit directly from fisheries. Boat owners may contribute to water pollution,	No expected change in roles.	Inadequate, with major gaps	Strengthening awareness of biodiversity and conservation issues.
Local community groups	Activities may encroach into ecologically sensitive areas but also plays roles in managing resource use and environmental protection.	• Protection Exploitation	Inadequate, with major gaps	Strengthening awareness of biodiversity and conservation issues; policy landscape. Participatory frameworks and initiatives for local communities.
Conservation non-government organisations	Undertake research and monitoring activities. Build awareness of conservation issues. Support government agencies with policymaking.	Expected to take a large role to support rural development and conservation activities.	Adequate	

7. Opportunities for RFI interventions

7.1 Recommended Interventions

Improving the management of the wider Meghna Delta will require a combination of terrestrial and marine interventions to address unsustainable grazing which increases erosion and lead to vegetation degradation on riverbanks and *chars*, a key wildlife habitat, and targeted interventions to address unsustainable marine fishing activities and increasing sedimentation, which affects several species and thereby threatening fish stocks across the coastal zones of the Meghna Delta (Haldar & Ali 2014).

Strengthening access to fishing rights and credit, especially for underrepresented fishing communities, can also be expected to ensure a more sustainable use of declining fisheries, and in accordance with management plans developed for the coastal and estuarine waters of the delta.

Addressing livelihood challenges, which affect a large proportion of local communities in the Meghna Delta, will be critical to strengthen frameworks promoting sustainable use of fishing resources, while ensuring the livelihoods of thousands of households. Financing rural development (impacted by fishing restrictions) and biodiversity conservation may also be enabled through PES and other compensation schemes.

Table 5: Summary of key RFI interventions proposed for the Eastern Meghna Delta

Intervention	Outcome	Indicators	Cost	Timeframe	Potential Stakeholders
Component 1: Coastal wetland habitat protection and management					
Livelihood and income-generating activities for select local communities, especially communities near to ecologically sensitive areas.	Local communities developed and had improved access to livelihood opportunities. Ecosystem services are better conserved.	Number of people benefitting from livelihood activities, with up to 30% beneficiaries from women, youth, elderly, indigenous people, and other vulnerable groups	300,000.00	2 years	Bangladesh Forest Department Local district administration Local government bodies Local community groups Conservation NGOs

Intervention	Outcome	Indicators	Cost	Timeframe	Potential Stakeholders
		Number of people trained on livelihood activities			
Strengthen the management (and enforcement) of fisheries through targeted fishing bans of young Hilsha or jatka, take quotas (for sensitive and commercially important species), in accordance with current management plans.	Five (5) new fish sanctuaries at prioritised spots in consultation with local co-management bodies, existing or newly established, created.	Number of fishery management policies facilitated Number of established fish sanctuaries Number of fisherfolk capacitated on sustainable fishing practices Number of trained national and local wetland stakeholders based on local capacity needs, with at least 30% participants from women, youth, and indigenous people's groups	500,000.00	5 years	Bangladesh Forest Department Local district administration Local government bodies Local community groups Fishers and boat owners Conservation NGOs
	Siltation from damaging fish and wetland habitat, including targeted dredging of silted up channels addressed		1,500,000.00	2-3 years	
	Fisherfolks capacitated on sustainable fisheries practices (especially destructive, monofilament nets), including setting up of new fishing cooperatives, e.g., fishing groups (to better empower small scale fishers)		500,000.00	5 years	
Stronger wildlife protection	Restoration of wildlife populations.	Number of updated local wetland	250,000.00	5 years	

Intervention	Outcome	Indicators	Cost	Timeframe	Potential Stakeholders
with focus on migratory birds. Establish and implement a management plan for Ganguirar Char.	Increased protection for migratory species.	management and financial plans, with gender-responsive and inclusive strategies Trend of population assemblage of migratory waterbirds recorded during the migration season improved.			
Component 2: Restoration of degraded wetlands					
Scale up mangrove restoration at degraded areas of mangroves, especially around ecologically important areas such as Ganguirar Char.	Degraded mangrove areas in the foreshore parts of the Meghna Delta and associated distributary channels restored.	Area of restored mangrove ecosystem	1,500,000.00	3 years	Bangladesh Forest Department Local district administration Local government bodies Local community groups Conservation NGOs
Socioeconomic surveys and consultation with local communities			50,000.00	1 year	
Total investment for five years			**15,900,000.00**		

7.2 Potential Financing

The estimated project cost is USD 15,900,000 over five years. This project budget supports the scaling up of the mangrove restoration program, the conduct of biodiversity monitoring activities for migratory waterbirds, fish, and potentially cetaceans, the construction of new eco-tourism infrastructure, the creation of five new fish sanctuaries, dredging of silted habitats, and capacity-building activities for fisherfolk.

If around half of the proposed USD 1.5 million investment in the Eastern Meghna Delta is allocated to mangrove restoration, this would enable the rehabilitation of roughly 75 hectares based on average restoration costs. With estimated coastal protection benefits of USD 1,050 per hectare annually (see Section 4.3), this nature-based component could yield approximately USD 78,750 in annual benefits—resulting in a benefit–cost ratio just above 1:1 over the long term. While lower than in other coastal regions, this return may still justify investment when paired with hard infrastructure, creating a cost-effective, hybrid approach to climate resilience. In contrast, prioritizing short-term land uses such as aquaculture may undermine future protection, leading to long-term opportunity costs that exceed their immediate economic value.

7.3 Proposed Institutional Arrangements

Capacity building and awareness activities will be led by the Bangladesh Forest Department. Civil society organisations with a focus on biodiversity conservation can play a major role with leading and delivering training activities on the ground at selected villages and promoting awareness of biodiversity, with a focus on threatened species, cetaceans (eastern Meghna is important for Irrawaddy Dolphin, and several shorebirds). The Fisheries Department can play a role in the implementation of fishery-related components of the project with local district administrations, focusing on activities to scope and develop management plans for fisheries while strengthening the capacity of fisher communities (2-5 years) and coordinating with other agencies for compensatory payments for fishing households affected by fishing restrictions, and follow up activities to implement them. Implementation will be coordinated with the local government, local administration and civil society organisations. Mangrove and wetland restoration activities can be financed by the private sector and driven on the ground through consortia between the BFD, FD, and civil society organisations.

7.4 Project Beneficiaries

There are a few indigenous communities in the proposed project site, but there are major opportunities to strengthen the representation of women and marginalised fishing communities (including fishing households unrepresented in any wider frameworks) in influencing management structures affecting their livelihoods.

7.5 Anticipated Implementation Risks

Climate: The densely populated and highly climate-vulnerable coast of the eastern Meghna Delta overlaps with several wetland landscapes of high conservation priority for migratory waterbirds such as Ganguirar Char (Chowdhury et al. 2017) and Nijhum Dwip (in the central Meghna Delta), and where there is scope for improved management and biodiversity conservation interventions, alongside interventions to promote livelihoods of local fisher communities. Integrating mitigation strategies into project interventions will help reduce climate-related impacts on the activities.

Social Safeguards: The implementation of short-term fishing bans, restrictions, and quotas, as part of wider fisheries management plans and zoning plans for the Meghna coastline, will have significant implications for the livelihoods of local communities. Scoping studies will be needed to assess the impact of fishing quotas on domestic incomes and the challenges of implementing quotas in a complex environment.

Environment: Proposed interventions for eco-tourism include the development of new infrastructure in the Eastern Meghna Delta. Building these infrastructures, however, would induce noise that may disturb the wildlife in the area. Planning with the stakeholders is critical before any infrastructure development.

Political and Governance: Understanding the relevant management stakeholders, conservation priorities, and capacity is essential for implementing project interventions effectively. For Ganguirar Char, the Forest Department holds land tenure/ownership within the Flyway Network Site, whereas the surrounding area is jointly owned by the Forest Department and the Deputy Commissioner of the District. The Forest Department is also the management authority for the site, and the Ministry of Environment, Forests, and Climate Change has functional jurisdiction there. There is also a possibility that Ganguirar Char overlaps with the boundary of one of the six sanctuaries established for the fish, Hilsa shad *Tenulosa ilisha* (Islam *et al.* 2014). Stakeholder mapping and discussions will facilitate better coordination with management stakeholders.

References

Aziz, M.A. (2019). Conservation action plan for Ganges River dolphin and Irrawaddy dolphin of Bangladesh. *Bangladesh Dolphin Action Plan 2020–2030*, 1-47.

Chowdhury, S.U., Foysal, M., Diyan, M.A.A., & Ahmed, S. (2017). Discovery of an important wintering site of the Critically Endangered Spoon-billed Sandpiper *Calidris pygmaea* in the Meghna Estuary, Bangladesh. *Bird Conservation International*, 1-12

Hasan, K., Wahab, M., Ahmed, Z. and Mohammed, E. (2015). *The biophysical assessments of the hilsa fish (*Tenualosa ilisha*) habitat in the lower Meghna, Bangladesh*. IIED, London.

Haldar, G.C., & Ali, L. (2014). *The cost of compensation. Transaction and administrative costs of hilsa fish management in Bangladesh*. IIED Working Paper. IIED, London.

Islam, S. N. (2016). Deltaic floodplains development and wetland ecosystems management in the Ganges–Brahmaputra–Meghna Rivers Delta in Bangladesh. *Sustainable Water Resources Management*, *2*, 237-256.

Mondal, K. P., Samad, S., Sarkar, M., Rahman, S. H., Islam, S. T., & Talukder, B. (2025). Wetlands of Bangladesh: Biodiversity, Livelihoods, and Conservation. *Wetlands of Tropical and Subtropical Asia and Africa: Biodiversity, Livelihoods and Conservation*, 19-39.

Rahman, M. M., Haque, A., Nicholls, R. J., Darby, S. E., Urmi, M. T., Dustegir, M. M., ... & Haque, M. A. (2022). Sustainability of the coastal zone of the Ganges-Brahmaputra-Meghna delta under climatic and anthropogenic stresses. *Science of the Total Environment*, *829*, 154547.

Sultana, M. A., Sunny, A. R., Hussain, M. A., Islam, M. R., Raposo, A., Al Shiam, S. A., ... & Prodhan, S. H. (2024). Beyond Economics: The Multitude of Benefits from Ecosystem Services in the Meghna River Basin. *Regional Studies in Marine Science*, 103985.

Annex 1. Supplementary information on coastal protection services

To further validate the identification of the top ecosystem services by means of stakeholder consultation, an expectedly essential or non-substitutable regulating service across all RFI sites, namely coastal protection and flood mitigation (i.e., storm and flood hazard regulation), was assessed based on a combination of globally available datasets supplemented by web-based tool Co$tingNature (Mulligan, 2022). Estimates for coastal protection by mangroves (after the effects of coral reefs) were spatially inferred in QGIS from a selection of metrics expressing different biophysical and monetary values modelled by Chaplin-Kramer et al. (2023) and Menéndez et al. (2020), respectively.

The key metrics selected for biophysical values (Table A1) were current maximum potential exposure to coastal hazards, which is a vulnerability risk index calculated in InVEST[1] for several hazard variables (i.e., wind, waves, sea level rise, geomorphology, and bathymetry) in the hypothetical absence of current mangrove extent, and nature's (i.e., the mangroves') contribution to reducing this coastal risk, both as an absolute value multiplied by the local population affected and a percentage of the maximum potential exposure.

Table A1. Contribution of mangroves to coastal protection as a critical natural asset in the Central Meghna Delta based on site-level (biophysical) values inferred from Chaplin-Kramer et al. (2023) and expressed as ranges to represent the resulting uncertainty. Key metrics are in italics.

Critical contribution of mangroves to coastal protection (metrics)	**Risk levels**
Current population density within 2.5 km of the coast (number of people per hectare)	77 – 202
Current maximum coastal risk to be mitigated, or potential exposure to coastal hazards (unitless index)	*3.03 – 3,14*
Maximum coastal risk to be mitigated, or potential exposure to coastal hazards in 2050 according to IPCC's Shared Socioeconomic Pathway #1 'Sustainability' (unitless index)	3.41 – 3.53
Maximum coastal risk to be mitigated, or potential exposure to coastal hazards in 2050 according to IPCC's Shared Socioeconomic Pathway #3 'Regional Rivalry' (unitless index)	3.64 – 3.77
Maximum coastal risk to be mitigated, or potential exposure to coastal hazards in 2050 according to IPCC's Shared Socioeconomic Pathway #5 'Fossil-fueled Development' (unitless index)	3.82 – 3.96
Current proportional risk reduction, nature's contribution to reducing coastal risk as a proportion of maximum coastal risk (unitless index)	0.0 – 0.0
Nature's contribution to reducing coastal risk as a proportion of population density within 2.5 km of the coast (# of people per hectare)	*0.00 - 0.00*
Nature's contribution to reducing coastal risk as a percentage of the maximum potential exposure (%)	*0.00 - 0.00*

The key metrics selected for economic values (Table A2) were the annual expected flood protection benefits to total stock, which is the monetary value of the averted damages to the industrial and

residential stocks (i.e., property) in 2015 US$, the same total annual benefits expressed per hectare of mangroves, and the total benefits in the event of a 100-year return period storm, which are the rarest of cyclonic conditions but cause the most flood damages to property (i.e., maximum level of coastal protection by mangroves).

Table A2. Coastal protection benefits offered by mangroves in the Central Meghna Delta based on site-level (monetary) values inferred from Menéndez et al. (2020) and expressed as ranges to represent the resulting uncertainty. Key metrics are in italics.

Benefits of mangroves in terms of coastal protection (metrics)	**Avoided costs (US$)**
Mangrove extent (hectares)[2]	14 – 29,954
Annual expected flood protection benefits to people (number of people)	9,603 – 9,717
Annual expected flood protection benefits to Industrial Stock (US$)	5,425,880 – 5,490,053
Annual expected flood protection benefits to Residential Stock (US$)	3,249,878 - 3,288,315
Annual expected flood protection benefits to Total Stock (US$)	*8,241,017 – 8,338,485*
Annual expected flood protection benefits to Industrial Stock per hectare of mangroves (US$ per hectare)	*1,043 – 1,056*
1-in-100-year return period damage in terms of area flooded (number of hectares)	3,027 – 3,117
Total expected flood protection benefits of mangroves per 100-year return period storms (US$)	*52,805,403 - 54,378,693*

Table A3. Biophysical benefits from RFI coastal wetland sites (expressed as ranges to represent the resulting uncertainty) and at the national level.

Site name	**Max pot exp (index)**	**Risk reduction (index * pop)**	**Risk reduction (% max pot exp)**
Central Meghna Delta	3.11 (±0.02)	17 (±2)	0.61 (±0.11)
Eastern Meghna Estuary	3.09 (±0.05)	No Data	No Data
Eastern Sundarbans	2.91 (±0.02)	29 (±2)	4.00 (±0.16)
Nijuhum Dwip NP & FNS	3.10 (±0.06)	0 (±0)	5.06 (±0.69)
Sanadia Island FNS	3.45 (±0.08)	89 (±32)	2.27 (±0.80)
Bangladesh RFI average	3.13	26	2.39
Bangladesh national average	2.99	38	1.69

Table A4. Monetary benefits from RFI coastal wetland sites (expressed as ranges to represent the resulting uncertainty) and at the national level.

Site name	Total annual benefits (US$)	Per mangrove area (US$/ha)	For 100-yr return period storms (US$)
Central Meghna Delta	385,472,048 (±48,974,595)	794,504 (±100,942)	1,476,259,077 (±858,019,635)
Eastern Meghna Estuary	8,289,751 (±48,734)	1,050 (±6.17)	53,592,048 (±786,645)
Sundarbans	167,762,956 (±54,512,767)	5,607 (±1,822)	1,098,664,838 (±3,285,219,032)
Nijhum Dwip NP & FNS	19,582,720 (±994,316)	21,346 (±1,084)	19,090,534 (±19,325,668)
Sonadia Island FNS	22,061,094 (±20,477,324)	7,176 (±425)	72,607,057 (±992,19)
Bangladesh RFI average	120,633,714	165,936	544,042,711
Bangladesh RFI total	603,168,569	Not Applicable	2,720,213,554
Bangladesh national average	15,050,804	165,936	87,177,719
Bangladesh national total	872,946,651	Not Applicable	4,533,241,399

Table A5. Key habitat types in the Eastern Meghna Delta based on stakeholder-based assessment at the Regional Flyway Initiative workshop in May 2024.

Habitat type	Current state		Alternative state (2035)	
	Area (ha)	Cover (%)	Area (ha)	Cover (%)
Permanent shallow marine waters	56255.7	40.0	91415.6	65.0
Marine subtidal aquatic beds	7032.0	5.0	4219.2	3.0
Sand, shingle, or pebble shores	14063.9	10.0	2812.8	2.0
Estuarine waters	28127.9	20.0	14063.9	10.0
Intertidal mud, sand or salt flats	21095.9	15.0	14063.9	10.0
Intertidal marshes	7032.0	5.0	7032.0	5.0
Intertidal forested wetlands	7032.0	5.0	7032.0	5.0
Total	140639.3	100.0	140639.3	100.0