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২. খামার পরিদর্শন ও মৎস্য বিষয়ক পরামর্শ প্রদান।

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১২. প্রশিক্ষণ প্রদান।

মৎস্য সম্পদ সংরক্ষণ ও উন্নয়নে প্রচলিত আইনসমুহ বাস্তবায়ন।

National Agricultural Technology Progarm Phase II Projet (NATP-2)

Department of Fisheries, Bangladesh

Table of Contents

1. Introduction

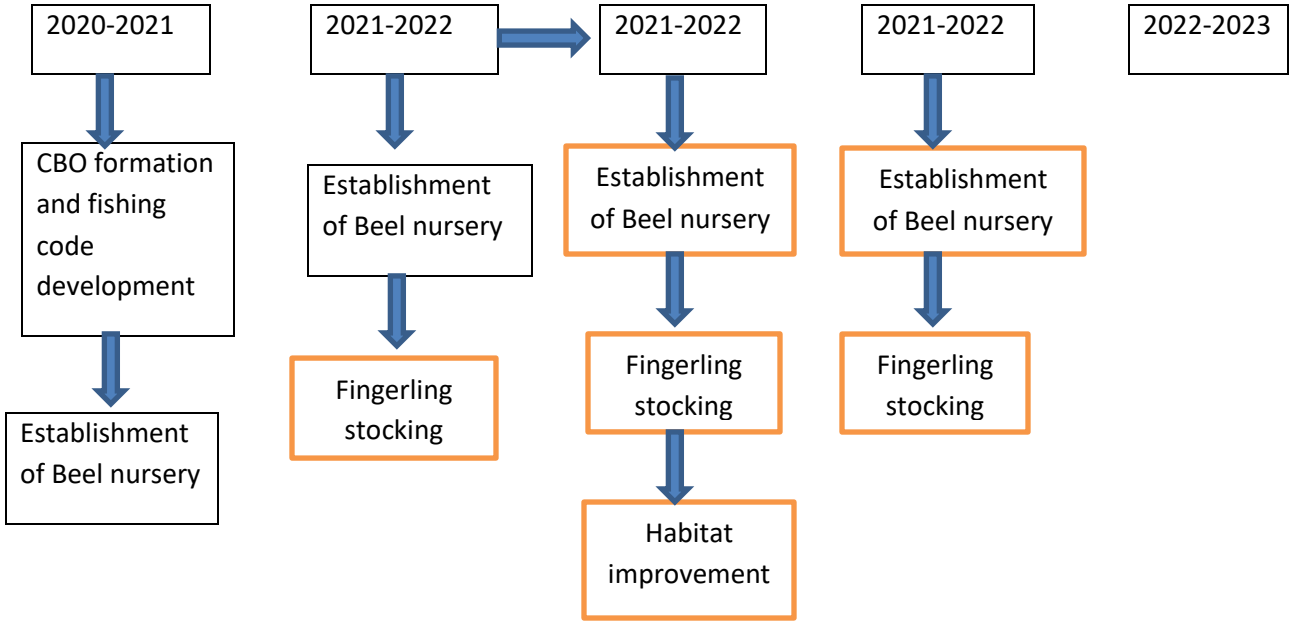
Beels are static water bodies that accumulate surface runoff water through internal drainage channels; these depressions are mostly topographic lows produced by erosions and are seen all over Bangladesh. They mostly occur in between the rivers and canals. *Beels* are small saucer-like depressions of a marshy character. Many of the *beels* dry up in winter but during the rains expand into broad and shallow sheets of water, which may be described as freshwater lagoons. *Beels* are mainly fed by surface runoff water. A few larger ones are fed by floodwater during the wet season from the parent river channel. Normally, *beels* remain deeply flooded for most of the wet season and are generally richer in fishes. But, fish production has declined in inland open waters during last three decades due to various causes such as, over fishing, blockage of connecting canals between floodplains due to siltation, destruction of fish breeding and nursery grounds, global warming and climate change, revenue oriented leasing system of water bodies, unjustified harvesting of broods and young fish, implementation of flood control and drainage program, construction of unplanned roads and dams, indiscriminate use of insecticides and pesticides for crop production, etc (Uddin & Rahman, 2017). However, Bangladesh covers 114161 ha area of *beel* fisheries, which plays a very important role in the alleviation of rural poverty and supplying food to the poor fishing community (DoF, 2020). NATP-2 Objective is to better manage these *beel* fisheries and provide livelihood to the poor communities living around these rich ecosystems by improving sustainable fish production.

The NATP-2 project has 40 selected *beels* to take under management according to DPP. But, the project at first started implementing activities in 23 *beels*. The rest 17 *beels* will started implementing activities in 2021-22 under management of NATP-2.

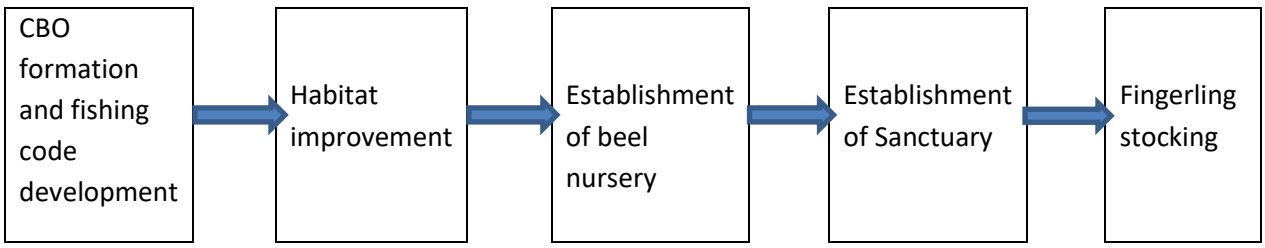
Rajgonj Baor is one of the 17 *beels* newly managing under NATP-2. The project will started its activity in this *beel* in 2021-22. Five types of activities were planned to be accomplished in the DPP, those are, formation of CBO and fishing code; habitat improvement; establishment of *beel* nursery; establishment of fish sanctuary and indigenous fingerling stocking. All the activities will implemented in the *beel* by the NATP-2 project follow the approved government instruction namely ``Development Project Activities Implementation Instruction, 2016''. The *beel* management activity will performed by the Community-based Fisheries Management (CBFM) approach. No objection certificate (NOC) was taken recently from the proper authority for this *beel.*

Methodology

The steps will need to follow to accomplish the *beel* management activities in *Rajgonj Baor beel* are shown below:



The standard steps to be followed for a successful beel management are:



It will have been better to follow the standard steps for managing the selected beels under NATP-2 project. Due to some unavoidable circumstances such as delayed start of the Project; feasibility study and finalization of *beel* selection took a good chunk of time; getting NOC for initiation of beel management activities and lastly the outbreak of COVID-19 pandemic, the standard steps con not be followed with a view to keep the beel management activities going on. According to DPP provision, *beel* nursery has to be established 5 times in each *beel* throughout project period. For the initiation of habitat improvement, NOC is required, which required lot of time as it involved other organizations. To implement the *beel* nursery activity as per DPP provision, it is done before habitat improvement following the government guideline in leased pond nearby the *beel*.

2. Baseline survey

Before starting all activities, a baseline survey was conducted in government guideline's prescribed form on Dec 2018 to know the present scenario about *baor* resources and to take proper management strategy. Baseline survey included physical, hydrological and biological information of the *beel*. The detailed baseline information is shown in Annexure I.

2.1. Location and demography

Rajgonj Baor is a natural reservoir in Putkhali *Mouza* of Putkhali Union in Sahrsha Upazila of Jashore District, 61 km north-east of Jashore Sadar by road. The total area of *Beel Sajia* is about 36.35 hectares, which dries up to 7 hectares during the dry season (Source: Upazilla Land Office, Sharsha, Jashore). During the rainy season, the average depth of the beel is about 8 meters, but in the dry season, it drops to 1 meter. Water current is found on the beel during rainy season. The *beel* was not properly managed before intervention of NATP-2. Now, it is managed by the CBO formed under NATP-2 project.

Figure 1: Map showing ***Rajgonj Baor***

2.2. Fisheries species diversity

The beel is enriched with fish diversity. The major species are Indian Major Carps (IMC), such as Catla, Rui, Mrigal, Silver carp, Mirror carp, Common carp and Small Indigenous Species (SIS), such as Punti, Olive barb, Tengra, Pabda, Pholi, Bata, Baim, Koi, Bele, Dhela, Mola, Taki etc. The endangered species listed in this beel are Rani, Chital, Kalbaus, Baim, Magur, Rita, Gajar. The beel is also available with Shing, small chingri Fresh water small crab, Kata kakra etc.

2.3. Aquatic vegetation diversity

Dominating aquatic weeds in the beel are Helencha, Malancha, Dol, Kalmilata, Topapana, Kachuripana, Khudipana etc.

2.4. Gear used in Beel

Siene net, Cast net,and Jhaki jal are the major gears used to catching fish in this beel. Khata fishing is also used for catching fishing.

2.5. Baseline fish production

The baseline fish production was 86,840 kg in 2019-20, in which 89% came from major carp and 11% from small indigenous species.

2.6. Feasibility study of beel management activities

The beel has a suitable area for the establishment of a fish sanctuary and require habitat improvement to make a *beel* nursery pond. There is suitable pond nearby *beel*, where *beel* nursery can be established, if habitat improvement is not possible in the meantime. Fingerling stocking is possible during rainy season and there are some deeper depressions in beel where the stocked fish can take shelter during dry season.

2.7. Socio-economic condition

CBO was formed with the marginal fishermen, land less villagers, fisheries traders, and other users of the *beel*. The average annual income of the beneficiaries was 3793500 BDT (2019-20).

2.8. Problems and recommendations

The problems and recommendations will be identified through a Focus Group Discussion (FGD).

2. Activities of *Beel* Management

3.1. Formation of Community Based Organization (CBO)

The first step of *beel* management activities is to form a CBO in order to implement all the activities properly and continue the activities sustainably after end of the project. The CBO is formed by the concern Upazilla Fisheries Office with the help of local government representatives discussing with the nearby fisherman, landless villagers, fisheries businessmen, and other users of the beel. The Rajgonj Baor Community Based Organization (CBO) was formed consisting 70 members. The CBO ensured at least 35% female members. An executive committee consisting of 11 members has also been formed to manage the group properly. The Executive committee of this *beel* is shown in Table-1.

Table-1. Executive committee of *Sajia Kawnia beel*

SL	Name	Post	National ID	Mobile no.
1.	Sree Nimai Sarkar	President	4119077501304	01838386037
2.	Noni Haldar	Vice-President	4119077553163	01951626735

3.	Sree Kanai Sarkar	General Secretary	4119077502483	01878439178
4.	Sree Robin Haldar	Assistant General	4119077501213	01705211299
5.	Bimol Chandra Biswas	Treasurer	4119077501149	01746083712
6.	Sushanta Sardar	Member-1	4119077501172	01969575741
7.	Badli Sardar	Member-2	4119077502487	01884096670
8.	Bipasha Rani	Member-3	5542005136	01612979798
9.	Mahadev Haldar	Member-4	4119077501155	01937784885
10.	Srimotee Aloka Rani	Member-5	4119077501165	01401674863
11.	Nomita Haldar	Member-6	4119077501230	01837905193

3.1.1. Implementation of fishing code

Fishing code will be comprised of a set of fishing rules that will be prepared by the beneficiary group with the assistance of Senior Upazilla Fisheries Office and also will follow by the CBO to manage the water body in a sustainable manner. The fishing code will impose a fishing ban period for at least 4 months. The *Rajgonj Baor* CBO will impose a total fishing ban period for 4 months (June to September). A small amount of budget (65,000 Tk) will be allocated from the project to support the CBO formation, and for management and implementation of fishing code. This support also included to establish 3 signboards (Size:10✕15 ft) containing fishing code, for awareness building meetings, publicity (poster, leaflet, miking) etc.

3.2. Establishment of *beel* nursery

Beel nursery has become a proven tool for increasing fish production in natural water bodies. DoF has continued this program as regular activity under revenue and development budget in various open water bodies (DoF, 2019). *Beel* nursery is usually established in relatively lower depressions of the *beel* or in nearby pond of the *beel*, where spawn can be reared for at least 2-3 months. After rearing the larger-size fish fry/fingerlings can be released throughout the main *beel* by overflow of rain water or can be released in the *beel* to enhance the abundance of fish stock in the *beel*. Different study results showed that *beel* nursery is economically profitable than fish fry releasing program (Islam et. al., 2012; Uddin and Rahman, 2017). These studies also suggested that the community based *beel* nursery management in the water areas was an excellent tool to stimulate income generation, employment opportunity and to supply nutrition.

3.2.1. Selection of nursery pond/area

Before stocking fish spawn in the *beel*, a suitable nursery pond/ground needed to be selected in the beel area. *Beel* nursery requires a moderate size pond ranging from 0.25 to 0.5 ha, which maintains at least 2.5-3 feet water depth for 4-5 months during dry season. The nursery pond should have good communication facility with a view to manage the nursery pond successfully and to ensure safe spawn/fry transportation.

3.2.2. Fish spawn stocking

The optimum period to start *beel* nursery is from end of February to March-April, when spawn of Indian major carp fishes become available in the hatcheries. After preparation of the *beel* nursery pond, it was stocked with 4-days old spawn of Rui, Catla and Mrigal during March-April A detail of *beel* nursery management is shown in Table-2. A total 2.5 kg of spawn/larvae was stocked in the pond. Species composition was maintained at 50%, 20% and 30% for Rui, Catla and Mrigal, respectively, according to the recommendation of Government Instruction.

3.2.3. Budget for beel nursery implementation

NATP-2 project allocates 60,000 BDT for each *beel* nursery each year, which is subdivided into 10000, 15000, 25000 and 10000 BDT for pond preparation, fish spawn/larvae, nursery feed and chemicals/fertilizers, respectively. The CBO also add 50000 BDT as operational cost.

3.2.4. Culture management and fry release

The fish are fed with commercial carp nursery feed. Fish survival, growth and health are monitored at every 15 days interval and the amount of feed is adjusted. After nursing period, usually on June or July when water is available in the main beel, the fingerlings from the nursery pond were released in the *beel*. As per GoB guideline, fingerling release from *beel* nursery is done in presence of Upazilla committee.

Upazilla committee is formed as follows:

Sl	Committee Member	Designation in committee
1.	Honorable Member of Parliament (MP)	Chief Adviser
2	Upazilla Parishad Chairman	Adviser
3	Upazilla Nirbahi officer	Chairman
4	Upazilla Agricultural Officer	Member
5	Upazilla Livestock Officer	Member
6	Upazilla Social welfare Officer	Member
7	Upazilla Cooperative Officer	Member
8	Upazilla women affair officer	Member
9	Govt/private high school head teacher	Member
10	Local NGO representative	Member
11	Representative from Fisherman Cooperatives Society	Member
12	CBO chairman/secretary	Member
13	Upazilla Fisheries officer	Member Secretary

All the *beel* nursery related activities are implemented by the CBO and are closely monitored and supervised by the Upazilla committee and Upazilla fisheries office.

Fig. 3. Fish health and growth monitoring in *beel* nursery pond

3.2.5. Record keeping

Respective CBO and Upazilla fisheries office is keeping records of every step of the activities, from pond preparation to stocking, feed and fertilizer management, sampling records, fry release record, etc. A signboard (4ft✕3ft) is displayed beside the nursery pond (Fig. 3). Upazilla fisheries office was requested to take and preserve photographs and videos at every step of *beel* nursery activity.

3.2.6. Yield of fingerling

In *Sajia Kawnia beel*, a total 3300 kg and 3700 kg fingerlings were produced in the *beel* nursery and released in the *bee*l in 2018-19 and 2019-20, respectively (Table-2).

3.2.7. Expected output of *beel* nursery (2018-19 and 2019-2020)

Fingerlings produced in the *beel* nursery are stocked in the main beel, which contributes to an increase in *beel* production in the next year. About 20625 kg and 22097 kg of fish are expected to be contributed to the final production in 2019-20 and 2020-21, respectively as an impact of *beel* nursery (Table-2). The expected value in terms of money that will be generated from those fish is 3314550 BDT. Apart from increasing production, the socio-economic condition of the beneficiaries of the CBO and beel surrounding also is expected to be uplifted.

Table-2. Year-wise production from *Beel* nursery in *Sajia Kawnia Beel*

Year	Budget/ Expense (BDT) from NATP-2	Expense by CBO	Pond area (ha)	Species of spawn stocked	Amount of spawn stocked (kg)	Duration of beel nursery (days)	No. of fingerlings released	Total No. of fingerlings released	Weight of fingerlings released (Kg)	Total Weight of fingerlings released (Kg)	Approx. value of the fingerlings (BDT)*	Expected output (contribute to production)	
												(kg)	(Tk)**
2018-19	60,000	50000***	0.25	Rui	1.0	90	79000	150000	1653	3300	495000	20625	3093750
				Catla	0.75		31000		645				
				Mrigal	0.75		48000		1002				
2019-20	60,000	50000***	0.25	Rui	1.0	100	85000	180000	1996	3700	555000	22097	3314550
				Catla	0.75		43000		715				
				Mrigal	0.75		52000		989				
Grand Total					6			330000		7000	1050000	42722	6808300

*Calculated as 150 BDT/ kg fish fingerling. ** Calculated as 150 BDT/ kg of produced fish.
*** 50000 BDT as operation cost

3.3. Habitat improvement

Sustainable production from inland fisheries depends on well functioning of the ecosystem and adequate habitat (Roni, *et.al*. 2005). Improvement or restoration of inland habitat plays a pivotal role in species stock and production increase. Habitat improvement can be done with a view to improve the quality of habitat to increase species abundance and stock size. These can be done either by restoring water flow system (excavation, sediment removal, construction or restoration of embankment, etc.) or installation of new structure for ensuring grazing and breeding ground (excavation of depressions to establish sanctuary, establishment of beel nursery pond, etc.)

Preparatory works before habitat improvement:

In *Sajia kawnia beel*, a *beel* nursery pond was required to construct under habitat improvement works. For this work, suitable site was selected based on demography, communication and feasibility to implement beel nursery effectively. Before initiation of procurement process, Pre-work survey was done on *beel*, project scheme, layout design and budget estimate prepared accordingly, following GoB guideline (Annexure II). No objection certificate (NOC) was received from local land authority.

Habitat improvement work was procured centrally from PIU, DoF following government procurement rules, 2008. In *Sajia Kawnia beel*, Open tender Method (OTM) was followed. OTM completed in 2019-2020 and Notification of Award (NOA) was issued on 09.03.2020. The deadline for the completion of the work was 23.6.2020. But, due to Covid-19 situation, the contractor could not start the work and requested for time extension for 6 more months to HOPE (Heat of Procuring Entity; DG, DoF), which eventually had been approved by HOPE. The work is expected to be completed in 2020-21. The tender value for this beel is BDT 3,50,000. About 2070 cubic meters of soil will be excavated according to the 'Bill of Quantities' of the contract document to develop the pond (Table-3). Dyke will be prepared as per layout design. This work is being executed under the close supervision by the Upazilla officer and a district level Engineer of DoF as a technical person. PIU, DoF and District Fisheries Office (DFO) also closely monitor and supervise this work.

Table-3. Bill of quantities of the contract document for the habitat improvement works in *Sajia Kawnia Beel*

Group	Description of Item	Measurement Unit	Quantity	Unit Price In figures (BDT)	Total Price In figures (BDT)	Total Price In Words (BDT)
Civil	Cleaning and grubbing by removal and disposal of everything above ground level including overhanging branches, removing of all foundation stumps, embedded logs, tree root and other material either to a depth of .3m below proposed surface elevation or to the level as shown on drawing disposing of all materials resulting from clearing and gubbing at a safe distance etc. all complete as per direction of the Engineering in charge.	sqm	1226.76	8.001	9815.30	Nine thousand Eight Hundred and Fifteen point Three Zero
Civil	Bailing out water by using diesel engine with pump or electric operated pump motor set including higher charge of Engine/Motor with pump, fuel electricity, operator, spares and maintenance etc. all complete and accepted by the Engineer-in-charge.	cum	500.00	25.001	12500.50	Twelve Thousand Five Hundred point Five
Civil	Earthwork in excavation/Re-excavation of ponds/Dighi/ Canal/ Dead river/Borrow pit of any dimension in all kinds of soil including cutting up to required depth including all leads and lifts. etc. complete including breaking clods, ramming and levelling, dressing in 225mm layer with maintaining the side slope and level of pond as per design and accepted by the Engineer-in-charge.	cum	2070.00	142.038	294018.66	Two lakh Ninety-Four Thousand and Eighteen point Six Six
Civil	Creating turf on the side slope and top of the embankment with good quality turf not less than 225mm square chunk, watering till the grass grown including all leads and lifts etc. complete and accepted by the Engineer-in-charge.	sqm	1980.25	17.001	33666.23	Thirty-Three Thousand Six hundred and Sixty-Six point Two three
					350000.697	Three Lakh Fifty thousand point Six Nine Seven

3.4. Fish sanctuaries

Aquatic bio-diversity especially species diversity of fish and other aquatic organism in open water have been declining sharply over the years due to natural and man-made causes. It is very essential to undertake necessary attempts on conserving and enhancing aquatic biodiversity. Hence, establishment of sanctuary has become obligatory to protect and conserve fish species from extinction and increase fish diversity in the open water like *beel*. So, the importance of fish sanctuary is infinite. Because of its importance, DoF has established 432 fish sanctuaries in different selected water bodies during the last five years. As a result, a substantial increase in production of fish was found in those water bodies. At the same time there was abundance of endangered species like *Chitol, Foli, Kalibaus, Air, Tengra, Meni, Rani, Sarputi, Pabda, Kajoli, Gojar, Tara baim* etc. (DoF, 2019, DoF, 2020).

The general importance of fish sanctuary is outlined below-

- Increase fish production;
- Provide breeding and feeding ground;
- Enhance and preserve aquatic biodiversity;
- It helps protecting breeding and nursery ground and producing brood fish and other fish and enhances fish diversity.
- Restoration as well as conservation of habitat may be possible by establishing aquatic sanctuary
- Increasing the abundance of threatened fish species
- Protect the fish from genetic pollution
- Full fill the demand of fish seed in a beel
- Improve the livelihood conditions of nearby fishers
- Protect many other aquatic fauna and flora etc.

3.4.1. Site selection

A suitable area of the *beel* is chosen for establishment of a fish sanctuary, where fishing is prohibited or restricted round the year. The following factors are considered for site selection-

- It should be the deepest part of the *beel*
- Relatively low water current is found in that place
- The place should have less probability of siltation
- The navigation route should not be hampered
- The place should be safe from human interferen

3.4.2 Establishment of sanctuary: Due to Covid-19 situation, the contractor could not start the work of establishment of fish sanctuary and requested for time extension which will be performed within 2020-2021 fiscal year.

Table- 4. Estimated Cost for Establishment of a Fish Sanctuary (Area=1.0 hector)

Sl. No.	Description of Items	Quantity	Unit	Rate in Taka	Amount in Taka
1	Making, supplying and placing RCC pillar of 0'-5"x0'-5"x15'-0" long with M.S. Shoe as required size. Providing 1'-6"x0'-6" sign board enclaving the word "Fish Sanctuary" on top of the pillar. Driving the same 4.0-5.0 ft vertically in the ground at the Boundary of the sanctuary etc. all complete as per drawing, design and direction of the PE. (The cost includes reinforcement and its fabrication).	12.00	Each	5000.00	60000
2	Supplying & Placing of straight and strong borrak bamboo posts between RCC pillar (Boundary of the Sanctuary) of Av. 5.00m long of having minimum 75mm dia at 1.50m from the bottom and driving the same 1.22-1.52m vertically in the ground. Top level of all bamboo will be of same level etc. all complete as per direction of the PE.	1190.00	Rm.	75.00	89250
3	Supplying & Placing of straight and strong borrak bamboo post with all its branches of having length 6.00m or above, minimum 75mm dia at 1.50m from the bottom and driving the same 1.22-1.52m vertically in the ground, top level of all branches will be of same level etc. all complete asper direction of the E/C.	160.00	Each	350.00	56000
4	Supplying & Placing branch of tree including its all subsidiary branches inside the sanctuary. Dia of main branch will be minimum 75mm at 0.30m down from the cutting point & covering 10.00 sqm area in/c the cost of carrying etc. all complete as per direction of the E/C. (Name of the tree permitted for this work: Tetul/ Boroi/ Mango/ Jam etc. approved by the authority).	112.00	Each	600.00	67200
5	Supplying and fitting-fixing horizontal bracing with half split borrak bamboo runner tighting along the RCC/Bamboo boundary pillar/post of sanctuary, including supply of G.I. wire, nails, etc. all complete as per direction of the PE.	400.00	Rm.	40.00	16000

Sl. No.	Description of Items	Quantity	Unit	Rate in Taka	Amount in Taka
6	Supplying, fitting and fixing 3'-0"x5'-0" size sign board (near sanctuary) made of 24BWG MS sheet with 1.50"x1.50"x3/16" M.S. angle frame painting & writing the sign board or providing digital colouring bill banner with writing such as to be directed. Including the construction of RCC pillars as per drawing and design. Fixing the sign board with M.S. flat bar clamp to the pillar, necessary earth work etc. all complete as per drawing & direction of the PE.	1.00	Each	9050.00	9050
7	Supplying and making 300mmx450mm Triangular Flag (Red) made of Cotton cloth in connection cutting, sewing and binding with bamboo post by cotton lace etc. all complete as per direction of the PE.	100.00	Each	25.00	2500
			Total Taka=		**300,000**
	In words: Taka (Three lakh) only.				

3.5. Fingerlings stoking

Natural recruitment of carp spawn and fingerlings declining due to human interferences and environmental degradation which hampered the productivity of open water capture fisheries resources. To improve the productivity of open water, DoF has initiated regular program from revenue and development budget to release fingerlings of major carp in open water bodies. Stocking of fish fingerlings into *beels* and floodplains is a temporary measure to address the quick declination of fish production in open water (DoF, 2019).

In addition to *beel* nursery, fish fingerling of different species of Indian major carp was stocked in the *beel* to increase *beel* productivity. Table-5 shows the allocation and the amount of fingerling stocked in the *beel*. The money is allocated to Upazilla Office and the Upazilla officer procures the fingerlings following Bangladesh Public Procurement Act, 2006 and Public Procurement Rules, 2008. There is an Upazilla committee for fingerling stocking in open water areas at Upazilla level comprising of 13 members, which includes local government representatives, government officers, farmers and beneficiaries. Responsibilities of that committee are to select fish species for fingerling stocking, procurement of fingerlings, receive and release the purchased fingerlings in selected area with transparency.

Fig. 5. Fingerling stocking in *Sajia Kawnia Beel.*

In the DPP, 120,00000 taka was allocated for releasing 48000 kg of indigenous fish fingerlings for all 40 *beels*. Therefore, 250 taka was allocated for a kilogram of fish fingerling, which was not sufficient to procure small indigenous fish species (SIS). So, in 2019-20, indigenous major carp species were stocked with an allocation of 182500 Tk in the beel (Table 5). If the proposed revised DPP permits, there will be sufficient funds for releasing SIS in the beel which will eventually support enhancing fish biodiversity, rejuvenating endangered species like magur, pabda, kalbaus and will increase beel production. A total of 730 kgs of fingerlings of Rui, Catla and Mrigal was stocked in *Sajia Kawnia beel* in 2019-20, which is expected to contribute 7063 kg additional production to the total *beel* production. The species composition was maintained as 30%, 40% and 30% for Rui, Catla and Mrigal, respectively following the Government guidelines.

Table-5. Summary of fingerling stocking of indigenous fish in *Sajia Kawnia Beel*

Year	Allocation (BDT)	Species stocked	Number of fingerlings stocked	Individual size of fingerling (kg)	Expected output (contribution to the production)	
					In quantity (kg)	In monetary value (tk)*
2019-20	1,82,500	Rui	8016	214	1915	287250
		Catla	8742	279	2757	413550
		Mrigal	6785	237	2392	358800
		Total	23543	730		

*Calculated the price as 150 BDT/ kg of fish.

4. Yield of the *beel*

To estimate the annual yield of the *beel*, `Catch assessment survey methodology of Department of Fisheries (DoF)' is applied. According to the methodology, a concern officer needs to visit the beel once a month during fishing period of the *beel*. Physical condition and general information of the *beel* has to be collected following format Beel-1. During visit, the responsible officer for data collection has to interview with fish farmers/fishermen/beneficiary to accumulate information of beel. *Beel* area, fishing method, no of fishing unit, fishers, no. of gears and type, no. of boat, no of *katta* etc. is incorporated to this form.

Beel fishing is being usually done by two ways, as Katta fishing and other fishing, where fish is caught by gears and other units. Detail procedure of catch data collection is as follows.

4.1. Other fishing

- During the visit the sample fishing *beel*, the respective officer has to collect data on fish catch by species-wise once in a month during fishing period of beel.
- He has to collect data on the visiting day and also previous day (Format Beel-2).
- Sample unit of fishing has to be selected for each type of gear.
- Estimate average production of two days.
- Gear-wise total production has to be estimated (Average production ✕ Raising Factor).
- Total catch of sample day' has to be estimated (Format Beel-3) for all gears.
- Total catch for the whole season on the basis of total no. of fishing days and sample data has to be estimated (Format Beel-4)

4.2. *Katta* fishing

- At the stage of declining water of *beel*, *katta* fishing is usually started.
- Firstly, total *katta* has to be listed.
- Sample size of *katta* has to be determined for collecting information.
- Total catch has to be estimated by using Raising Factor (Format Beel-5).

4.3. Estimation of annual production/yield

Annual total fish production can be estimated from (Format Beel-6) other fishing and *katta* fishing.

Year-wise production/yield in *Sajia Kawnia Beel* is shown in Table-6. Fishing period of this *beel* is usually from October to January. So, the production of 2020-21 in this *beel* has not been compiled yet, only partial catch is shown. General information and the other formats of catch data collection for this *beel* are shown as Annexure (Format Beel-1 to 6)

Table-6. Year-wise yield in *Sajia Kawnia Beel*

Year	Total Production (kg)	Average Area (ha)	Unit Production (Kg/ha)	Increased production from baseline (kg)	Value of the additional production (BDT)*	Value of the total production (BDT)*	Remarks
2017-18 (Baseline)	28987	41	707.02	-	-	4348050	
2018-19	29380	41	716.59	393	58950	4407028	
2019-20	35478	41	865.32	6098	914700	5321718	Production impacted by beel nursery and fishing code implementation
2020-21 (Expected)	44157	41	1077.55	11679	1751850	6623550	Production is supposed to be impacted by beel nursery, fish sanctuary, fingerling stocking and fishing code implementation
2021-22 (Projected)	50635	41	1344.78	13948	2097600	7595250	Production is expected to be increased due to all project interventions
2022-23 (Projected)	56785	41	1385	15769	2365350	8517750	Production is expected to be increased due to all project interventions
			Total	47887	7188450	36813346	
*Calculated as 150 BDT/ kg fish fingerling.							

5. Economic analysis

Economic analysis for the year of 2018-19 and 2019-20 of *Sajia Kawnia beel* has been shown in Table-7. The total NATP-2 investment for this *beel* was 2,89,500 BDT and the CBO's investment was 5,50000 BDT in 2018-19 and 2019-20. So, the total investment was 12,39,500 BDT. On the other hand, the total return was 18036000 BDT in these two years.

Therefore, the net return was 1934981 BDT. Total number of beneficiary of this *beel* is 100. So, individual average benefit from these two years was 128609 BDT.

Table-7. Economic analysis of *Sajia Kawnia beel* (2018-19 and 2019-20) (Unit: BDT)

Activities	Govt. Investment	CBO investment	Total investment	Total Return in 2 yrs	Net Return in 2 yrs	Individual benefit from 2 years
CBFM support	87000	0	87000	11309837	9374856	93748.56
Habitat improvement	0	0	350000			
Beel nursery	120000	150000	220000			
Fish sanctuary	0	0	0			
Fingerling stocking	182500	0	182500			
Govt. lease value	-	400000	400000			
Total	389500	550000	1239500			

The projected economic analysis for the whole project period of *Sajia Kawnia beel* has been shown in Table-8. The total NATP-2 investment for this *beel* was 13,50,000 BDT and the CBO's investment was 1400000 BDT. So, the total investment was 2050000 BDT. On the other hand, the total return was 36813346 BDT. Therefore, the net return was 23098340 BDT. Total number of beneficiary of this beel is 100. So, individual average projected benefit/year was 46874.28 BDT.

Table-8. Projected economic benefits of *Sajia Kawnia beel* beneficiaries for the project period (2018-19 and 2022-23) (Unit: BDT)

Activities	Govt. Investment	CBO investment	Total investment	Total Return*	Net Return	Individual Benefit/Year
CBFM support	100000	0	100000	36813346	23098340	230894
Habitat improvement	350000	0	350000			
Beel nursery	300000	300000				
Fish sanctuary	300000	0	300000			
Fingerling stocking	300000	100000	300000			
Govt. lease value	-	1000000	1000000			
Total	1350000	1400000	2050000			
*Figure came from Table-6						

6. Milestone chart for the implementation of *Sajia Kawnia beel* management plan

A milestone chart for the implementation of *Sajia Kania beel* management plan is shown in Table-9. All the activities, which have already been done and the future planning have been shown in this chart. CBO of this beel was formed at the fourth quarter of 2018-19. Habitat improvement could not be done in proper time due to Covid-19 situation. But, the tender procedure has been completed and supposes to be implemented at the third quarter of 2020-21. *Beel* nursery was implemented two times in 2018-19 and 2019-20. This activity will continue every year for the rest of the project period. Fish sanctuary was established at the fourth quarter of 2019-20. Fingerling stocking was also done at the fourth quarter of 2019-20 and it will be continued in this financial year.

7. Conclusion

The sustainability of *beel* fisheries resources are especially important both from ecological and economic point of view. *Beel* management involving local beneficiary is required to increase productivity. NATP-2 intervention regarding beel management exhibits encouraging results. But, there are some challenges, such as sustainability of access right to the *beel*, illegal fishing, interference of influential persons, lack of awareness, lack of government manpower to support the community etc. are needed to overcome for successful management of this beel. Government policy support regarding beel leasing system is important for the sustainability of this activity.

Table- 9. Milestone chart for *Sajia Kawnia beel* management plan

Activities	2017-'18				2018-19				2019-20				2020-21				2021-22				2022-23				Progress up to December, 2020
	1Q	2Q	3Q	4Q	1Q	2Q	3Q	4Q	1Q	2Q	3Q	4Q	1Q	2Q	3Q	4Q	1Q	2Q	3Q	4Q	1Q	2Q	3Q	4Q	
1.CBFM support for fishing code implement																									CBO formed in 2018-2019 and functioning continuously
2. Habitat improvement																									Time has been extended till March, 2021
3. Beel Nursery																									2 times implementation completed in year 2018-19 and 2019-2020. For 3rd time, money will be allocated to Upazila office in 2020-21. Rest 2 times implementation will be completed next consecutive 2 FY after DPP revision.
4. Fish sanctuary																									Implementation is completed in 2019-2020 and will be managed throughout project period
5. Fingerling stocking																									Partially implemented in 2019-2020 and rest will be implemented by allocating money to Upazila office in 2020-21.
1Q= July-Aug-Sep, 2Q= Oct-Nov-Dec, 3Q= Jan-Feb-Mar, 4Q= April-May-June.																									

8. Reference

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Annexure I: Baseline Survey Form for *Beel* Management Activity

1. **Name and address of the office:**

Rajgong Baor, Putkhali, Sharsha, Jashore.

2. Name and ownership pattern:

No.	Parameters	Response
1.	Name of the Beel:	Rajgong Baor
2.	Type of ownerships: (Government/khas=1, Private=2, Mixed=3)	1
3.	Location of Beel:	Putkhali, Sharsha, Jashore
4.	Village:	Rajgong
5.	Mouza:	Putkhali
6.	Union:	Putkhali
7.	Upazilla:	Sharsha
8.	District:	Jashore

3. Physical features of the Beel:

No.	Parameters	Response
1.	Area of Beel in dry season (ha)	36.35 ha
2.	Area of Beel in rainy season (ha)	36.35 ha
3.	Maximum water depth in rainy season (m)	8 m
4.	Minimum water depth in dry season (m)	1 m
5.	Mean depth (m)	4.5 m
6.	Type of water body (Beel=1, Cannel=2, River/ dead river=3, Haor=4, Baor=4, Flood plain=5)	4

7.	Nature of the Beel (Seasonal=1, Perennial=2)	2
8.	Existence of current (Year round=1, Less than 06 months=2, More than 06 months=3)	1

4. Connectivity of the Beel with other water body:

No.	Parameters	Response
1.	Connected with cannel (Yes=1, No=2)	1
2.	Connected with other Beel (Yes=1, No=2)	1
3.	Connected with river (Yes=1, No=2)	1
4.	Connectivity regulated by sluice gate (Yes=1, No=2)	1
5.	Connected with Haor basin (Yes=1, No=2)	2
6.	Connectevity interrupted by road/embankment (Yes=1, No=2)	1

5. Present fisheries related activities:

No.	Parameters	Response
1.	Natural: Not under any management (Yes=1, No=2)	2
2.	Under Community-based Fisheries Management (Yes=1, No=2)	1
3.	Aquaculture by individual (Yes=1, No=2)	2
4.	Leased out (Yes=1, No=2)	1

6. List of available fish species (natural/stoked/cultured):

No.	Local Name	Common/English Name	Scientific Name
01	Rui	Rui	*Labeo rohita*
02	Catla	Catla	*Catla catla*
03	Mrigala	Mrigala	*Cirrhinus cirrhosus*
04	Silver carp	Silver carp	*Hypophthalmichthys molitrix*
05	Mirror carp	Mirror carp	*Cyprinus carpio*
06	Common carp	Common carp	*Cyprinus carpio*

7. List of available small indigenous species (SIS):

No.	Local Name	Common/English Name	Scientific Name
01	Mola	Mola	*Amblypharyngodon mola*
02	Koi	Climbing perch	*Anabas testudineus*
03	Chanda	Indian glassy fish	*Chanda ranga*
04	Sarpunti	Olive barb	*Puntius sarana*
05	Pabda	Pabda	*Ompok pabda*
06	Foloi	Pholi	*Notopterus notopterus*
07	Tengra	Tengra	*Mystus tengara*
08	Bata	Bata	*Labeo bata*

8. List of available endanger/rare fish species:

No.	Local Name	Common/English Name	Scientific Name
01	Gozar	Great snakehead	*Channa marulius*
02	Chital	Clown knife fish	*Notopterus chitala*
03	Kalbaus	Orange fin labeo	*Labeo calbasu*
04	Rani fish	Bengal loach	*Botia dario*
05	Baim	Zig-zag eel	*Mastacembelus armatus*

9. List of other aquatic species (shrimp, crab, swamp eel, tortoise, birds etc.):

No.	Local Name	Common/English Name	Scientific Name
01	Golda chingri	Giant freshwater prawn	*Macrobrachium rosenbergii*
02	Kata kakra	Freshwater crab	*Potamon woodmasoni*
03	Bok pakhi	Heron	*Nycticorax nycticorax*
04	Hash	Goose	*Anser anser*
05	Mach ranga pakhi	Pale capped pigeon	*Alcedo atthis*

10. List of available aquatic weed:

No.	Local Name	Common/English Name	Scientific Name
01	Kochuripana	Water hyacinth	*Eichhornia crassipes*
02	Topapana	Water lettuce	*Pistia stratiotes*
03	Khudipana	Duck weed	*Lemna minor*

04	Kolmi	Water spinach	*Ipomea aquatic*
05	Dol	Asian water weed	*Hygrorayza aristata*
06	Helencha	Hingcha	*Enhydra fluctuans*
07	Malancha	Alligator weed	*Alternanthera philoxerodies*

11. Structure of Beneficiary Group:

No.	Parameters	Response
1.	Is there any beneficiary group (Yes=1, No=2)	1
2.	If yes, total number of members in the group	59
3.	If yes, total number of female members in the group	00
4.	If yes, is there any executive committee (Yes=1, No=2)	1
5.	If yes, total number of members in the executive committee	8
6.	If yes, total number of female members in the executive committee	00

12. List of fishing gears used for fishing:

No.	Local Name	Common/English Name	Group Name
1	Beir jal	Seine net	Fishing gears

13. Annual fish production (kg/ha):

No.	Species	Total production	Unit production (kg/ha)
1.	Rui	12000 kg	339.36 kg

2.	Catla	1200 kg	33 kg
3.	Mrigal	8000 kg	220 kg
4.	Kalibaus	80 kg	2.2 kg
5.	Bata	200 kg	5.5 kg
6.	Silver carp	40000 kg	1100.4 kg
7.	Grass carp	2000 kg	55 kg
8.	Mirror carp/ Common carp	4000 kg	110 kg
9.	Other exotic carp	10000 kg	275.1 kg
10.	Khoira	6000 kg	165 kg
11.	Maya	1200 kg	33 kg
12.	Boal/ Air	800 kg	22 kg
13.	Shol/ Gozar/ Taki	200 kg	5.5 kg
14.	Vetki	160 kg	4.4 kg
15.	Singi/ Magur/Bele	80 kg	2.2 kg
16.	Small shrimp/prawn	400 kg	11 kg
17.	Tilapia/ Nilotica	200 kg	5.5 kg
18.	Punti/Sarpunti/ Thai sarpunti	320 kg	8.8 kg
	Grand Total	86,840 kg	2434.96 kg

14. No of fish landing center: 01

15. Description of suitable area for establishment of a Fish Sanctuary:

No.	Parameters	Response
1.	Is there any suitable place for establishing fish sanctuary (Yes=1, No=2)	1

2.	Location of the place (East side=1, West side=2, North side=3, South side=4, Middle=5)	1
3.	Area of the sanctuary (ha)	1 ha
4.	Maximum water depth in rainy season (m)	4.57 m
5.	Minimum water depth in dry season (m)	2.29 m
6.	Mean depth (m)	3.43 m

16. Description of suitable area for habitat improvement:

No.	Parameters	Response
1.	Is there any area to which require improvement (Yes=1, No=2)	1
2.	Purpose for habitat improvement (Beel nursery pond=1, Fish sanctuary area=2, others=3)	1
3.	Location of the area (East side=1, West side=2, North side=3, South side=4, Middle=5)	2
4.	Area of the site (ha)	1 ha
5.	Maximum water depth in rainy season (m)	4.57 m
6.	Minimum water depth in dry season (m)	2.29 m
7.	Mean depth (m)	3.43 m

17. Existing problems in case of proper management:

No.	Problems
1	Water flows from the junction of baor and river
2	Lack of equipment (fry, feed, fishing gears etc.) for fish farming.

18. Suggestion/ recommendation for improvement of fishery resources in the beel:

No.	Suggestion/ recommendation
1	Habitat improvement
2	Releasing fish fry of native species
3	Arrangement of a sluice gate at the junction of baor and river
4	Arrangement of equipment for fish farming