Report on Fifth Round Fish Catch Monitoring and Bio-diversity Impact Study of HFMLIP-LGED/WorldFish

Haor Flood Management and Livelihood Improvement Project

Local Government Engineering Department
WorldFish Bangladesh
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Abbreviations

BUG	Beel User Group
CE	Community Enumerator
CBO	Community Based Organization
CR	Critically Endangered
CRMCE	Community Resource Management Coordination Expert
DoF	Department of Fisheries
DPC	District Project Coordinator
EN	Endangered
HFMLIP	Haor Flood Management and Livelihood Improvement Project
JICA	Japan International Cooperation Agency
IUCN	International Union for Conservation of Nature
Kg	Kilogram
LGED	Local Government Engineering Department
NGO	Non-Government Organization
Spp	Species
SIS	Small Indigenous Species
UPC	Upazila Project Coordinator
VN	Vulnerable

Executive Summary

Haor Flood Management and Livelihood Improvement Project (HFMLIP) has been implementing by Local Government Engineering Department (LGED) in five *haor* basin districts namely Kishoreganj, Netrokona, Sunamganj, Habiganj and Brahmanbaria. LGED and WorldFish have proven experience of community-based fisheries resource management (CBFRM), so, it would be quite effective to implement such activities which could contribute to increasing productivity together with infrastructure improvement so that living standard of the people in the target areas would be improved. WorldFish is undertaking fish catch, biodiversity and livelihood impact monitoring study under fisheries promotion component. Since capture fisheries is one of the major income sources of the *haor* people, so, fishing is a key livelihood opportunity for most of the households in *haor* areas. As such, Capture fisheries play an important role in food security and poverty alleviation.

Beel User Groups (BUGs) have been implementing a variety of management interventions to increase fish production and improve biodiversity within the command area of HFMLIP. The management and physical interventions included forming BUG for waterbody management, skill development training, habitat restoration and improvement by *beel* excavation, plantation on *kanda* (raised landscape surrounding *beel*), established *beel* connectivity by canal desiltation, conserved fish species through fish sanctuary establishment in the *beel*, observing closed fishing season, restricting destructive fishing gears, regulate fisher access, reducing levels of fish exploitation during critical periods and fishing effort.

The objective of the HFMLIP-WorldFish partnership is to assess the impact on fish production and biodiversity. This assessment should be made in context of environmental conditions and fisheries management practices. Fish catch monitoring studies have been carried out in 30 (25 project/case and 5 control) waterbodies in Sunamganj, Netrokona, Kishoreganj, Brahmanbaria and Habiganj. This report presents a consolidated result of the analysis carried out in 2017-18 to 2020-22.

Data reveal that during baseline year (2017-18 data slot) total combine catch (open catch and major catch) was 245 kg/ha/year. Catch trend was steadily increased as 272 kg/ha/year, 356 kg/ha/year and 384 kg/ha/year on 2018-19 data slot, 2019-20 data slot and 2020-21 data slot respectfully. However, catch was 360 kg/ha/year on 2021-22 data slot due to less flooding extend period in *haor* area. Catch trend shows that the coefficient of determination

R^2 value is 0.7869 means 78% of the variation in the output variable is explained by the input variables.

In control waterbodies (n=5) open and major catch estimated like case waterbodies. Data of control waterbodies reveal that during baseline year (2017-18 data slot) total combine catch (open catch and major catch) was 215 kg/ha little bit lower than case waterbodies. Catch trend was increased as 230 kg/ha, 300 kg/ha and 320 kg/ha on 2018-19 data slot, 2019-20 data slot and 2020-21 data slot respectfully. In compare with case waterbodies R^2 value 0.0847 is less in control waterbodies. However, fish production increasing rate was less than case waterbodies. This status indicated that the project intervention is contributed on open waterbodies fish production in *haor* areas.

A total of 144 species of fish and prawn were recorded from open catch during monitoring period (2017-2021) from all (25) case waterbodies. The maximum numbers of species 124 found in Sunamganj. District wise species of fish and prawn were recorded 92 at Netrokona, 108 at Kishoreganj, 118 at Habiganj and 57 at Brahmanbaria. The present study revealed that total number of species were varies from 54 to 90 at the case waterbodies. However, waterbody wise yearly species number were varying from 17 (Suraiya Beel, 2021, Dattakhila, 2021) to 64 (Kala-sunda Beel, 2020). Shannon–Wiener diversity index (H') value range found in case waterbodies from 1.13 to 3.66. Most of the waterbody H' value found near 3 that indicating sustainable species diversity in the habitat.

Open water catch data reveled that highest 20 threatened species were identified from Andaura Beel in Habiganj. Lowest 9 threatened species were recorded in Hogla, Netrokona and Boro Paikka Beel in Habiganj. Critically Endangered (CR) species ranges found 1-3 in a waterbody among 9 CR species in Bangladesh. Vulnarable (VU) species ranges found 3-9 in a waterbody among 25 VU species in Bangladesh and Endangered (EN) species ranges found 1-10 in a waterbody among 30 EN species in Bangladesh. Finding reflected that case waterbodies in *haor* were very rich and important habitat including breeding, feeding and growing ground for threatened species. So, waterbodies in *haor* must protect for threatened fish species conservation in Bangladesh.

Catch per Unit Effort (CPUE) (catch/gear/day) found higher for seine net, because this net is a large net and operated by 6 to 10 people. On the other hand, push net CPUE was low, because push net is small and operated by one person, even children. CPUE of cast net, gill net, seine net and trap were found decreased trend over the monitoring period. On the other hand, hook and line, long line and set bag net found nearly steady over the monitoring

period. Decreasing trend of gill net catch (4.36 kg to 2.62 kg) indicating either lack of fish availability in the waterbody or number of gears increased in the fishing area. Decreasing trend of seine net CPUE indicating (10.96 to 6.33 kg) fishes in the feeding area also decresed. So, seine net and gill net should be controlled for sustainable fish catch.
Like CPUE, Catch per Person per Day (CPD) also decreasd for cast net, gill net and seine net user. CPD increased found longline and set bag net user over monitoring period in case waterbodies. Highest CPD found for large lift net user (4 kg/day) and lowest for push net user (1.28 kg). Overall data reflected the actual income was decreased over the monitoring period from open catch for maximum types of gear user. Fishing pressure should be decreased to gain profit from increased production from the waterbody and sustainable livelihood on fishing.

Project intervention also contributed on species diversity increament that ensured sustainable fish production from waterbodies. *Haor* waterbodies were good habitat for threatened species shelter and breeding. *Haor* waterbodies are important for conserving fisheries resources in inland fresh water fish species that contributing fresh water fish production in Bangladesh. It is also contributing to fisher's livelihood and nutrition in *haor*. For fisheries conservation and sustainability fish sanctuary scale up and establishment should continue. Less productive waterbodies and ecological diversity can be assessed for seasonal stocking with threatened species and local fast-growing fish species.

WorldFish arranged district level result dissemination workshop on " Fish Catch, Biodiversity and BUG Members Livelihood Impact Monitoring", presented the study results of fish catch & biodiversity and livelihood studies carried out in sample waterbodies in Sunamganj, Netrokona, Kishoreganj, Brahmanbaria and Habiganj district.

In addition, a national level workshop also held on ''Fish Catch Monitoring and Biodiversity Impact Study and Livelihood Impact Assessment of Beel user Group Members under HFMLIP (LGED Part) on 22nd June, 2022 at the Seminar Room (Level-4), LGED HQ, Dhaka chaired by Mr. Sk. Md. Mohsin, Chief Engineer, LGED. Honorable Chairman indicated Haor region as one of the Hot Spots for providing livelihood support for the vulnerable people. He highlighted the enormous impact of the interventions for species diversity, habitat restoration and beel connectivity establishment for maintaining a balanced fisheries population stock in the Haor region. WorldFish Team attended and delivered final presentation on that workshop. The overall progress of the project in terms of Fish production, biodiversity and livelihood of fisher's was first presented to the audiences who joined from different government and non-government organizations including LGED Bangladesh, JICA

Representative, Department of Fisheries, Bangladesh Water Development Board, CNRS, BRAC, We CARE Bangladesh, WorldFish-Bangladesh and others.

Chapter-1

1. Introduction

The Inland capture fisheries sector comprises rivers and estuary (853,863 ha), Sundarban (177,700 ha), *Beels*[1] (114,161 ha), Kaptai Lake (68,800 ha) and Floodplain[2] (2,651,567 ha) in Bangladesh. Total capture fisheries area 3,866,091 ha produced 1,248,401 MT fish (323 kg/ha) in 2019-20 (DoF. 2020). Bangladesh ranked 3rd in inland open water capture production (FAO,2020). The share of inland capture fisheries to total fish production have been gradually reduced to the lowest level from 62.59% in 1983-84 to 27.72% in 2019-20. However, the implementation of governments several need-based special programs has impacted to minimize the declination of fish production (DoF. 2020).

Haors[3] are endowed with enormous fisheries resources in the project area, as a source of income, employment and consumption for the rural poor. Fishing is a key livelihood opportunity for most of the households in *haor* areas and plays an important part in food security and poverty alleviation. In practice, the management of *haor* fishery has often excluded poor fishers and encourage leaseholders to exploit fisheries resources at non-sustainable level. The Haor Flood Management and Livelihood Improvement Project (HFMLIP) has been intervening fisheries in *haor* waterbody, often with permanent area of water resources management through group approach called a Beel User Group (BUG). The BUG constitutes with mostly fishers and others project beneficiaries living around the waterbodies and use it's resources. HFMLIP cover 129 waterbodies under fisheries co-management within the project period. The fisheries component of HFMLIP need to provide information on average fish catch and fish diversity situation of respective project waterbody located in *haor* (consists *beel*, floodplain, canal and river).

HFMLIP has assigned WorldFish to undertaking impact monitoring activities on fish catch, fish diversity (ichthyodiversity) and livelihoods. WorldFish has been assigned to accomplish following objectives:

[1] Beel is an open water (capture) fisheries. Beel is defined as lake-like wetland with relatively large surface, static water body as opposed to moving water in rivers, canals-typically called khals. It is a low-lying depression on a wetland or floodplain, sometimes drying up in the dry season. Sometimes, it contains water around the whole year.

[2] Floodplains are relatively low-lying flat land area, bordering rivers and seasonally over flooded by overspill from the main river channel. It is inundated for 3-4 months in the rainy season and partly dried during the dry season.

[3] A *haor* is a marshy wetland ecosystem which physically a bowl or saucer shaped. The *haors* remain flooded for about 7 to 8 months. During the rainy season, the *haors* look just like vast inland sea.

- Assessment of the impact of HFMLIP intervention on fish catch and fish diversity through regular monitoring and surveys and modeling the relationship between productivity and biodiversity to provide waterbody specific management recommendations based on ecological conditions in 25 case and 5 control waterbodies.
- Analysis of livelihood impacts, including fish consumption and household food security status, for case and control participation in project waterbodies and non-project waterbodies.
- Dissemination of research findings and institutional learning to local, national and international audiences through production of innovative high quality communication products and peer reviewed research publications.

In HFMLIP, Beel User Groups (BUGs) have been implemented a variety of management interventions to increase fish production and improve biodiversity. The interventions included forming BUG for waterbody management, skill development training, habitat restoration and improvement by *beel* excavation, plantation on *kanda* (raised landscape surrounding *beel*), conserved fish species through fish sanctuary establishment in the *beel*, observing closed fishing season, restricting destructive fishing gears, regulate fisher access, reducing levels of fish exploitation during critical periods and fishing effort etc.

This report covers fish catch and fish diversity status, catch per unit effort, fishing intensity on the basis of gear and fisher number, fish price, status of threatened species, environmental condition of *haor* in HFMLIP project/case (25) and control waterbodies (5) over the period of 2017 to 2022 and recommendations for waterbody management for sustainable fish production as well as fish species conservation.

Chapter-2

2. Methodology

2.1 Site Selection and Waterbody Sampling

The HFMLIP waterbodies are located in deeply flooded areas of the Sunamganj, Kishoreganj, Netrokona, Habiganj and Brahmanbaria. Together with adjacent waterbodies converted into single floodplain in monsoon season are sometime treated as a single cluster. There are three categories of waterbody considered for sampling and monitoring i.e. single *beel*, cluster *beel* and river type. Formal and informal meetings were conducted with HFMLIP staffs to select the sample waterbodies for the monitoring purposes. Currently 30 waterbodies have been selected for monitoring of which 25 case waterbodies and 5 control waterbodies in five districts. Among these 30 waterbodies, 11 waterbodies located in Sunamganj (case 9 and 2 control), 5 in Netrokona (case 4 and control 1), 7 in Kishoreganj (case 6 and control 1), 1 case *beel* in Barhmanbaria and 6 in Habiganj (case 5 and control 1). Table 1 shows list of monitoring case waterbody in different districts and Upazilas (sub-district). To ensure quality monitoring, each Technical Specialist was assigned to a certain number of waterbodies to supervise fish catch and diversity monitoring.

Table 1: List of Project/Case and Control Waterbody According to Habitat Type, Monitoring Started in 2017
Project/Case waterbody

Sl	Waterbody	Upazila	Habitat	Area (ha)
	Sunamganj			
1	Chat of Sunbari	Dharmapasha	River Type	30.5
2	Kal Dora Nak Dora Beel	South Sunamganj	River Type	29.22
3	Pakhimara Ram Ghuta Jolokorpunjo	South Sunamganj	Single Beel	47.38
4	Kumaria Beel	Dharmapasha	Single Beel	18.59
5	Shimul Tola Chikon Dair	Dharmapasha	Single Beel	41.45
6	Kirton Khola	Dharmapasha	Single Beel	7.94
7	Suraiya Beel	South Sunamganj	Single Beel	5.38
8	Kala Sunda Beel	Chatok	Single Beel	7.61
9	Chto Nainda Boro Nainda Beel	Derai	Cluster Beel	17.12
	Netrokona			
10	Rangadair Jolmohal	Barhatta	River Type	15.09

Sl	Waterbody	Upazila	Habitat	Area (ha)
11	Baradia Beel	Atpara	Cluster Beel	6.54
12	Hogla	Purbadhola	Single Beel	56.89
13	Dattakhila	Mohonganj	Single Beel	7.91
	Kishoreganj			
14	Noniala Beel	Itna	Single Beel	7.05
15	Chapra Beel	Itna	Cluster Beel	5.34
16	Kalni Beel	Itna	Cluster Beel	8.06
17	Dhoniar Kona Beel	Itna	Cluster Beel	2.06
18	Korgaon- ½ Gazipur	Austogram	Single Beel	7.55
19	Goza Beel	Bajitpur	Single Beel	2.06
	Brahmanbaria			
20	Satbila Fishery	Bancharampur	Single Beel	30.61
	Habiganj			
21	Choto Beri Beel	Baniachong	Single Beel	7.79
22	Andaura Beel	Baniachong	Single Beel	34.72
23	Kutiara Beel, Udgar Khal O Kutiarar Khal	Baniachong	Khal Type	14.38
24	Boro Paikka Beel	Bahubal	Single Beel	5.07
25	Silarag Group Fishery	Azmiriganj	Single Beel	17.88

Control waterbody

Sl	Waterbody	District	Upazila	Habitat	Area (ha)
1	Buriya River	Sunamganj	Dharmapasha	River Type	35.21
2	Kasto Chapra Beel	Sunamganj	South Sunamganj	Single Beel	6.88
3	Rouha Beel	Netrokona	Barhatta	Single Beel	10.12
4	Patuajuri Beel	Kishoreganj	Itna	Cluster Beel	12.14
5	Mourra Beel	Habiganj	Baniachong	Single Beel	10.93

2.2. Catch Monitoring and Biodiversity

2.2.1. Open Catch

The biological monitoring program was implemented during the reporting period. Fish catch and fishing effort were monitored to estimate the annual total catch and fishing effort through catch assessment and frame (fishing gear) survey. The daily catch of every individual fisherman and his/her gear (Catch per unit effort-CPUE) was monitored for 8 days in a month (equal interval, 4th day for next sampling). The numbers and weight of all fish species

in the catch were recorded. Furthermore, the gear-type, its mesh size, its owner status and the number of units used per fisherman were recorded 8 days in a month through a standardized counting of the number of gears to estimate gear wise fishing effort (fishing days).

2.2.2. Major Catch

Normally major or organized fishing activities start when the dykes surrounding waterbodies appear, which occur is usually before winter. In the *haor* habitat, major catch generally starts in late November and continues up to March of the following year.

Community Enumerators (CE) are involved in data collection process at each waterbody level. One CE was responsible for open catch monitoring and major catch data collection. In addition to catch monitoring, CEs also collected information on the gear types used by each fisherman during fishing and gear landing from fishing. CE individually assigned to each waterbody provided the CEs with logistical and technical support.

The total organized catch for each waterbody was calculated as follows:

$$\sum catch\ done\ by\ BUG$$

The present study incorporates open catch data in 2017, 2018, 2019, 2020 and 2021, and major catch data in 2017-18, 2018-19, 2019-20, 2020-21 and 2021-22.

*Production/Ha = Total catch(Open+Major)/Area(Ha)

2.3. Data Analysis

Survey covered gear census in a waterbody and sample catch monitoring for open catch. Catch monitoring is an observational process on fishing effort that was done for the duration of eight days per month per site. It recorded species wise catch statistics of each gear type, Microsoft access will be used for data entry and analysis.

Gear survey involves a regular spot survey for a sample of gears in operation and their total catch. In this case, gear census covered all the gears (types and numbers) operating in the study sites. The total monthly catch for each waterbody was calculated as follows:

Where,

$$Monthly\ Catch\ per\ site = N * \sum_{i,j=1} f_{i,j} * cpue_{i,j}$$

N : number of days per month when fishing was monitored

f : average number of gears used per day (for each gear type)

CPUE : average daily catch per gear type (calculated yield/no of gears).

Average number of gear per day was used to estimate total number of gear-wise fishing effort for that month as well as for the whole year. Simultaneously, mean gear-wise catch rate was used to estimate total catch for that month and for the whole year.

Overall species distributions by gear were calculated using annual catch statistics data. Year wise and overall species distribution were calculated using catch statistics data. Overall production was estimated by summing up all estimated production of different gear types in each year.

2.4. Biodiversity - Shannon-Wiener Bio-diversity Index

The Shannon-Wiener Index (H') is one of several diversity indices used to measure biodiversity. In this study, species wise production rates were used to estimate the Shannon-Wiener diversity index (H'). The function was originally devised to determine the amount of information in a code or signal, and is defined as:

$$H' = -\sum_{i=1}^{S_{obs}} pi \log_e p$$

where,

H': Information content of sample (Index of diversity or Degree of uncertainty)

S_{obs}: number of species observed

pi: the proportion of individuals in the i^{th} species.

(Species Diversity & Richness calculates the index using the natural logarithm).

2.5. Monitoring Fishing Activities

According to the activity plan, major catch and open catch monitoring data have been collected by CEs. The major catch records reflect quantity of fish catches (kg), price of fish

sales (BDT), management costs, species diversity, income from fish sales and consumption during harvesting. These records are also shared with Beel User Groups (BUGs) members and respective HFMLIP staff.

Chapter-3

3. Results and Discussion

3.1. Fisheries Production

3.1.1. Total Production in Project/Case Waterbody

In project/case waterbodies (n=25) open and major catch estimated. Beginning year (2017-18 data slot) is considered as baseline information, because project interventions were not fully affected in the beginning year. Data reveal that during baseline year (2017-18 data slot) total combine catch (open catch and major catch) was 245 kg/ha/year. By the following year it was steadily increased as 272 kg/ha/year, 356 kg/ha/year and 384 kg/ha/year on 2018-19 data slot, 2019-20 data slot and 2020-21 data slot respectfully. However, catch was 360 kg/ha/year on 2021-22 data slot due to less flooding extend period in *haor* area. Fish catch trend shows that coefficient of determination R^2 value is 0.7869 means 78% of the variation in the output variable is explained by the input variables. However, fish production is increased by 47% compare with 2017 and 2022 in project/case waterbodies.

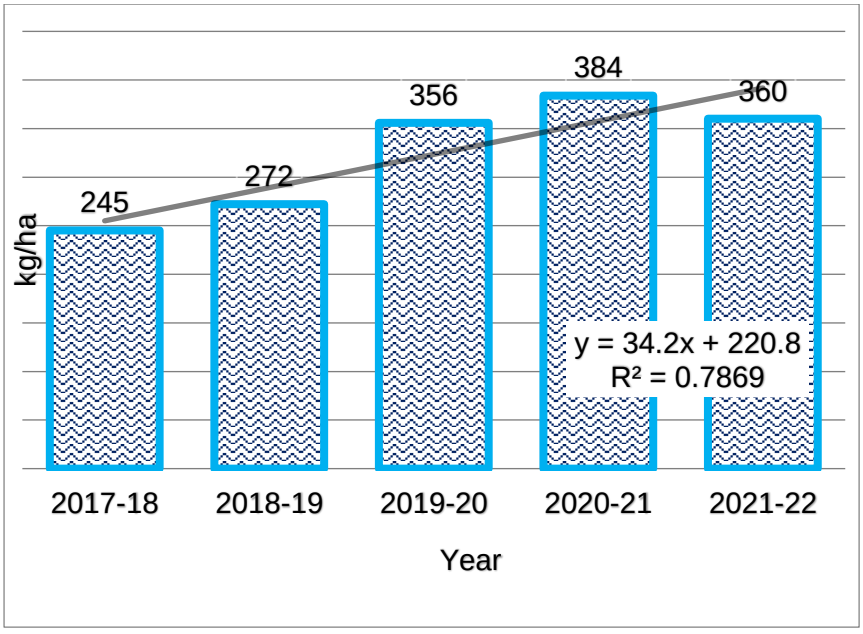

Figure 1: Productivity (Kg/ha/year) From Combined (Open & Major) Catches in Project/Case waterbodies.

3.1.2. Total Production in Control Waterbody

In control waterbodies (n=5) open and major catch estimated like case waterbodies. Data of control waterbodies reveal that during baseline year (2017-18 data slot) total combine catch (Open catch and Major catch) was 215 kg/ha/year little bit lower than case waterbodies. By the following year it was steadily increased as 230 kg/ha/year, 300 kg/ha/year and 320 kg/ha/year on 2018-19 data slot, 2019-20 data slot and 2020-21 data slot respectfully. In compare with project/case waterbodies R^{2*} value 0.0847 is less in control waterbodies. However, fish production increased by 0.47 % comparing 2017 and 2022 in control waterbodies that less than project/case waterbodies. This status indicates project intervention is contributed on open waterbodies fish production in *haor* areas.

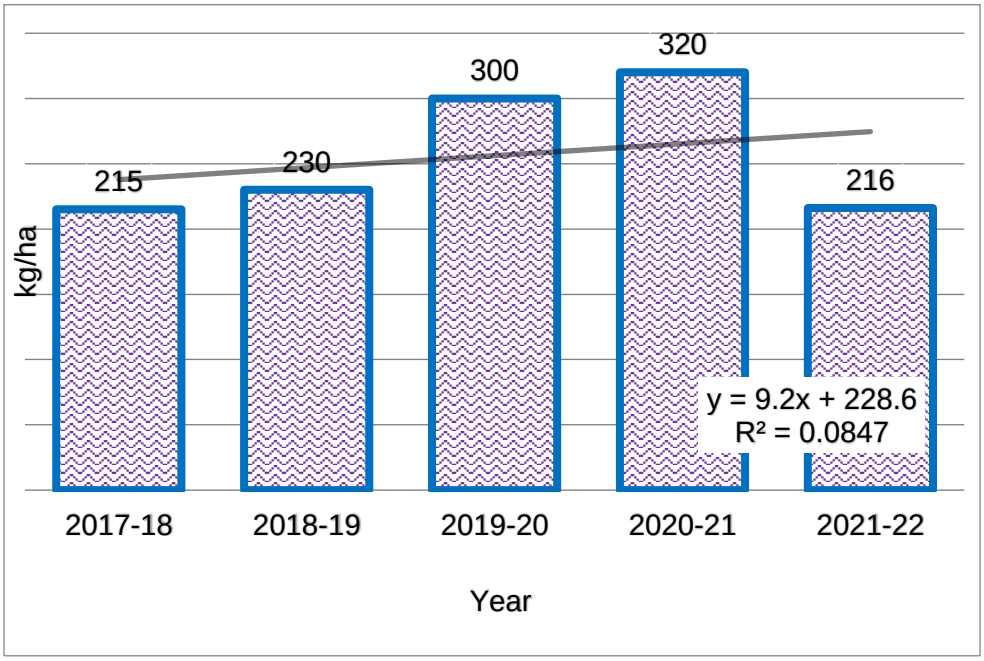

Figure 2: Productivity (Kg/ha/year) From Combined (Open catch and Major catch) Catches in Control Waterbodies

*The coefficient of determination, denoted R^2 is the proportion of the variation in the dependent variable that is predictable from the independent variable(s). R2 0.95 means 95% of the variation in the output variable is explained by the input variables. R^2 indicates strong correlation with fish production.

3.1.3. Open Catch in Project/Case Waterbody

District wise open catch data was analyzed. Fish catch during open catch period (May to December) found increasing trend. However, open catch decreased on 2021 compare with previous year in Sunamganj and Netrokona due to less flooding extend in 2021 that influenced on over all open catch trend (Figure-1). However, in down stream of *haor* districts like Kishorganj and Habiganj remained upward trend. Over all open catch was 48.56 ton (111.84 kg/ha/yaer) in 2017 that increased over the monitoring period (2017-2021) into 71.33 ton (164.28 kg/ha/year) in 2021, open catch increment was 46.89 % in all districts. It was 85.20 ton (196.22 kg/ha/year) pick open catch over the monitoring period in 2020.

Sunamganj: Estimated open catch found 19.88, 31.88, 35.85, 37.31 and 25.73 ton/year in Sunamganj in 2017, 2018, 2019, 2020 and 2021 respectively. Open catch increment trend was lower (R^2=0.1385) than over all increment trend (R^2=0.468). Waterbody wise yearly open water catch is furnished in Table-2.

Netrokona: Estimated open catch found 5.16, 9.02, 22.98, 17.11 and 11.60 ton/year in 2017, 2018, 2019, 2020 and 2021 respectively (R^2=0.2247) in Netrokona.

Kishoreganj: Estimated open catch were 9.67, 10.68, 12.15, 15.46 and 15.38 ton/year found in 2017, 2018, 2019, 2020 and 2021 respectively. Open catch increment trend was higher (R^2=0.9253) than over all increment trend.

Habiganj: Estimated open catch found 12.61, 14.82, 10.16, 14.40 and 17.33 ton/year in 2017, 2018, 2019, 2020 and 2021 respectively (R^2=0.2864).

Brahmanbaria: Estimated open catch were 1.24, 1.45, 1.26, 0.92 and 1.28 ton/year found in 2017, 2018, 2019, 2020 and 2021 respectively (R^2=0.1244).

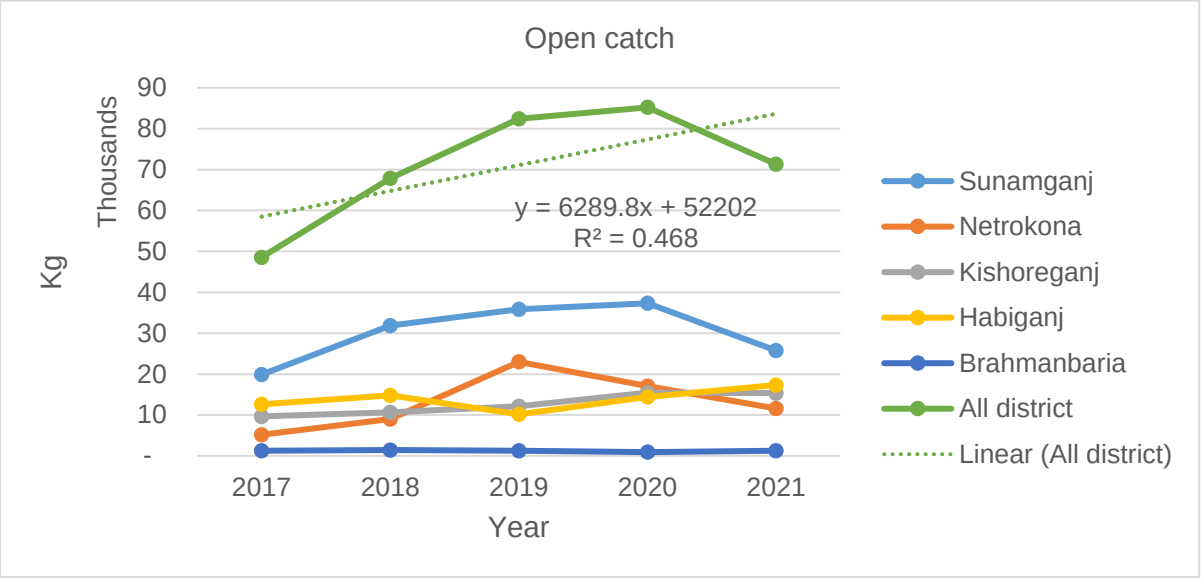

Figure 3: District Wise Open Catch Trend in Project/Case Waterbodies

Waterbody wise catch was analysed. The yearly catch range varied from 703 kg to 8,928 in Sunamganj (Table-2). Netrokona it was 488 kg to 11,659 kg. The production variation due to size of waterbody, habitat condition of waterbody and location of waterbody. But yearly production in a waterbody reflects production (fish catch) trends of the waterbody.

Table 2: Waterbody Wise Yearly Open Catch (kg/year) in Project/Case Waterbodies.

Waterbody/Year	Catch (kg)					
	2017	2018	2019	2020	2021	Total
Sunamganj	**19,883**	**31,883**	**35,846**	**37,308**	**25,731**	**150,651**
Chat of Sunbari	1,536	4,492	8,928	5,642	2,889	23,487
Choto Nainda Boro Nainda	3,671	8,897	4,394	6,107	7,263	30,332
Kal Dora Nak Dora Beel	3,027	4,668	3,826	3,965	2,175	17,660
Kala-sunda Beel	703	912	2,938	4,118	1,266	9,937
Kirton Khola	1,236	2,754	2,375	5,245	3,278	14,888
Kumaria Beel	2,421	2,020	1,503	1,961	2,858	10,763
Pakhimara Ram Ghuta Jolokorpunjo	3,306	2,678	8,071	3,913	1,996	19,964
Shimul Tola Chikon Dair	1,494	3,292	2,269	4,363	2,172	13,589
Suraiya Beel	2,490	2,170	1,542	1,995	1,834	10,031
Netrokona	**5,164**	**9,022**	**22,983**	**17,108**	**11,603**	**65,880**
Baradia Beel	1,158	1,058	1,328	1,970	2,225	7,740
Dattakhila	970	3,242	5,996	8,326	4,222	22,756
Hogla	1,492	2,194	3,999	4,828	4,668	17,182
Ranggadair Jolmohal	1,544	2,528	11,659	1,984	488	18,202

Waterbody/Year	Catch (kg)					
Kishoreganj	**9,670**	**10,680**	**12,154**	**15,465**	**15,381**	**63,349**
Chapra Beel	692	1,664	1,753	3,759	3,291	11,159
Dhoniar Kona Beel	1,245	2,412	3,211	3,398	2,248	12,514
Goza Beel	2,132	726	1,252	1,495	2,556	8,161
Kalni Beel	2,718	2,562	2,515	3,405	4,670	15,870
Korgaon -1/2 Gazipur	746	1,965	1,056	1,374	1,677	6,819
Noniala Beel	2,136	1,350	2,367	2,034	939	8,826
Habiganj	**12,611**	**14,816**	**10,165**	**14,403**	**17,333**	**69,328**
Andaura Beel	2,405	2,558	1,917	2,541	3,076	12,497
Boro Paikka Beel	486	1,630	1,939	2,328	2,813	9,196
Choto Beri Beel	2,639	1,798	2,184	3,163	1,518	11,303
Kutiara Beel, Udgar Khal O Kutiarar Khal	1,065	924	1,423	2,283	2,269	7,963
Silarag Group Fishery	6,015	7,906	2,702	4,088	7,658	28,369
Brahmanbaria	**1,235**	**1,445**	**1,260**	**921**	**1,284**	**6,145**
Satbila Fishery	1,235	1,445	1,260	921	1,284	6,145
Grand Total (kg)	**48,563**	**67,847**	**82,408**	**85,205**	**71,332**	**355,354**
Monitoring area (ha)	434.21	434.21	434.21	434.21	434.21	
Catch kg/ha	**111.84**	**156.25**	**189.79**	**196.23**	**164.28**	**163.68**

3.1.3. Major Catch in Project/Case Waterbody

The yearly catch range varied from 307 kg, Kalni Beelin Kishoreganj to 12,582 kg, Silarag Group Fishery in Habiganj (Table-3). Netrokona it was 488 kg to 11,659 kg. The production variation due to size of waterbody and management of waterbody after flooding season.

Table 3: Waterbody Wise Yearly Major Catch (kg/year) in Project/Case Waterbodies.

Waterbody	2017	2018	2019	2020	2021
Chat of Sunbari	3,005	2,751	2,460	2,800	2,118
Kal Dora Nak Dora Beel	7,073	5,192	7,533	9,500	10,430
Pakhimara Ram Ghuta Jolokorpunjo	7,116	5,092	6,108	8,889	7,583
Kumaria Beel	2,571	1,655	1,792	1,880	1,726
Shimul Tola Chikon Dair	4,705	1,944	2,825	2,440	2,373
Kirton Khola	1,107	1,750	1,528	850	1,494
Suraiya Beel	1,060	988	1,961	3,190	2,498
Kala-sunda Beel	2,166	1,918	2,246	5,200	4,018
Choto Nainda Boro Nainda	3,275	2,817	8,403	4,087	3,675
Ranggadair Jolmohal	990	540	955	1,238	649
Baradia Beel	1,401	584	582	1,599	811
Hogla	1,012	820	1,037	2,000	2,044
Dattakhila	1,057	2,122	3,843	3,687	4,020
Noniala Beel	1,271	1,137	1,286	985	1,075

Chapra Beel	807	1,238	1,680	1,550	1,761
Kalni Beel	307	981	1,414	1,690	1,695
Dhoniar Kona Beel	363	436	981	1,150	1,162
Korgaon -1/2 Gazipur	760	1,717	2,858	2,442	2,462
Goza Beel	358	328	459	855	841
Satbila Fishery	841	1,307	1,769	1,726	1,880
Choto Beri Beel	1,221	742	2,004	1,250	1,830
Andaura Beel	5,574	4,413	5,865	4,750	6,297
Kutiara Beel Udgar Khal	835	548	1,970	1,050	1,750
Boro Paikka Beel	386	438	352	725	608
Silarag Group Fishery	7,173	8,514	10,036	12,582	9,674
Total	56,433	49,973	71,947	78,118	74,473

Combining major and open catch also analysed. Date reveal that initial baseline year (2017-18) major catch (56 ton) was heigher than open catch (50 ton). It reflects fish recruitment in open waterbody is not enough for open waterbody productivity. But after project intervention open catch found heigher than major catch for good recruitment of fish in open waterbody. However, during 2021 and 2022 major catch again slitly increased due to short flooding condition. Total productions were 106, 118, 154, 165 and 145 ton/year found in 2017-18, 2018-19, 2019-20, 2020-21 repectively.

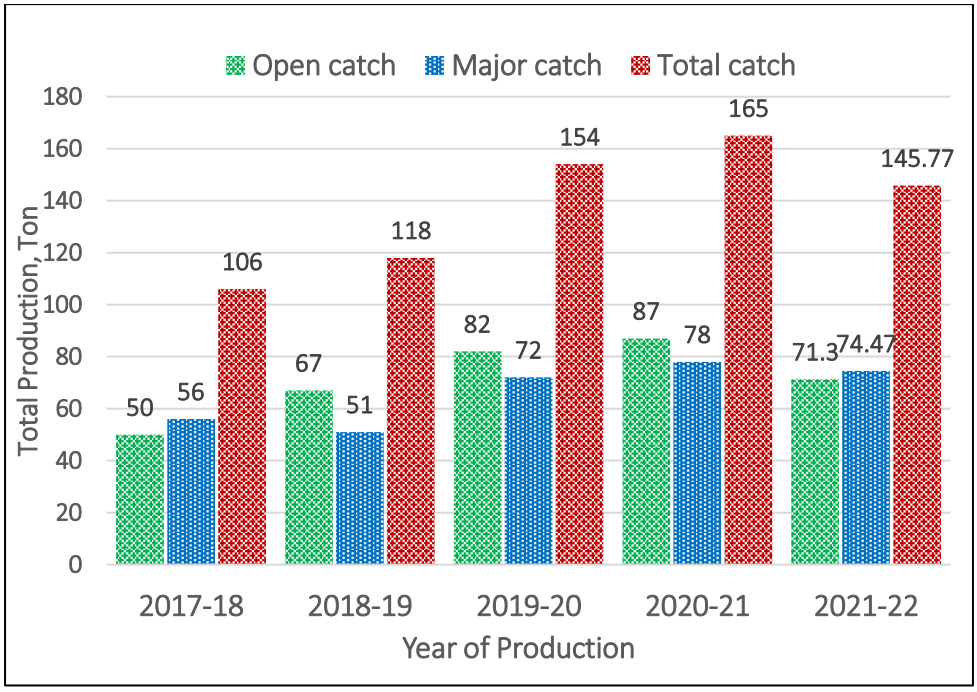

Figure 4: Yearly Open and Major Catch in Project/Case Waterbodies.

3.1.5. Open Catch in Control Waterbody

Control waterbody wise open catch also analysed. It varied from 238 kg to 5,925 kg/year that lower than project/case waterbody (Table-4). Data available in Kasto Chapra Beel for starting 3 years. Then this waterbody replaced with Deo Beel for next two years due to project intervention taken in Kasto Chapra Beel.

Table 4: Open Water Catch (kg) in Control Sites

Waterbody	2017	2018	2019	2020	2021	Total
Buriya River	1,281	1,259	2,267	4,406	2,323	11,535
Deo Beel				1,472	2,594	4,066
Kasto Chapra Beel	1,585	1,590	2,196			5,371
Mourra Beel	712	890	717	1,078	1,188	4,584
Patuajuri Beel	1,421	1,265	3,592	2,796	2,287	11,360
Rouha Beel	238	1,091	4,827	5,925	3,543	15,624
Grand Total	5,236	6,096	13,598	15,677	11,935	52,541

Note: Kasto Chapra Beel monitored from 2017 to 2019 and Deo beel in 2020 and 2021

3.1.6. Major Catch in Control Waterbody

Major catch in control waterbody varies from 387 kg to 1,653 kg per year (Table-5). Waterbody wise production variation found due to habitat status, size and location.

Table 5: Major Catch (kg) in Control Waterbody

Waterbody	**2017**	**2018**	**2019**	**2020**	**2021**
Buriya River	1,623	1,653	645	1,275	849
Rouha Beel	855	556	586	1,718	1,441
Patuajuri Beel	387	412	446	755	322
Mourra Beel	528	982	482	960	728
Total	3,392	3,603	2,159	4,709	3,340

3.2. Species Wise Production

Species wise open and major catch (kg) also analysed. *Puntius sophore* found mostly available and highest catch from both open and major catch (Table-6). *Nematopalaemon tenuipes* (prawn) species followed by *Puntius sophore* (*Jat puti*). Prawn is zooplankton in early stage of their life cycle that mainly used as food by fin fish species in a habitat. This indicates availability of zooplankton of a habitat that can contribute more fin fish production by zooplankton consumption of fin fish. *Channa punctatus* (*Taki*) is a bottom dweller carnivorus fish, it has 3rd position in open catch indicating high fishing pressure in open catch. However, *Wallago attu* large size carnivorous fish stands in 4th position in open catch indicating availability of top predator fish in the habitat. It also indicating good quality of fish assemblages (fish community) in the open waterbody.

Table 6: Species Wise Open and Major Catch (kg) in Project/Case Waterbody During Monitoring Period.

Local name	Scientific name	Open	Major	Total (kg)
Jatputi/Vadi Puti	*Puntius sophore*	29,936	36,310	66,246
Gura Icha/Isla/Jal Mach	*Nematopalaemon tenuipes*	21,072	5,927	26,999
Taki/Ladi/Saitan/Voskol	*Channa punctatus*	19,036	14,154	33,190
Boal	*Wallago attu*	15,868	25,539	41,407
Tengra/Guinga	*Mystus vittatus*	13,461	10,772	24,233
Guchi Baim/Chikra	*Mastacembelus pancalus*	12,213	7,161	19,373
Dimua/Kathali Icha	*Macrobarchium villosimanus*	10,964	1,448	12,411
Meni/Veda/Royna	*Nandus nandus*	10,543	8,256	18,799
Goinna	*Labeo gonius*	10,435	10,847	21,282
Kalibaus/Baus/Kalla Mach	*Labeo calbasu*	10,342	9,872	20,215
Tit punti	*Pethia ticto*	10,057	10,613	20,670
Bojuri Tengra/Choto Tengra	*Mystus tengara*	9,988	12,401	22,389
Baila/Bele/Vangla	*Glossogobius giuris*	9,661	8,580	18,241
Sarputi/Sheron Puti	*Puntius sarana*	8,735	4,991	13,726
Tara Baim	*Macrognathus aculeatus*	8,500	6,550	15,050
Koi/Gachua Koi	*Anabas testudineus*	7,318	6,165	13,483
Chapila/Korti/Chalpa	*Gudusias chapra*	7,085	11,442	18,527
Mola/Maya/Moa	*Amblypharyngodon mola*	7,062	8,587	15,648
Boro Baim/Shal Baim	*Mastacembelus armatus*	6,866	5,009	11,875
Lomba Chanda	*Chanda nama*	6,701	6,282	12,983
Chela/Katari/Narkeli Chela	*Salmostoma bacaila*	6,475	2,656	9,130
Kakila/Kaikla	*Xenentodon cancila*	6,318	4,210	10,528
Shing/Jiol Mach/Kanuch	*Heteropneustes fossilis*	5,824	4,689	10,513
Golsha/Golsha Tengra	*Mystus seenghala*	5,669	4,627	10,295
Gol Chanda	*Chanda lala*	5,384	8,341	13,724

Local name	Scientific name	Open	Major	Total (kg)
Shol/Shoil	*Channa striatus*	4,965	12,337	17,302
Golda Icha	*Machrobrachium rosenbergii*	4,703	1,415	6,118
Kholisha/Pata Kholisha	*Colisa fasciatus*	4,297	4,344	8,641
Carfu/Japani Rui	*Cyprinus carpio (specularis)*	3,561	10,388	13,949
Rui/Ruhit/Vuitta	*Labeo rohita*	3,487	8,655	12,142
Gutum/Butkuni/Pia	*Lepidocephalus guntea*	3,482	2,818	6,300
Kuichcha/Kuichcha Baim	*Monopterus cuchia*	3,172	251	3,423
Pabda	*Ompok pabo*	3,014	2,567	5,581
Gura Icha/Kuncho Icha	*Macrobrachium lamarrei*	2,974	1,865	4,840
Thengua/Shul Icha	*Macrobrachium birmanicum*	2,709	1,267	3,976
Mrigal/Mirka	*Cirrhinus mrigala*	2,593	4,968	7,561
Batashi/Batai/Aluni	*Pseudeutropius atherinoides*	2,141	1,925	4,066
Chhatka Chingri	*Macrobrachium malcolmsonii*	2,123	1,092	3,215
Silver Carp	*Hypophthalmichthys molitrix*	2,118	1,577	3,696
Teri Puti	*Puntius terio*	1,992	4,312	6,305
Katla/Katol/Fega	*Catla catla*	1,953	3,706	5,660
Raek/Nora/Lachchu	*Cirrhinus reba*	1,785	1,813	3,598
Magur/Mojgur	*Clarias batrachus*	1,727	4,122	5,849
Bata	*Labeo bata*	1,646	282	1,928
Ful Chela	*Salmostoma phulo*	1,600	1,282	2,883
Ghaura	*Clupisoma garua*	1,477	68	1,545
Gazar/Gazal	*Channa marulius*	1,446	7,086	8,532
Darkina/Chukkuni	*Esomus danricus*	1,437	1,219	2,656
Foli/Kanila/Fotol/Vali/Foloi	*Notopterus notopterus*	1,278	3,890	5,168
Thai Sarputi/Raj Puti	*Puntius gonionotus*	1,250	2,050	3,300
Nilotica	*Oreochromis niloticus*	1,248	564	1,812
Lal Kholisha/Boicha	*Colisa lalius*	1,228	1,885	3,113
Jhili Puti/Gini Puti	*Puntius gelius*	1,170	1,252	2,422
Tengra (Batashi)/Aluni	*Batasio batasio*	1,110	378	1,487
Grass Carp	*Ctenopharyngodon idellus*	1,058	5,806	6,864
Guji Ayre/Guji Kata	*Mystus bleekeri*	1,005	4,490	5,495
Tepa/Potka	*Tetraodon cutcutia*	947	1,763	2,710
Ranga Chanda/Lal Chanda	*Chanda ranga*	927	877	1,804
Chhep Chela	*Chela cachius*	926	226	1,152
Kholisha/Pata Kholisha	*Colisa labiosus*	840	379	1,218
Chanda	*Chanda beculis*	790	1,336	2,126
Nona Chingri	*Metapeanous brevicornis*	765	175	940
Cheka/Bou	*Botia dario*	737	297	1,034
Futani Puti	*Puntius phutunio*	713	1,673	2,386
Rani/Cheka/Bou	*Botia dayi*	690	495	1,185
Ayre	*Mystus aor*	642	5,054	5,696
Kosua punti/ Kosuati punti	*Oreichthys cosuatis*	634	1,048	1,682
Mola Puti	*Puntius guganio*	624	421	1,045

Local name	Scientific name	Open	Major	Total (kg)
Darkina	*Rasbora daniconius*	613	647	1,261
Bacha	*Eutropiichthys vacha*	586	539	1,124
Kanchon Puti/Taka Puti	*Puntius conchonius*	528	213	741
Rita/Ritha	*Rita rita*	503	61	564
Gutum	*Somileptes gongota*	469	507	976
Gagor	*Mystus menoda*	446	397	844
Kabashi Tengra	*Mystus cavasius*	431	521	952
Dhela/Lohasur	*Rohtee cotio*	427	279	706
Ghagra/Medh/Maita	*Cybium guttatum*	405	84	489
Gang Tengra/Gongra	*Gagata gagata*	400	200	600
Gutum	*Nemacheilus savona*	360	462	823
Chola Puti	*Puntius chola*	360	495	854
Chuna Kholisha/Chata	*Colisa sota*	352	273	626
Bighead Carp	*Aristichthys nobilis*	305	280	585
Telapia/Telapata	*Oreochromis mossambica*	297	838	1,135
Ghora Dhela	*Oxygaster gora*	281	450	731
Gang Magur	*Plotosus canius*	268	168	436
Kani Pabda/Boali Pabda	*Ompak bimaculatus*	259	160	420
Karka/Khorika/Koirka	*Nemacheilus corica*	216		216
Kachki/Kechki/Suborna	*Corica soborna*	205	244	450
Mohashol/Mohal	*Tor tor*	200	124	324
Tinchokha/Kanpona	*Aplocheilus panchax*	191	684	875
Gachua/Cheng/Raga	*Channa orientalis*	183	286	469
Black Carp	*Mylpharyngodon pisceus*	173	811	984
Kali Koi/Napit	*Badis badis*	170	513	683
Gachua/Telo Taki	*Channa gachua*	166	0.20	166
Fesha/Fefri/Fasha	*Setipinna phasa*	141	2	143
Mirror Carp	*Cyprinus carpio (communis)*	135	484	619
Illish	*Hilsa ilisa*	134	25	159
Thai Pangas	*Pangasianodon hypophthalmus*	132		132
Kash Khoira/Lobuka	*Chela laubuca*	125	184	309
Tatkini	*Crossochelius latius*	105	233	338
Pangus	*Pangasius pangasius*	86	39	125
Kajoli	*Ailia coila*	83	59	142
Bagha Ayre/Bagair	*Bagarius bagarius*	80	270	351
Modhu Pabda/Paiva/Pabda	*Ompak pabda*	78	375	454
Chitol	*Chitala chitala*	76	248	325
Ekthota	*Dermogenys pussilus*	71	133	204
Chaika/Choukka	*Pellona ditchela*	64	78	142
Khorshola/Kholla	*Rhinomugil corsula*	63	15	78
Ekthota/Subol	*Hemiramphas gaimardi*	61	341	402
Gutum	*Nemacheilus spp.*	56	16	72
Piali/Morar/Morari	*Aspidoparia morar*	56	56	112
Shilong/Shilon	*Silonia silondia*	52	60	112
Goni Chapila/Bori	*Gonialosa manmina*	45	16	61

Local name	Scientific name	Open	Major	Total (kg)
Bali chata/Buth Koi	*Nemacheilus botia*	38	12	50
Bichi/Kanpona	*Oryzius melastigma*	32		32
Kholoi muchuri/ Gutum	*Acanthocobitis botia*	31	183	214
Ghora Mach/Longu	*Labeo pangusia*	29	78	107
Tak Chanda	*Leiognathus equulus*	27		27
Puti tor/Mohasher	*Tor putitora*	26		26
Naftani/Naptani	*Ctenops nobilis*	25	88	112
Bashpata/Chhebri/Dibari	*Danio devario*	24	41	65
Bori/Goni chapila/Chapila	*Gonialosa manmina*	20	23	43
Gon mach/Gaara	*Goganra viridescens*	17	3	20
Panga/Sindure gutum	*Pangio pangia*	17	14	32
Kachki Bata	*Mugil cascasis*	16	0.16	17
Nipati/Jhia/Darakona	*Danio dangila*	16	0.18	16
Chekbeka/Cheka	*Chaca chaca*	15	33	48
Bichi Guinga/Jol Guinga	*Chandramara chandramara*	14	85	99
Kumirer Khil	*Microphis deocata*	11		11
Hizra/Hizme/Bamas	*Pisodinophis boro*	11	2	13
Baus/Bamus/Bonehara	*Anguilla bengalensis*	10	202	212
Bashpata/Kajoli	*Aillichthys punctata*	8	34	42
Dhal magur/Telechita	*Glypothorax telchitta*	6		6
Elong	*Megarasbora elanga*	6	0.37	6
Gang Tengra/Gongra	*Gagata youssoufi*	5		5
Puia	*Lepidocephalus berdmorei*	5		5
Loitta/Lutta/Nehari	*Harpodon nehereus*	3		3
Puia/Goru Puia/Puia	*Lepidocephalichthys annandalei*	3	55	58
Nandil/Nandina	*Labeo nandina*	3	43	46
Puia/Goru Puia	*Lepidocephalus irrorata*	2		2
Teli Fesha/Orchona	*Setipinna taty*	2		2
Onju	*Danio rerio*	2		2
Ptul/Beti/Bet	*Botia lohachata*	1	25	26
Kakra	*Stylla sp.*	1	1	2
African Magur	*Clarias garipinas*		9	9
Thai Magur	*Clarias macrocephalus*		124	124
Kaua/Jongla/Telia	*Gagata cenia*		47	47
Balitora	*Psilorhynchus balitora*		13	13
Boiragi/Boirali	*Salmostoma argentea*		10	10
Leujja Darkina	*Rasbora Rasbora*		0.01	0.01
Koksa/Nun chora/Joia	*Barilius bendlisis*		5	5

3.2.1. Fish Species Diversity in Open Catch

A total of 144 species of fish and prawn were recorded from open catch during monitoring period (2017-2021) from all (25) project/case waterbodies (Appendix-1). The maximum numbers of species 124 found in Sunamganj. District wise species of fish and prawn were 92 at Netrokona, 108 at Kishoreganj, 118 at Habiganj and 57 at Brahmanbaria recorded. It is noted that only one waterbody was selected from Brahmanbaria. The present study reveals that total number of species varies from 54 to 90 at the case site. However, waterbody wise yearly species number varies from 17 (Suraiya Beel, 2021, Dattakhila, 2021) to 64 (Kala-sunda Beel, 2020) (Table-7).

Table 7: Waterbody Wise Fish Species Number in Open Catch During Monitoring Period.

Waterbody	2017	2018	2019	2020	2021
Sunamganj					
Chat of Sunbari	31	37	48	49	48
Kal Dora Nak Dora Beel	56	58	57	41	32
Pakhimara Ram Ghuta	57	63	61	57	53
Kumaria Beel	31	32	36	38	48
Shimul Tola Chikon Dair	36	36	39	48	37
Kirton Khola	39	37	31	40	25
Suraiya Beel	28	34	35	42	17
Kala-sunda Beel	36	50	52	64	62
Choto Nainda Boro Nainda	49	52	44	44	48
Netrokona					
Ranggadair Jolmohal	33	45	49	50	38
Baradia Beel	35	43	44	34	41
Hogla	36	47	51	45	40
Dattakhila	33	36	41	21	17
Kishoreganj					
Noniala Beel	22	33	49	63	49
Chapra Beel	37	44	46	34	56
Kalni Beel	41	44	46	21	35
Dhoniar Kona Beel	33	39	44	50	43
Korgaon -1/2 Gazipur	31	39	41	53	54
Goza Beel	27	36	45	55	48
Brahmanbaria					
Satbila Fishery	33	41	42	35	33
Habiganj					
Choto Beri Beel	49	51	52	49	36
Andaura Beel	56	62	62	58	48
Kutiara Beel	37	38	40	58	36

Waterbody	2017	2018	2019	2020	2021
Boro Paikka Beel	29	34	40	38	37
Silarag Group Fishery	58	57	60	59	59

Yearly segregated species number furnished in figure 5. Number of species always higher in open catch. It was 105 in all project/case waterbodies that increased into 122 species. Species number 92 found in major catch in the baseline year that increased 114 species in 2020-21. Data also revealed that number of fish species is increasing due to project interventions. Species number increased by 22 in major catch.

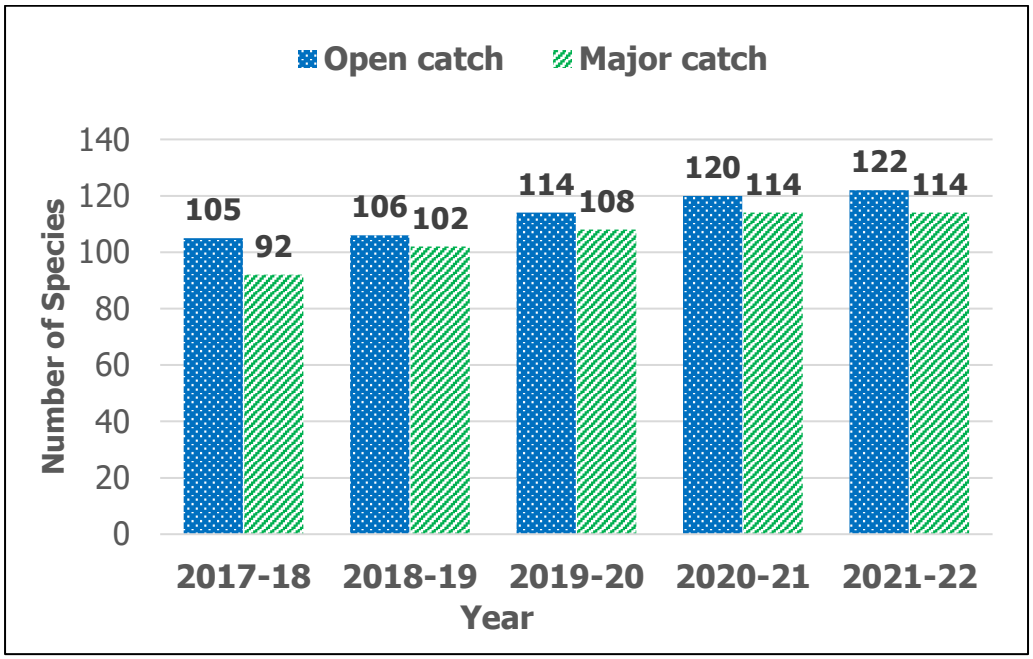

Figure 5: Yearly Species Number Found From Open and Major Catch in Project/Case Waterbodies

Fish diversity (number of species) from open and major catch analysed separately in control waterbody as well. Species number increased in open catch but decreased in major catch (Figure-6). During basline year species number was 72 in both open and major catch. However, it was decreased into 62 in major catch in control waterbody. It is indicating without waterbody management species diversity would not sustainable and as a result waterbody will be lost their productivity. Open catch species number was found increased from 72 to 84, because open catch fish recruitment is depended on different habitat in an ecological area.

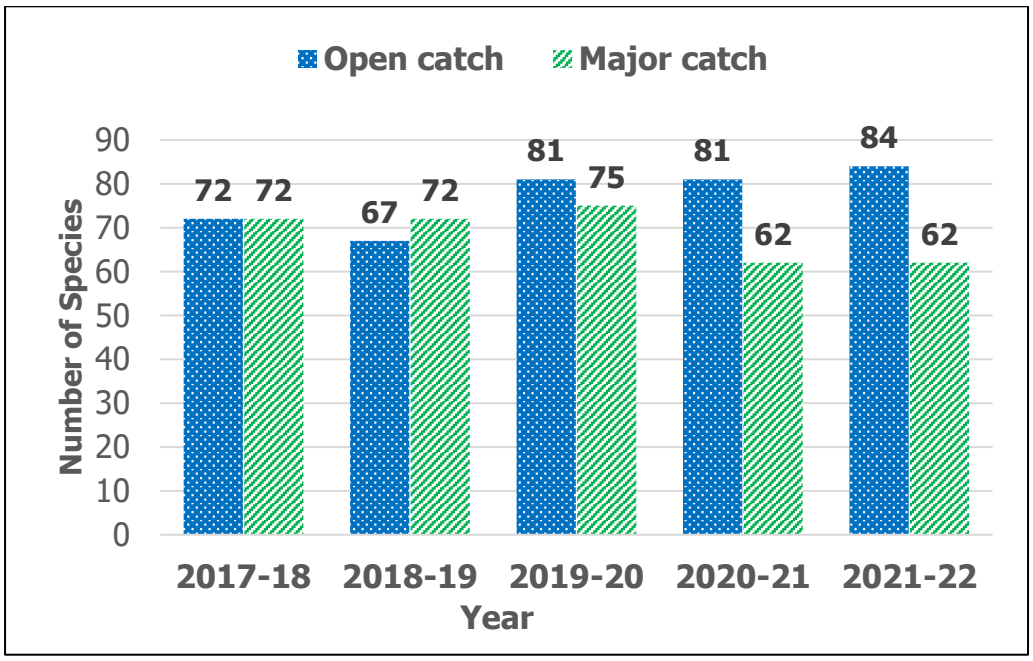

Figure 6: Fish Diversity (Number of Species) From Open & Major Catch Separately in Control Waterbodies

All together in project/case waterbody, species number increased into 106 to 127 (Figure-7). Increament found steady upward and there is more scope for species recruitment in the habitat.

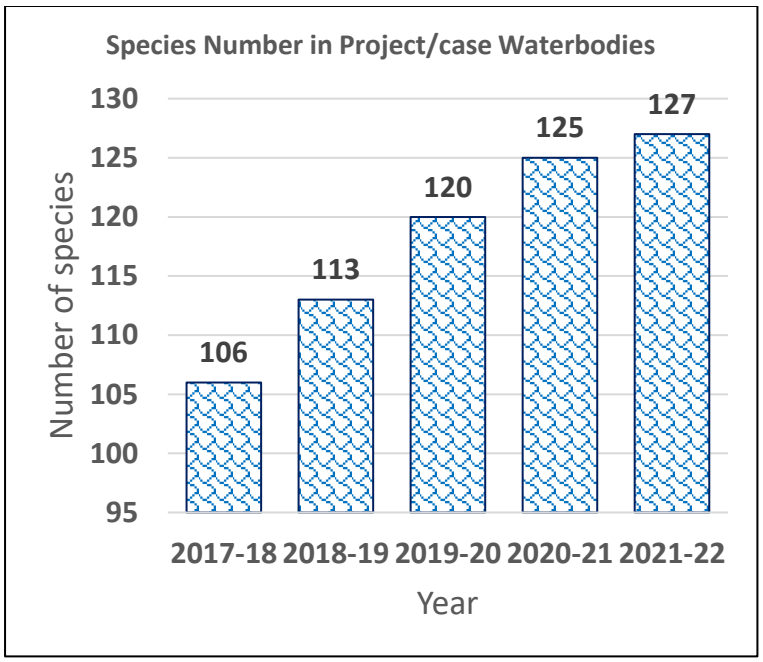

Figure 7: Fish Diversity (Numbers of Species) From Combine Catch (Open & Major) in Project/Case Waterbodies.

Higher no of species diversity in project/case waterbodies reveals the positive impacts of management activities. In control waterbody species number increament found less in compare with case waterbodies. During baseline year it was 91 that reached into 98 in end year (2021-22) (Figure-8).

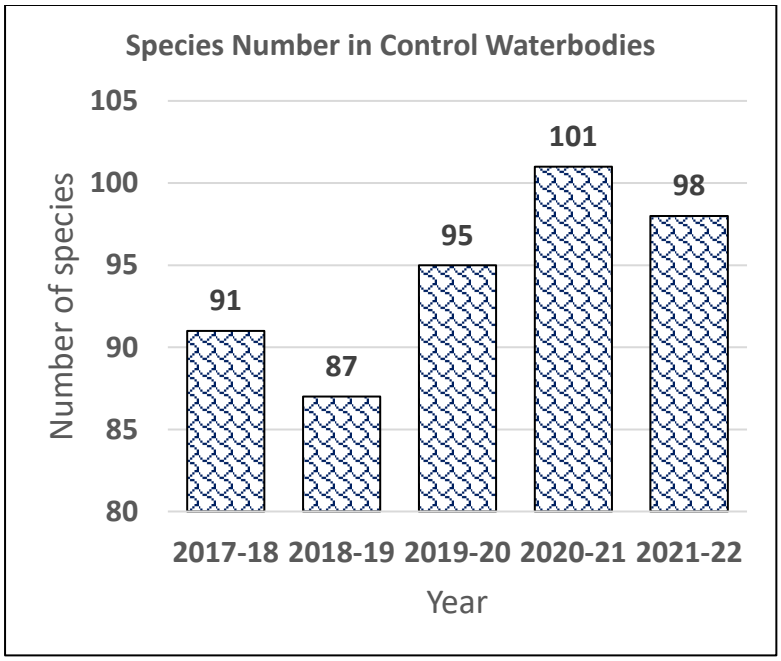

Figure 8: Fish Diversity (Numbers of Species) From Combine Catch (Open & Major) in Control Waterbody

Prawn and Crab number were not considered for Shannon–Wiener diversity index (H') calculation because they are not fin fish. There's no upper limit to the index. The maximum value occurs when all species have the same number of individuals. It equals log(k), where k is the number of species. Range of values (using the natural logarithm as the base): for 100 species, the maximum possible value would be 4.605, for 1,000 species: 6.908, for 10,000 species: 9.21, for 1,000,000 species: 13.816. In real-world ecological data, the Shannon diversity index's range of value is usually 1.5 - 3.5. (The higher the value of H', the higher the diversity of species in a particular community). Shannon–Wiener diversity index (H') value range found in case waterbody from 1.13 to 3.66 (Table-8). Most of the waterbody value found near 3 that indicating sustainable species diversity in a habitat.

Table 8: Shannon–Wiener Diversity Index (H') in Open Catch in Project/Case Waterbodies.

Waterbody	H'	Waterbody	H'
Sunamganj		**Kishoreganj**	
Choto Nainda Boro Nainda	2.73	Kalni Beel	2.50
Kala-sunda Beel	2.77	Chapra Beel	2.91
Suraiya Beel	3.07	Dhoniar Kona Beel	2.63
Kirton Khola	1.94	Korgaon -1/2 Gazipur	2.91
Shimul Tola Chikon Dair	2.22	Goza Beel	3.13
Kumaria Beel	2.90	Noniala Beel	1.13
Pakhimara Ram Ghuta	2.33	**Habiganj**	
Kal Dora Nak Dora Beel	2.98	Silarag Group Fishery	3.66
Chat of Sunbari	1.98	Boro Paikka Beel	2.65
Netrokona		Kutiara Beel	2.82
Hogla	2.63	Andaura Beel	2.36
Baradia Beel	2.90	Choto Beri Beel	2.84
Ranggadair Jolmohal	2.97	**Brahmanbaria**	
Dattakhila	2.66	Satbila Fishery	2.88

Species composition by weight (%) is calculated. It is found that 20 main species contributing 66.37% of total catch in open catch (Figure-9). *Jatputi* is most available species followed *gura icha, taki* and so on.

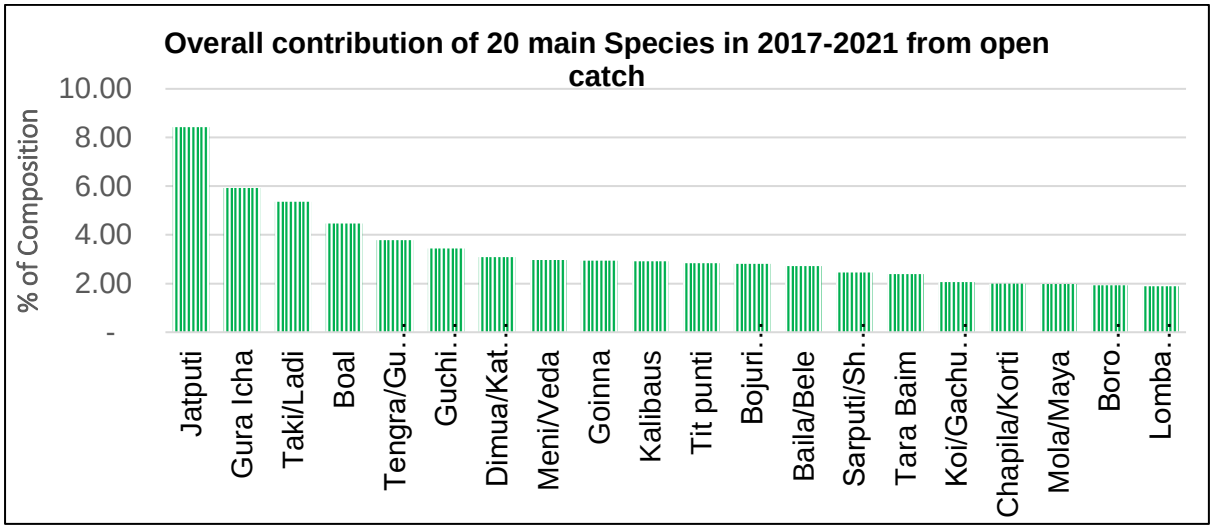

Figure 9: Species Composition by Weight (%) Based on Open Catch in Project/Case Waterbody

In major catch *Jatputi* also top species on catch followed by *boal, taki* and so on (Figure-10). Top 20 species contributing 64.77% of total catch in major catch in project/case waterbodies. It indicates major catch species assembles is better than open catch in project/case waterbodies.

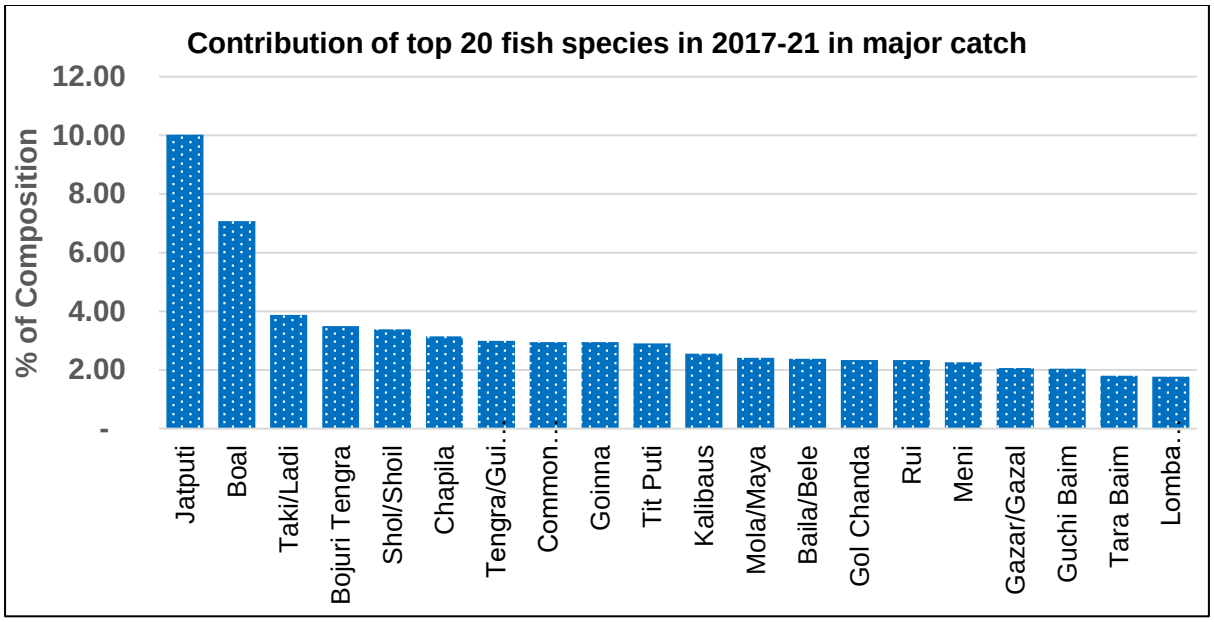

Figure 10: Species Composition by Weight (%) Based on Major Catch in Project/Case Waterbodies.

3.3. Threatened Species

All taxa listed as Critically Endangered (CR) qualify for Vulnerable (VU) and Endangered (EN), and all listed as Endangered qualify for Vulnerable. Together these categories are described as 'threatened' (IUCN, 2015). Critically Endangered is considered to be facing an extremely high risk of extinction in the wild. Endangered is considered to be facing a very high risk of extinction in the wild and Vulnerable is considered to be facing a high risk of extinction in the wild.

Open water catch data reveled that highest 20 threatened species were identified from Andaura Beel in Habiganj (Table-9). Lowest 9 threatened species were recorded in Hogla, Netrokona and Boro Paikka Beel in Habiganj. CR species ranges found 1-3 in a waterbody

among 9 CR species in Bangladesh. VU species ranges found 3-9 in a waterbody among 25 VU species in Bangladesh and EN species ranges found 1-10 in a waterbody among 30 EN species in Bangladesh. However, CR species no 9, VU species no 25 and EN species no 30 threatened species cover all type of habitats like River, hill stream, *haor*, baor, beel floodplain and estuary in Bangladesh.

Finding reflects that case sites (waterbodies) in *haor* were very important habitat including breeding, feeding and growing ground for threatened species. So, waterbodies in *haor* must protect for threatened species conservation in Bangladesh.

Table 9: Waterbody Wise Threatened Number of Species Count as per IUCN 2015 in Project/Case Waterbodies Open Catch During Monitoring Period (2017, 2018, 2019, 2020, 2021)

Status Code: CR- Critically Endangered, EN- Endangered, VU- Vulnerable

Waterbody	CR	EN	VU	Total count
Sunamganj				
Chat of Sunbari	2	9	8	19
Choto Nainda Boro Nainda	2	6	7	15
Kal Dora Nak Dora Beel	2	6	7	15
Kala-sunda Beel	1	4	7	12
Kirton Khola		4	6	10
Kumaria Beel	1	4	5	10
Pakhimara Ram Ghuta	2	5	8	15
Shimul Tola Chikon Dair	2	6	4	12
Suraiya Beel	1	6	3	10
Netrokona				
Baradia Beel	2	5	5	12
Dattakhila	1	6	5	12
Hogla	1	4	4	9
Ranggadair Jolmohal	1	5	6	12
Kishoreganj				
Chapra Beel	1	6	7	14
Dhoniar Kona Beel	2	6	6	14
Goza Beel	2	7	9	18
Kalni Beel	1	5	8	14
Korgaon -1/2 Gazipur	1	3	6	10
Noniala Beel	1	7	6	14
Habiganj				
Andaura Beel	2	9	9	20
Boro Paikka Beel	2	1	6	9
Choto Beri Beel	3	5	4	12
Kutiara Beel	1	8	8	17
Silarag Group Fishery	1	10	7	18
Brahmanbaria				

Waterbody	CR	EN	VU	Total count
Satbila Fishery	1	5	5	11

Figure-11 indicating 4 Critically Endangered species among 9 species in Bangladesh fresh water found in project/case waterbody. *Ompok Pabo* found in 23 waterbodies among 25 case waterbodies.

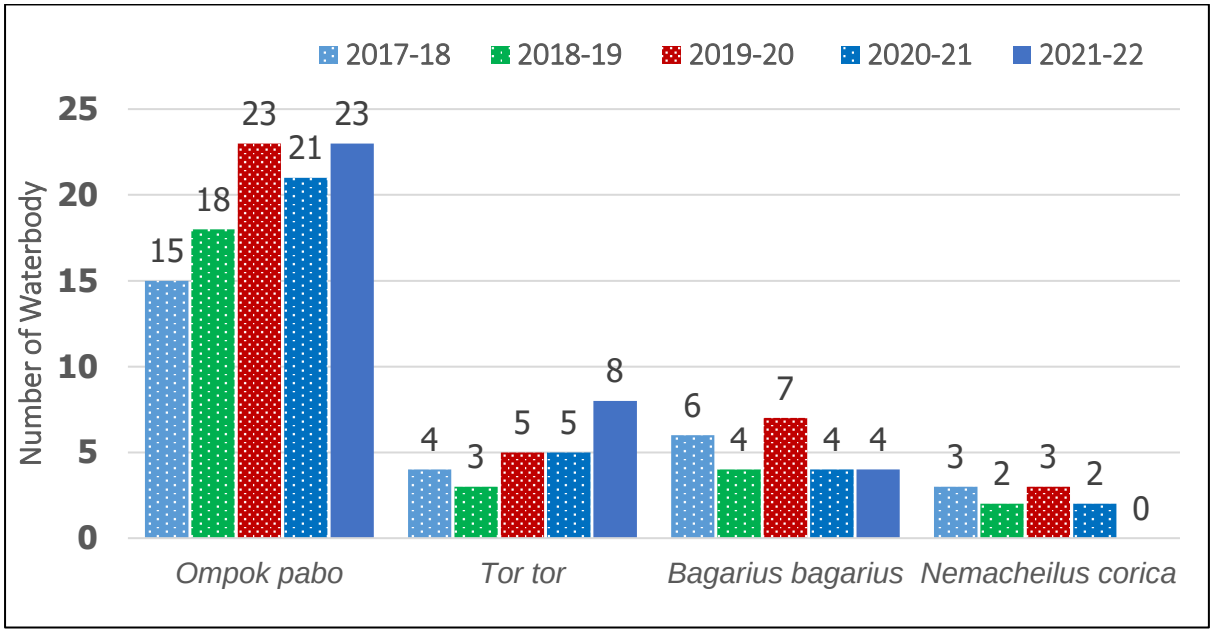

Figure 11: Number of Project/Case Waterbody where Critically Endangered Species Found.

Figure-12 indicating 14 Endangered species among 30 species in Bangladesh fresh water found in project/case waterbody. *Mastacembelus armatus* found in 23 waterbodies among 25 project/case waterbodies.

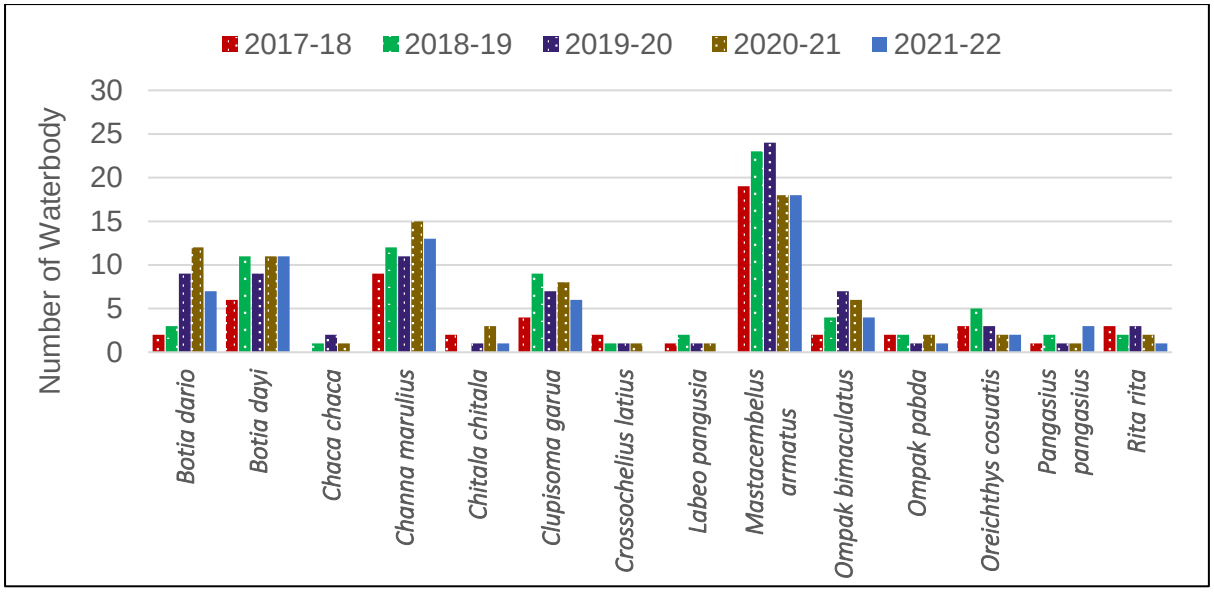

Figure 12: Number of Project/Case Waterbody Where Endangered Species Found.

3.4. Catch per Unit Effort (CPUE)

Different types of gear used for catching fish from open water. Each gear has it's own efficiency for catching fish. Some gears are passive and some are active. Passive gear includes gill net, hook and line, set bag and traps. Active gear includes cast net, push net, seine net and traps. Catch per Unit Effort (CPUE) per day found higher for seine net, because this net is large and operated by 6 to 10 people. On the other hand, push net CPUE was low, because push net is small and operated by one person, even children. So, CPUE depends on gear nature, operation period and availability of fish in fishing ground. CPUE of cast net, gill net, seine net and trap were found decreased trend over the monitoring period. On the other hand, hook and line, long line and set bag net found nearly steady over the monitoring period. However, very little increasing trend found in *katha* and large lift net (Table-10). Passive gill net normally installed deep water or far from fringing area for waterbody. Decreasing trend of gill net catch (4.36 kg to 2.62 kg) indicating either lack of fish availability in the waterbody or number of gears increased in the fishing area. On the other hand, non selective seine net operated near the fringing area and shallow water, decreasing trend of seine net CPUE indicating (10.96 to 6.33 kg) fishes in the feeding area also decresed. So, seine net and gill net should be controlled for sustainable fish catch.

Table 10: Catch per Unit Effort (CPUE) (kg/gear/day) of Gear That Frequent Used in Open Catch in Project/Case Waterbody

Gear	2017	2018	2019	2020	2021
Non-destructive fishing gear					
Cast net	3.08	3.16	1.44	1.80	1.71
Hook and line	2.43	2.18	2.21	2.08	2.00
Large lift	5.92	6.38	4.76	2.49	6.55
Long line	5.00	4.97	4.79	4.97	4.63
Pen/Other	6.67	19.16	6.53	1.20	6.55
Push net	1.73	1.30	2.63	1.23	1.17
Trap	4.34	2.75	3.06	2.66	2.70
Small lift	3.20	2.73	1.30	1.26	1.45
Spear	1.74	1.66	2.45	1.38	1.40

Destructive fishing gear					
Seine net	10.96	10.33	9.29	7.77	6.33
Gill net	4.36	3.38	2.85	2.60	2.62
Set Bag	7.51	3.44	7.61	7.31	6.47

Like case waterbody CPUE also varied year to year. Destructive gear Seine net catch found increased from 10.51 kg to 11.01 indicating there is no control over seine net use in control waterbody area (Table-11).

Table 11: Catch per Unit Effort (CPUE) (kg/gear/day) of Gear That Frequent Used in Open Catch in Control Waterbody

Gear	2017	2018	2019	2020	2021
Non destructive gear					
Cast net	2.43	3.21	2.91	2.68	2.72
Hook and line	1.97	1.67	2.83	2.59	1.80
Large lift	1.89	2.29	3.16	2.93	2.59
Long line	4.78	3.02	4.89	6.53	6.61
Push net	1.56	1.23	1.74	2.11	1.78
Trap	1.64	2.39	3.19	2.87	2.77
Destructive gear					
Seine net	10.51	7.40	7.16	9.20	11.01
Set Bag	5.28	4.94	4.49	10.69	9.72
Gill net	5.50	2.13	3.13	3.51	2.94

3.5. Catch per Day (CPD)

Fish catch per day by a person related to his income from fish and also nutrition availability in his meal. Like CPUE, CPD also decreasd for cast net, gill net and seine net user. CPD increased found longline and set bag user over monitoring period in project/case waterbodies. Highest CPD found for large lift net user (4 kg/day) and lowest for push net user (1.28 kg) (Table-12). Overall data reflects the actual income was decreased over the monitoring period from open catch for maximum type of gear user. Fishing pressure should be decreased to gain profit from increased production from the waterbody and sustainable livelihood on fishing.

Table 12: Catch per Person per Day (CPD) (kg/person/day) by Gear in Open Catch

Gear	2017	2018	2019	2020	2021	All year
Cast net	2.03	1.27	1.36	1.36	1.58	1.50
Gill net	2.43	1.96	1.90	1.77	1.84	1.97
Hook and line	1.96	1.75	1.99	1.67	1.55	1.76
Katha	0.71	0.60	1.29	1.29	4.17	2.11
Large lift	4.38	6.38	4.58	2.49	3.37	4.00
Long line	1.85	2.20	2.24	2.40	2.39	2.24
Push net	1.49	1.20	1.59	1.16	1.10	1.28
Set Bag	2.00	0.98	3.97	2.12	2.59	2.28
Seine net	2.92	1.92	1.73	1.66	1.40	1.89
Small lift	3.20	2.73	1.30	1.24	1.45	1.68
Spear	1.25	1.26	1.81	1.17	1.20	1.31
Trap	2.54	1.65	1.67	1.64	1.68	1.78

Yearly fisher persons also calculated to evaluate fishing pressure in the fishing ground. Data revealed that it was 8,404 fisher person days in 2017 that increased in to 12,666 fisher person days in 2021 (Figure-13). Fisher person days increased trend shown upward till 2020 that decreased in 2021 due to short flooding period. Fisher person days trend line found similar as fish catch trend that reflect more fisher person days results more catch. However, it is depended on availability of fish in a fishing ground. This scenario also indicating fishing going on at sustainable level. If down ward trend remains in 2022 then we can conclude maximum sustainable fisher person days would be 16,441 depended on current fish production.

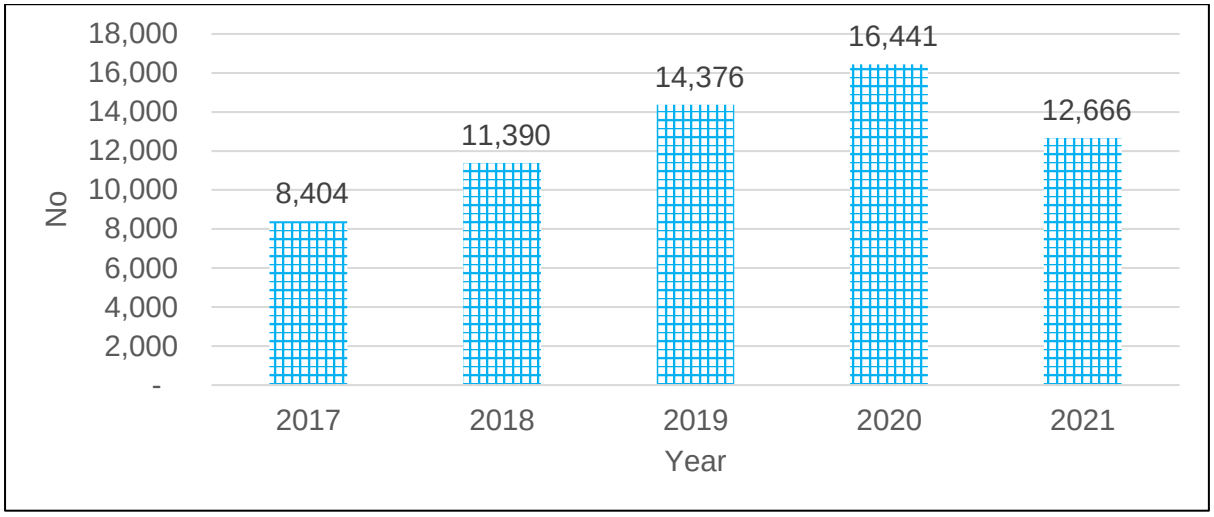

Figure 13: Yearly Fisher Person Day in Open Catch in Project/Case Waterbody

Yearly fisher persons also calculated in control waterbody. Data revealed that it 3.172 fisher person days in 2017 that increased into 4,724 fisher person days in 2021 (Figure-14). Increment of fisher person days was less in control waterbodies due to less productivity of the control waterbodies.

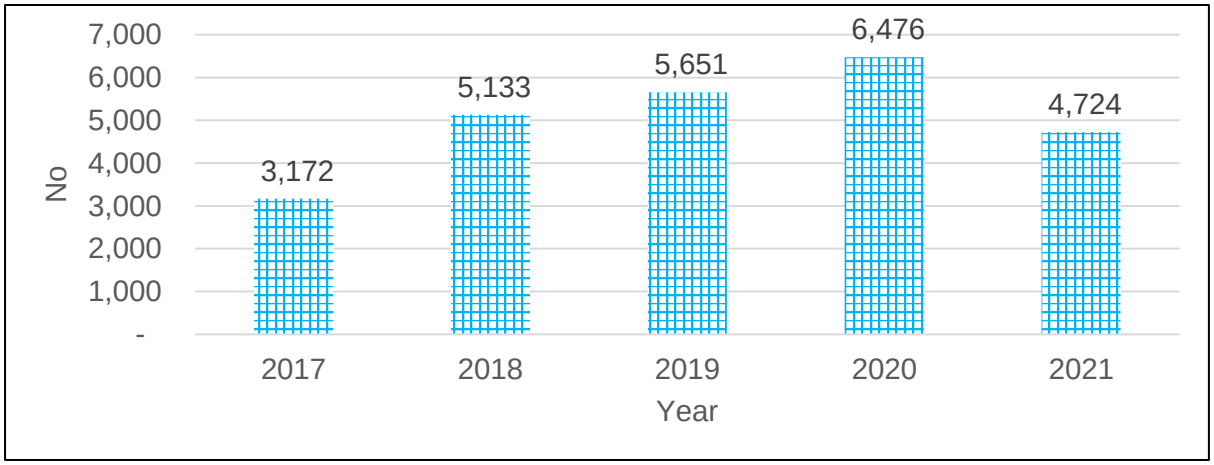

Figure 14: Yearly Fisher Person Day in Open Catch in Control Waterbody

3.6. Income from Fishing

Income from fishing also calculated. Average yearly fish price taken from database and calculated with catch. Data revealed that total 19.16 million BDT income from fishing in project/case waterbodies (Figure-15). It was increased upto 30.34 million BDT in 2021-22. Product was higher in 2020-21 compare with 2021-22, but due to less price in Covid-19 period, it was 28.08 million BDT in 2020-21. However, income increased due to higher fish price in 2021-22.

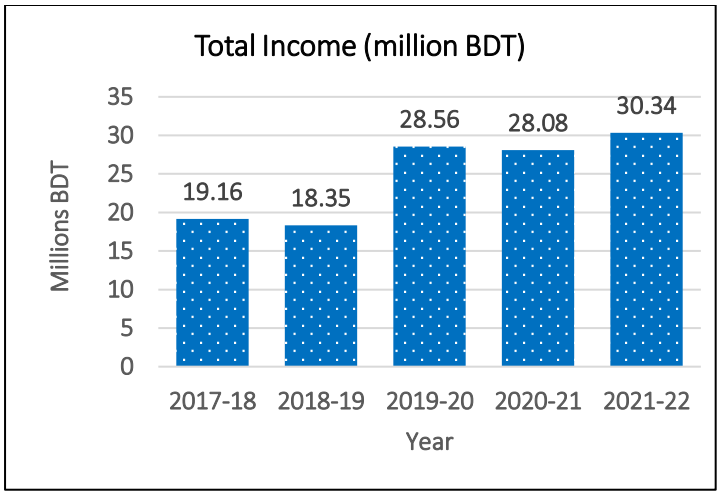

Figure 15: Total Income from Fishing in Project/Case Waterbody

3.7. Environmental Parameter

Water quality parameters were recorded in 30 (project/case 25 & control 5) sample waterbodies, these informations are very important for further improvement of aquatic ecosystem restoration and resource development. Water temperature, transparency and water depth data were collected regularly in each sample waterbody twice in a month.

Temperature is defined as the degree of hotness or coldness in the body of a living organism either in water or on land (Lucinda and Martin, 1999). As fish is a cold-blooded animal, its body temperature changes according to that of environment affecting its metabolism and physiology, which ultimately affecting the overall production. Higher temperature at a cetain point increases the rate of bio-chemical activity of the micro biota, plant respiratory rate, and so increase in oxygen demand. Temperature influences several other parameters and can alter the physical and chemical properties of water. It further causes decreased solubility of oxygen and also increased level of ammonia in water.

Water temperature, may not be as important in pure water because of the wide range of temperature tolerance in aquatic life, but in polluted water, temperature can have profound effects on dissolved oxygen (DO) and biological oxygen demand (BOD). The fluctuation in river water temperature usually depends on the season, geographic location, sampling time and temperature of effluents entering the stream (Ahipathy, 1995).

According to Delince (1992) 30-35^{0}C is tolerable to fish, Bhatnagar et al. (2004) suggested the levels of temperature as 28-32^{0}C good for tropical major carps; <12^{0}C – lethal but good for cold water species; 25-30^{0}C – ideal for Penaeous monodon culture; < 20^{0}C – sub lethal for growth and survival for fishes and > 35^{0}C – lethal to maximum number of fish species and according to Santhosh and Singh (2007) suitable water temperature for carp culture is between 24 and 30^{0}C. Anita Bhatnagar, Pooja Devi (2013) suggested acceptable range 15-35^{0}C, desirable range 20- 30^{0}C and stress <12, >35^{0}C. Temperatures above 35°C can begin to denature, or breakdown, enzymes, reducing metabolic function.

Fluctuation of water temperature was recorded to investigate the status of the water quality in the HFMLIP waterbodies (beels and rivers) through the year round. The water temperature of project waterbdies varies from 14-36^0 C which was acceptable range for fisheries management (Table-13).

Transparency (Water clarity), a direct measure of visible distance through water is another important measure related to the presence of sediment in the water column. Visual water clarity describes the distance that an organism can see underwater. Water clarity is affected by suspended and dissolved materials (Davies-Colley and Smith 2000).

Changes in water clarity alter the balance between predators and prey and may have a strong effect on individual behaviours. Historically, water clarity has been measured with a Secchi disk, a black and white disk submerged vertically into the water until it can no longer be seen (Davies- Colley and Smith 2000). Fluctuation of water clarity was recorded to investigate the status of the water quality in the HFMLIP sample waterbdies through the year round. The water clarity of project waterbodies varies from 170 cm to 18 cm.

Water depth, fluctuation of water level was also recorded to investigate the status of the water depth in the HFMLIP waterbodies through the year round, in the report water depth was analyzed for a period of one year from January-December 2021. The highest value of water depth of project waterbody was 13.1 meter in Chat of sunbari beel in Sunamganj, and the lowest value were 0.7 meters at Choto Nainda boro nainda in Sunamganj. Highest value

of water depth in control waterbodies were 12.8 meter in Buriya river in Sunamganj, and the lowest value were 0.9 meters at Patuajuri beel in Kishoreganj. Table 13 shows the changes of water quality and temperature information fluctuations (maximum & minimum) of 30 assigned waterbodies (January-December 2021).

Table 13: Detail Information of Water Temperature, Water Transparency and Water Level of Project/Case Waterbodies (25) and Control Waterbody in 2021

District/Upazila	Name of Waterbody	Water temperature		Water transparency		Water level	
		(^{0}C)		(cm)		(m)	
		Maximum	Minimum	Maximum	Minimum	Maximum	Minimum
District: Sunamganj							
South Sunamganj	Kal Dora Nak Dora Beel	35	14	95	45	6.5	1.8
	Pakhimara Ram GhutaJolokorpunjo	34	19	130	16	7.6	0.8
	Suraiya Beel	33	19	150	28	6.1	1.5
	Deo Beel*	35	17	155	31	6.6	1.7
Dharmapasha	Chat of Sunbari	36	22	165	19	13.1	5.0
	Kumaria Beel	34	23	120	23	8	1.0
	Shimul Tola Chikon Dair	33	18	135	18	7.6	0.8
	Kirton Khola	35	22	125	22	6.6	1.3
	Buriya River*	35	20	100	24	12.8	5.1
Chatak	Kala Sunda Beel	33	15	115	40	6.7	1.1
Derai	Choto Nainda Boro NaindaBeel	34	19	170	44	6.9	0.7
District: Netrokona							
Barhatta	Rangadair Jolmohal	30	20	125	40	6.8	4.0
	Rouha Beel*	34	18	100	45	5.6	1.9
Atpara	Baradia Beel	32	21	78	38	5.0	1.1
Purbadhola	Hogla	33	22	110	40	6.0	1.0
Mohonganj	Dattakhila	34	18	120	43	6.1	1.2
District: Kishoreganj							
Austogram	Korgaon- ½ Gazipur	34	17	110	36	6.1	0.8
Itna	Noniala Beel	33	19	121	39	6.5	2.8
	Chapra Beel	32	22	90	45	5.6	2.3
	Kalni Beel	33	24	98	50	5.5	1.1
	Dhoniar Kona Beel	32	16	96	20	5.7	1.0
	Patuajuri Beel*	31	15	85	22	5.4	0.9
Bajitpur	Goza beel	33	24	88	33	4.9	1.2
District: Brahmanbaria							
Bancharampur	Satbila Fishery	34	18	94	36	4.9	.8
District: Habiganj							
Baniachong	Choto Beri Beel	32	15	120	30	6.1	1.4
	Andaura Beel	34	19	111	45	7.1	2.6
	Kutiara Beel, Udgar Khal O Kutiarar Khal	32	17	114	30	5.5	2.3
	Mourra Beel*	34	20	110	38	6.7	1.9
Bahubal	Boro Paikka Beel	33	16	125	40	5.3	1.0
Azmiriganj	Silarag Group Fishery	34	23	120	40	5.5	1.1

* Water Temperature (°C): Max-36, Min-14 *Water Transparency (cm): Max-170, Min-20 *Water Level (m): Max-13.1, Min-0.7

Chapter-4

4. Conclusion and Recommendations

Overall catch increased during monitoring period due to project interventions. Along with fish catch fisher person days also increased, that is production created opportunity of fishing. Project interventions also contributed on fish species diversity increament that ensured sustainable fish production from waterbodies. *Haor* waterbodies are good habitat for threatened species shelter and breeding. Threatened fish species was found in every project/case and control waterbodies, so *haor* waterbodies are important for conserving fisheries resources in inland fresh water fish species that contributing fresh water fish production in Bangladesh. *Haor* fisheries is contributing to fisher's livelihood and nutrition in *haor*. On the data analysis following recommendations are given for conservation of fisheries resources.

- Fish sanctuary establishment and their scaling should be continue for species diversity and productivity.
- Less productive waterbodies and ecological diversity can be assessed for seasonal stocking with threatened species and local fast-growing species.
- To reduce fishing pressure in the waterbodies, compensatory alternative income generating activities and women friendly aquaculture activities may be adopted and strengthened.
- The study revealed that *haor* waterbodies were suitable habitat for the threatened species, so special attempts like species stocking, sanctuary maintaining, beel re-excavation and beel connectivity should be made for conservation of threatened species.
- Strengthening institutional capacity and CBOs networking for access to the waterbodies and management for sustainable fish production as a whole.
- Capacity building and institutionalization of the CBOs can provide legal access to government agencies for future sustainability and access to waterbody beyond project period.
- Establishment of co-management in fisheries mainly depend on favourable fisheries policy formulation, in this regards government departments and ministries should work together to reform existing policy in consultation with development partners.

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Appendix-1

Species wise Catch and Threatened Species as per IUCN 2015 Found in HFMLIP Project/Case Waterbodies During Monitoring Period.

Note: Status Code: CR- Critically Endangered, EN- Endangered, VU- Vulnerable, NT- Near Threatened, LC- Least Concern, NE- Not Evaluated, FP-Floodplain, R- River, HS- Hill stream, ET- Estuary. BS- Bangladesh status, GS- Global status

Order	Family	Scientific name	Local name	BS	GS	Habitat	Wt (kg)
Sunamganj	**Chat of Sunbari**						
Siluriformes	Siluridae	Ompok pabo	Pabda	CR	NT	FP	192.95
Cypriniformes	Cyprinidae	Tor tor	Mohashol/Mohal	CR	NT	R	1.36
Siluriformes	Chacidae	Chaca chaca	Chekbeka/Cheka	EN	LC	FP	11.04
Synbranchiformes	Mastacembelidae	Mastacembelus armatus	Boro Baim/Shal Baim	EN	NE	R	1,125.78
Siluriformes	Siluridae	Ompok pabda	Modhu Pabda/Paiva/Pabda	EN	NT	FP	3.33
Siluriformes	Pangasiidae	Pangasius pangasius	Pangus	EN	LC	R, ET	17.44
Perciformes	Channidae	Channa marulius	Gazar/Gazal	EN	LC	FP	8.95
Cypriniformes	Cobitidae	Botia dario	Cheka/Bou	EN	LC	FP	12.98
Cypriniformes	Cyprinidae	Devario anomalus	Bashpata/Chhebri/Dibari	EN	VU	HS	13.95
Siluriformes	Schilbeidae	Clupisoma garua	Ghaura	EN	NE	R	42.45
Cypriniformes	Cobitidae	Botia dayi	Rani/Cheka/Bou	EN	NE	R	21.66
Siluriformes	Siluridae	Wallago attu	Boal	VU	NT	R, Migratory	918.17
Cypriniformes	Cyprinidae	Pethia ticto	Tit punti	VU	LC	FP, HS	89.88
Cypriniformes	Cobitidae	Lepidocephalichthys irrorata	Puia/Goru Puia	VU	LC	R	1.12
Siluriformes	Bagridae	Sperata seenghala	Golsha/Golsha Tengra	VU	LC	R	336.02
Siluriformes	Bagridae	Sperata aor	Ayre	VU	LC	R	124.48
Cypriniformes	Cyprinidae	Danio dangila	Nipati/Jhia/Darakona	VU	LC	HS	15.50
Osteoglossiformes	Notopteridae	Notopterus notopterus	Foli/Kanila/Fotol/Vali/Foloi	VU	LC	FP	13.68
Clupeiformes	Clupeidae	Gudusia chapra	Chapila/Korti/Chalpa	VU	LC	R, FP	12.35
Sunamganj	**Choto Nainda Boro Nainda**						
Siluriformes	Siluridae	Ompok pabo	Pabda	CR	NT	FP	476.56
Cypriniformes	Cyprinidae	Tor tor	Mohashol/Mohal	CR	NT	R	43.87
Cypriniformes	Cobitidae	Botia dayi	Rani/Cheka/Bou	EN	NE	R	8.80
Siluriformes	Pangasiidae	Pangasius pangasius	Pangus	EN	LC	R, ET	5.46
Synbranchiformes	Mastacembelidae	Mastacembelus armatus	Boro Baim/Shal Baim	EN	NE	R	730.17
Siluriformes	Schilbeidae	Clupisoma garua	Ghaura	EN	NE	R	0.90
Perciformes	Channidae	Channa marulius	Gazar/Gazal	EN	LC	FP	408.25
Siluriformes	Bagridae	Rita rita	Rita/Ritha	EN	LC	R	6.30

Order	Family	Scientific name	Local name	BS	GS	Habitat	Wt (kg)
Synbranchiformes	Syngnathidae	Microphis deocata	Kumirer Khil/Kota Kumirer Khil	VU	NT	R, ET	9.96
Siluriformes	Siluridae	Wallago attu	Boal	VU	NT	R, Migratory	1,474.98
Siluriformes	Bagridae	Sperata seenghala	Golsha/Golsha Tengra	VU	LC	R	53.02
Osteoglossiformes	Notopteridae	Notopterus notopterus	Foli/Kanila/Fotol/ Vali/Foloi	VU	LC	FP	61.89
Cypriniformes	Cyprinidae	Pethia ticto	Tit punti	VU	LC	FP, HS	226.12
Clupeiformes	Clupeidae	Gudusia chapra	Chapila/Korti/Chalpa	VU	LC	R, FP	778.44
Cypriniformes	Cyprinidae	Chela cachius	Chhep Chela	VU	LC	R, FP	702.35
Sunamganj	**Kal Dora Nak Dora Beel**						
Siluriformes	Sisoridae	Bagarius bagarius	Bagha Ayre/Bagair	CR	NT	R	26.22
Siluriformes	Siluridae	Ompok pabo	Pabda	CR	NT	FP	191.14
Synbranchiformes	Mastacembelidae	Mastacembelus armatus	Boro Baim/Shal Baim	EN	NE	R	591.44
Cypriniformes	Cobitidae	Botia dario	Cheka/Bou	EN	LC	FP	30.75
Cypriniformes	Cobitidae	Botia dayi	Rani/Cheka/Bou	EN	NE	R	14.18
Cypriniformes	Cobitidae	Botia lohachata	Ptul/Beti/Bet	EN	NE	R	1.02
Siluriformes	Bagridae	Rita rita	Rita/Ritha	EN	LC	R	29.89
Siluriformes	Siluridae	Ompok bimaculatus	Kani Pabda/Boali Pabda	EN	NT	FP	5.14
Synbranchiformes	Synbranchidae	Monopterus cuchia	Kuichcha/Kuichcha Baim	VU	VU	FP	292.06
Siluriformes	Bagridae	Sperata seenghala	Golsha/Golsha Tengra	VU	LC	R	151.41
Siluriformes	Bagridae	Sperata aor	Ayre	VU	LC	R	8.86
Osteoglossiformes	Notopteridae	Notopterus notopterus	Foli/Kanila/Fotol/ Vali/Foloi	VU	LC	FP	366.24
Cypriniformes	Cyprinidae	Pethia ticto	Tit punti	VU	LC	FP, HS	194.43
Clupeiformes	Clupeidae	Gudusia chapra	Chapila/Korti/Chalpa	VU	LC	R, FP	40.83
Siluriformes	Siluridae	Wallago attu	Boal	VU	NT	R, Migratory	395.98
Sunamganj	**Kala-sunda Beel**						
Siluriformes	Siluridae	Ompok pabo	Pabda	CR	NT	FP	108.80
Cypriniformes	Cobitidae	Botia dario	Cheka/Bou	EN	LC	FP	80.57
Synbranchiformes	Mastacembelidae	Mastacembelus armatus	Boro Baim/Shal Baim	EN	NE	R	266.26
Cypriniformes	Cobitidae	Botia dayi	Rani/Cheka/Bou	EN	NE	R	8.21
Perciformes	Channidae	Channa marulius	Gazar/Gazal	EN	LC	FP	85.63
Siluriformes	Bagridae	Sperata seenghala	Golsha/Golsha Tengra	VU	LC	R	85.83
Siluriformes	Bagridae	Sperata aor	Ayre	VU	LC	R	2.01
Osteoglossiformes	Notopteridae	Notopterus notopterus	Foli/Kanila/Fotol/ Vali/Foloi	VU	LC	FP	173.27
Cypriniformes	Cyprinidae	Pethia ticto	Tit punti	VU	LC	FP, HS	278.47
Siluriformes	Siluridae	Wallago attu	Boal	VU	NT	R, Migratory	137.74
Synbranchiformes	Synbranchidae	Monopterus cuchia	Kuichcha/Kuichcha Baim	VU	VU	FP	120.65

Order	Family	Scientific name	Local name	BS	GS	Habitat	Wt (kg)
Clupeiformes	Clupeidae	Gudusia chapra	Chapila/Korti/Chalpa	VU	LC	R, FP	296.39
Sunamganj	**Kirton Khola**						
Cypriniformes	Cyprinidae	Oreichthys cosuatis	Kosua punti/ Kosuati punti	EN	NE	Fp	163.02
Cypriniformes	Cobitidae	Botia dayi	Rani/Cheka/Bou	EN	NE	R	10.06
Cypriniformes	Cobitidae	Botia dario	Cheka/Bou	EN	LC	FP	5.81
Synbranchiformes	Mastacembelidae	Mastacembelus armatus	Boro Baim/Shal Baim	EN	NE	R	777.47
Siluriformes	Bagridae	Sperata seenghala	Golsha/Golsha Tengra	VU	LC	R	613.49
Siluriformes	Bagridae	Sperata aor	Ayre	VU	LC	R	2.09
Osteoglossiformes	Notopteridae	Notopterus notopterus	Foli/Kanila/Fotol/ Vali/Foloi	VU	LC	FP	7.56
Cypriniformes	Cyprinidae	Pethia ticto	Tit punti	VU	LC	FP, HS	32.16
Clupeiformes	Clupeidae	Gudusia chapra	Chapila/Korti/Chalpa	VU	LC	R, FP	14.19
Siluriformes	Siluridae	Wallago attu	Boal	VU	NT	R, Migratory	437.08
Sunamganj	**Kumaria Beel**						
Siluriformes	Siluridae	Ompok pabo	Pabda	CR	NT	FP	85.73
Synbranchiformes	Mastacembelidae	Mastacembelus armatus	Boro Baim/Shal Baim	EN	NE	R	69.04
Cypriniformes	Cobitidae	Botia dayi	Rani/Cheka/Bou	EN	NE	R	75.78
Siluriformes	Siluridae	Ompok bimaculatus	Kani Pabda/Boali Pabda	EN	NT	FP	4.98
Cypriniformes	Cyprinidae	Oreichthys cosuatis	Kosua punti/ Kosuati punti	EN	NE	Fp	288.06
Cypriniformes	Cyprinidae	Pethia ticto	Tit punti	VU	LC	FP, HS	400.76
Siluriformes	Bagridae	Sperata seenghala	Golsha/Golsha Tengra	VU	LC	R	20.16
Clupeiformes	Clupeidae	Gudusia chapra	Chapila/Korti/Chalpa	VU	LC	R, FP	576.00
Siluriformes	Sissoridae	Glypothorax telchitta	Dhal magur/Telechita	VU	LC	R	6.39
Siluriformes	Siluridae	Wallago attu	Boal	VU	NT	R, Migratory	1.55
Sunamganj	**Pakhimara Ram Ghuta**						
Siluriformes	Sisoridae	Bagarius bagarius	Bagha Ayre/Bagair	CR	NT	R	1.55
Siluriformes	Siluridae	Ompok pabo	Pabda	CR	NT	FP	61.37
Synbranchiformes	Mastacembelidae	Mastacembelus armatus	Boro Baim/Shal Baim	EN	NE	R	33.79
Siluriformes	Siluridae	Ompok bimaculatus	Kani Pabda/Boali Pabda	EN	NT	FP	3.41
Perciformes	Channidae	Channa marulius	Gazar/Gazal	EN	LC	FP	17.95
Cypriniformes	Cobitidae	Botia dario	Cheka/Bou	EN	LC	FP	2.08
Cypriniformes	Cobitidae	Botia dayi	Rani/Cheka/Bou	EN	NE	R	26.22
Cypriniformes	Cyprinidae	Pethia ticto	Tit punti	VU	LC	FP, HS	486.38
Siluriformes	Siluridae	Wallago attu	Boal	VU	NT	R, Migratory	316.11
Siluriformes	Bagridae	Sperata seenghala	Golsha/Golsha Tengra	VU	LC	R	82.66
Siluriformes	Bagridae	Sperata aor	Ayre	VU	LC	R	30.15

Order	Family	Scientific name	Local name	BS	GS	Habitat	Wt (kg)
Osteoglossiformes	Notopteridae	Notopterus notopterus	Foli/Kanila/Fotol/ Vali/Foloi	VU	LC	FP	9.09
Cypriniformes	Cobitidae	Lepidocephalichthys annandalei	Puia/Goru Puia/Puia	VU	LC	FP	3.25
Clupeiformes	Clupeidae	Gudusia chapra	Chapila/Korti/Chalpa	VU	LC	R, FP	299.13
Cypriniformes	Cyprinidae	Chela cachius	Chhep Chela	VU	LC	R, FP	0.76
Sunamganj	**Shimul Tola Chikon Dair**						
Cypriniformes	Cyprinidae	Tor tor	Mohashol/Mohal	CR	NT	R	10.94
Siluriformes	Siluridae	Ompok pabo	Pabda	CR	NT	FP	104.82
Cypriniformes	Cobitidae	Botia dario	Cheka/Bou	EN	LC	FP	0.04
Cypriniformes	Cyprinidae	Oreichthys cosuatis	Kosua punti/ Kosuati punti	EN	NE	Fp	155.38
Siluriformes	Siluridae	Ompok bimaculatus	Kani Pabda/Boali Pabda	EN	NT	FP	19.70
Siluriformes	Schilbeidae	Clupisoma garua	Ghaura	EN	NE	R	110.92
Synbranchiformes	Mastacembelidae	Mastacembelus armatus	Boro Baim/Shal Baim	EN	NE	R	455.70
Perciformes	Channidae	Channa marulius	Gazar/Gazal	EN	LC	FP	2.03
Clupeiformes	Clupeidae	Gudusia chapra	Chapila/Korti/Chalpa	VU	LC	R, FP	101.01
Cypriniformes	Cyprinidae	Pethia ticto	Tit punti	VU	LC	FP, HS	193.08
Siluriformes	Bagridae	Sperata seenghala	Golsha/Golsha Tengra	VU	LC	R	195.28
Siluriformes	Siluridae	Wallago attu	Boal	VU	NT	R, Migratory	147.58
Sunamganj	**Suraiya Beel**						
Siluriformes	Siluridae	Ompok pabo	Pabda	CR	NT	FP	74.46
Perciformes	Channidae	Channa marulius	Gazar/Gazal	EN	LC	FP	76.08
Synbranchiformes	Mastacembelidae	Mastacembelus armatus	Boro Baim/Shal Baim	EN	NE	R	148.89
Siluriformes	Siluridae	Ompok pabda	Modhu Pabda/Paiva/Pabda	EN	NT	FP	17.79
Siluriformes	Siluridae	Ompok bimaculatus	Kani Pabda/Boali Pabda	EN	NT	FP	5.15
Siluriformes	Schilbeidae	Clupisoma garua	Ghaura	EN	NE	R	3.90
Cypriniformes	Cobitidae	Botia dayi	Rani/Cheka/Bou	EN	NE	R	150.83
Siluriformes	Bagridae	Sperata seenghala	Golsha/Golsha Tengra	VU	LC	R	10.56
Cypriniformes	Cyprinidae	Pethia ticto	Tit punti	VU	LC	FP, HS	275.69
Siluriformes	Siluridae	Wallago attu	Boal	VU	NT	R, Migratory	125.50
Netrokona	**Baradia Beel**						
Cypriniformes	Cyprinidae	Tor tor	Mohashol/Mohal	CR	NT	R	1.65
Siluriformes	Siluridae	Ompok pabo	Pabda	CR	NT	FP	11.48
Cypriniformes	Cobitidae	Botia dayi	Rani/Cheka/Bou	EN	NE	R	6.72
Cypriniformes	Cobitidae	Botia dario	Cheka/Bou	EN	LC	FP	15.55
Perciformes	Channidae	Channa marulius	Gazar/Gazal	EN	LC	FP	14.14
Siluriformes	Siluridae	Ompok bimaculatus	Kani Pabda/Boali Pabda	EN	NT	FP	5.21
Synbranchiformes	Mastacembelidae	Mastacembelus armatus	Boro Baim/Shal Baim	EN	NE	R	8.76

Order	Family	Scientific name	Local name	BS	GS	Habitat	Wt (kg)
Cypriniformes	Cyprinidae	Pethia ticto	Tit punti	VU	LC	FP, HS	125.15
Osteoglossiformes	Notopteridae	Notopterus notopterus	Foli/Kanila/Fotol/ Vali/Foloi	VU	LC	FP	0.39
Synbranchiformes	Synbranchidae	Monopterus cuchia	Kuichcha/Kuichcha Baim	VU	VU	FP	43.55
Clupeiformes	Clupeidae	Gudusia chapra	Chapila/Korti/Chalpa	VU	LC	R, FP	71.38
Siluriformes	Siluridae	Wallago attu	Boal	VU	NT	R, Migratory	190.06
Netrokona	**Dattakhila**						
Siluriformes	Siluridae	Ompok pabo	Pabda	CR	NT	FP	60.64
Siluriformes	Schilbeidae	Clupisoma garua	Ghaura	EN	NE	R	47.96
Cypriniformes	Cobitidae	Botia dayi	Rani/Cheka/Bou	EN	NE	R	7.80
Cypriniformes	Cyprinidae	Oreichthys cosuatis	Kosua punti/ Kosuati punti	EN	NE	Fp	25.50
Osteoglossiformes	Notopteridae	Chitala chitala	Chitol	EN	NT	R	9.00
Perciformes	Channidae	Channa marulius	Gazar/Gazal	EN	LC	FP	3.38
Synbranchiformes	Mastacembelidae	Mastacembelus armatus	Boro Baim/Shal Baim	EN	NE	R	300.34
Clupeiformes	Clupeidae	Gudusia chapra	Chapila/Korti/Chalpa	VU	LC	R, FP	1,431.25
Cypriniformes	Cyprinidae	Pethia ticto	Tit punti	VU	LC	FP, HS	2,291.77
Siluriformes	Bagridae	Sperata aor	Ayre	VU	LC	R	24.50
Siluriformes	Siluridae	Wallago attu	Boal	VU	NT	R, Migratory	110.21
Siluriformes	Bagridae	Sperata seenghala	Golsha/Golsha Tengra	VU	LC	R	297.25
Netrokona	**Hogla**						
Siluriformes	Siluridae	Ompok pabo	Pabda	CR	NT	FP	43.65
Synbranchiformes	Mastacembelidae	Mastacembelus armatus	Boro Baim/Shal Baim	EN	NE	R	25.20
Perciformes	Channidae	Channa marulius	Gazar/Gazal	EN	LC	FP	12.29
Siluriformes	Siluridae	Ompok bimaculatus	Kani Pabda/Boali Pabda	EN	NT	FP	6.84
Cypriniformes	Cobitidae	Botia dario	Cheka/Bou	EN	LC	FP	9.83
Clupeiformes	Clupeidae	Gudusia chapra	Chapila/Korti/Chalpa	VU	LC	R, FP	98.93
Cypriniformes	Cyprinidae	Pethia ticto	Tit punti	VU	LC	FP, HS	898.05
Siluriformes	Bagridae	Sperata seenghala	Golsha/Golsha Tengra	VU	LC	R	182.97
Siluriformes	Siluridae	Wallago attu	Boal	VU	NT	R, Migratory	43.57
Netrokona	**Ranggadair Jolmohal**						
Siluriformes	Siluridae	Ompok pabo	Pabda	CR	NT	FP	295.39
Siluriformes	Siluridae	Ompok bimaculatus	Kani Pabda/Boali Pabda	EN	NT	FP	6.56
Synbranchiformes	Mastacembelidae	Mastacembelus armatus	Boro Baim/Shal Baim	EN	NE	R	49.77
Siluriformes	Schilbeidae	Clupisoma garua	Ghaura	EN	NE	R	8.86
Perciformes	Channidae	Channa marulius	Gazar/Gazal	EN	LC	FP	13.44

Order	Family	Scientific name	Local name	BS	GS	Habitat	Wt (kg)
Cypriniformes	Cobitidae	Botia dario	Cheka/Bou	EN	LC	FP	350.15
Siluriformes	Bagridae	Sperata aor	Ayre	VU	LC	R	44.93
Siluriformes	Bagridae	Sperata seenghala	Golsha/Golsha Tengra	VU	LC	R	190.47
Cypriniformes	Cyprinidae	Pethia ticto	Tit punti	VU	LC	FP, HS	161.84
Siluriformes	Siluridae	Wallago attu	Boal	VU	NT	R, Migratory	943.31
Osteoglossiformes	Notopteridae	Notopterus notopterus	Foli/Kanila/Fotol/ Vali/Foloi	VU	LC	FP	120.19
Clupeiformes	Clupeidae	Gudusia chapra	Chapila/Korti/Chalpa	VU	LC	R, FP	109.85
Kishoreganj	**Chapra Beel**						
Siluriformes	Siluridae	Ompok pabo	Pabda	CR	NT	FP	80.05
Siluriformes	Bagridae	Rita rita	Rita/Ritha	EN	LC	R	26.98
Cypriniformes	Cobitidae	Botia dario	Cheka/Bou	EN	LC	FP	131.43
Perciformes	Channidae	Channa marulius	Gazar/Gazal	EN	LC	FP	11.32
Cypriniformes	Cobitidae	Botia dayi	Rani/Cheka/Bou	EN	NE	R	11.50
Siluriformes	Siluridae	Ompok bimaculatus	Kani Pabda/Boali Pabda	EN	NT	FP	7.75
Synbranchiformes	Mastacembelidae	Mastacembelus armatus	Boro Baim/Shal Baim	EN	NE	R	17.66
Cypriniformes	Cyprinidae	Pethia ticto	Tit punti	VU	LC	FP, HS	421.50
Mugiliformes	Mugilidae	Sicamugil cascasia	Kachki Bata	VU	LC	ET	11.62
Osteoglossiformes	Notopteridae	Notopterus notopterus	Foli/Kanila/Fotol/ Vali/Foloi	VU	LC	FP	1.40
Siluriformes	Siluridae	Wallago attu	Boal	VU	NT	R, Migratory	125.66
Siluriformes	Bagridae	Sperata seenghala	Golsha/Golsha Tengra	VU	LC	R	466.24
Siluriformes	Bagridae	Sperata aor	Ayre	VU	LC	R	11.42
Clupeiformes	Clupeidae	Gudusia chapra	Chapila/Korti/Chalpa	VU	LC	R, FP	456.59
Kishoreganj	**Dhoniar Kona Beel**						
Siluriformes	Siluridae	Ompok pabo	Pabda	CR	NT	FP	210.57
Cypriniformes	Cyprinidae	Tor tor	Mohashol/Mohal	CR	NT	R	7.60
Siluriformes	Schilbeidae	Clupisoma garua	Ghaura	EN	NE	R	43.75
Osteoglossiformes	Notopteridae	Chitala chitala	Chitol	EN	NT	R	19.79
Siluriformes	Pangasiidae	Pangasius pangasius	Pangus	EN	LC	R, ET	29.28
Cypriniformes	Cobitidae	Botia dario	Cheka/Bou	EN	LC	FP	16.30
Synbranchiformes	Mastacembelidae	Mastacembelus armatus	Boro Baim/Shal Baim	EN	NE	R	393.86
Perciformes	Channidae	Channa marulius	Gazar/Gazal	EN	LC	FP	329.26
Siluriformes	Siluridae	Wallago attu	Boal	VU	NT	R, Migratory	1,850.01
Siluriformes	Bagridae	Sperata aor	Ayre	VU	LC	R	62.24
Osteoglossiformes	Notopteridae	Notopterus notopterus	Foli/Kanila/Fotol/ Vali/Foloi	VU	LC	FP	25.31
Cypriniformes	Cyprinidae	Pethia ticto	Tit punti	VU	LC	FP, HS	159.35
Clupeiformes	Clupeidae	Gudusia chapra	Chapila/Korti/Ch	VU	LC	R, FP	32.80

Order	Family	Scientific name	Local name	BS	GS	Habitat	Wt (kg)
			alpa				
Siluriformes	Bagridae	Sperata seenghala	Golsha/Golsha Tengra	VU	LC	R	582.42
Kishoreganj	**Goza Beel**						
Siluriformes	Siluridae	Ompok pabo	Pabda	CR	NT	FP	40.17
Cypriniformes	Cyprinidae	Tor tor	Mohashol/Mohal	CR	NT	R	1.39
Perciformes	Channidae	Channa marulius	Gazar/Gazal	EN	LC	FP	22.05
Cypriniformes	Cobitidae	Botia dayi	Rani/Cheka/Bou	EN	NE	R	3.92
Cypriniformes	Cyprinidae	Oreichthys cosuatis	Kosua punti/ Kosuati punti	EN	NE	Fp	2.48
Osteoglossiformes	Notopteridae	Chitala chitala	Chitol	EN	NT	R	3.75
Synbranchiformes	Mastacembelidae	Mastacembelus armatus	Boro Baim/Shal Baim	EN	NE	R	14.52
Siluriformes	Schilbeidae	Clupisoma garua	Ghaura	EN	NE	R	122.88
Siluriformes	Siluridae	Ompok bimaculatus	Kani Pabda/Boali Pabda	EN	NT	FP	6.80
Siluriformes	Bagridae	Sperata aor	Ayre	VU	LC	R	10.62
Clupeiformes	Clupeidae	Gudusia chapra	Chapila/Korti/Chalpa	VU	LC	R, FP	136.10
Synbranchiformes	Synbranchidae	Monopterus cuchia	Kuichcha/Kuichcha Baim	VU	VU	FP	7.00
Cypriniformes	Cyprinidae	Aspidoparia morar	Piali/Morar/Morari	VU	NE	R	19.04
Cypriniformes	Cyprinidae	Pethia ticto	Tit punti	VU	LC	FP, HS	349.32
Mugiliformes	Mugilidae	Sicamugil cascasia	Kachki Bata	VU	LC	ET	1.94
Siluriformes	Bagridae	Sperata seenghala	Golsha/Golsha Tengra	VU	LC	R	110.83
Osteoglossiformes	Notopteridae	Notopterus notopterus	Foli/Kanila/Fotol/ Vali/Foloi	VU	LC	FP	7.89
Siluriformes	Siluridae	Wallago attu	Boal	VU	NT	R, Migratory	598.36
Kishoreganj	**Kalni Beel**						
Siluriformes	Siluridae	Ompok pabo	Pabda	CR	NT	FP	562.69
Cypriniformes	Cobitidae	Botia dario	Cheka/Bou	EN	LC	FP	9.44
Siluriformes	Schilbeidae	Clupisoma garua	Ghaura	EN	NE	R	302.23
Siluriformes	Pangasiidae	Pangasius pangasius	Pangus	EN	LC	R, ET	12.68
Perciformes	Channidae	Channa marulius	Gazar/Gazal	EN	LC	FP	7.79
Synbranchiformes	Mastacembelidae	Mastacembelus armatus	Boro Baim/Shal Baim	EN	NE	R	93.35
Siluriformes	Bagridae	Sperata aor	Ayre	VU	LC	R	5.63
Siluriformes	Siluridae	Wallago attu	Boal	VU	NT	R, Migratory	684.60
Osteoglossiformes	Notopteridae	Notopterus notopterus	Foli/Kanila/Fotol/ Vali/Foloi	VU	LC	FP	3.95
Cypriniformes	Cyprinidae	Pethia ticto	Tit punti	VU	LC	FP, HS	148.76
Cypriniformes	Cobitidae	Lepidocephalichthys irrorata	Puia/Goru Puia	VU	LC	R	0.82
Anguilliformes	Anguillidae	Anguilla bengalensis	Baus/Bamus/Bonehara	VU	NT	R	10.00
Clupeiformes	Clupeidae	Gudusia chapra	Chapila/Korti/Chalpa	VU	LC	R, FP	41.35

Order	Family	Scientific name	Local name	BS	GS	Habitat	Wt (kg)
Siluriformes	Bagridae	Sperata seenghala	Golsha/Golsha Tengra	VU	LC	R	876.25
Kishoreganj	**Korgaon -1/2 Gazipur**						
Siluriformes	Siluridae	Ompok pabo	Pabda	CR	NT	FP	31.40
Cypriniformes	Cobitidae	Botia dario	Cheka/Bou	EN	LC	FP	35.70
Synbranchiformes	Mastacembelidae	Mastacembelus armatus	Boro Baim/Shal Baim	EN	NE	R	67.97
Perciformes	Channidae	Channa marulius	Gazar/Gazal	EN	LC	FP	43.81
Clupeiformes	Clupeidae	Gudusia chapra	Chapila/Korti/Chalpa	VU	LC	R, FP	178.25
Mugiliformes	Mugilidae	Sicamugil cascasia	Kachki Bata	VU	LC	ET	2.93
Osteoglossiformes	Notopteridae	Notopterus notopterus	Foli/Kanila/Fotol/ Vali/Foloi	VU	LC	FP	30.06
Siluriformes	Bagridae	Sperata seenghala	Golsha/Golsha Tengra	VU	LC	R	235.70
Siluriformes	Siluridae	Wallago attu	Boal	VU	NT	R, Migratory	42.27
Cypriniformes	Cyprinidae	Pethia ticto	Tit punti	VU	LC	FP, HS	89.44
Kishoreganj	**Noniala Beel**						
Siluriformes	Siluridae	Ompok pabo	Pabda	CR	NT	FP	112.80
Cypriniformes	Cobitidae	Botia dario	Cheka/Bou	EN	LC	FP	1.07
Synbranchiformes	Mastacembelidae	Mastacembelus armatus	Boro Baim/Shal Baim	EN	NE	R	528.07
Osteoglossiformes	Notopteridae	Chitala chitala	Chitol	EN	NT	R	10.46
Siluriformes	Schilbeidae	Clupisoma garua	Ghaura	EN	NE	R	121.79
Cypriniformes	Cobitidae	Botia dayi	Rani/Cheka/Bou	EN	NE	R	0.46
Perciformes	Channidae	Channa marulius	Gazar/Gazal	EN	LC	FP	9.15
Siluriformes	Siluridae	Ompok bimaculatus	Kani Pabda/Boali Pabda	EN	NT	FP	56.19
Clupeiformes	Clupeidae	Gudusia chapra	Chapila/Korti/Chalpa	VU	LC	R, FP	14.93
Cypriniformes	Cyprinidae	Pethia ticto	Tit punti	VU	LC	FP, HS	328.81
Synbranchiformes	Synbranchidae	Monopterus cuchia	Kuichcha/Kuichcha Baim	VU	VU	FP	3.25
Osteoglossiformes	Notopteridae	Notopterus notopterus	Foli/Kanila/Fotol/ Vali/Foloi	VU	LC	FP	0.32
Siluriformes	Bagridae	Sperata seenghala	Golsha/Golsha Tengra	VU	LC	R	430.28
Siluriformes	Siluridae	Wallago attu	Boal	VU	NT	R, Migratory	645.64
Habiganj	**Andaura Beel**						
Siluriformes	Sisoridae	Bagarius bagarius	Bagha Ayre/Bagair	CR	NT	R	49.65
Siluriformes	Siluridae	Ompok pabo	Pabda	CR	NT	FP	37.22
Cypriniformes	Cobitidae	Botia dayi	Rani/Cheka/Bou	EN	NE	R	45.21
Cypriniformes	Cyprinidae	Devario anomalus	Bashpata/Chhebri/Dibari	EN	VU	HS	9.84
Synbranchiformes	Mastacembelidae	Mastacembelus armatus	Boro Baim/Shal Baim	EN	NE	R	139.43
Cypriniformes	Cobitidae	Botia dario	Cheka/Bou	EN	LC	FP	3.64
Siluriformes	Siluridae	Ompok bimaculatus	Kani Pabda/Boali Pabda	EN	NT	FP	6.43

Order	Family	Scientific name	Local name	BS	GS	Habitat	Wt (kg)
Siluriformes	Schilbeidae	Clupisoma garua	Ghaura	EN	NE	R	42.43
Siluriformes	Chacidae	Chaca chaca	Chekbeka/Cheka	EN	LC	FP	4.38
Cypriniformes	Cyprinidae	Tor putitora	Puti tor/Mohasher	EN	NT	R	24.26
Perciformes	Channidae	Channa marulius	Gazar/Gazal	EN	LC	FP	35.58
Cypriniformes	Cyprinidae	Aspidoparia morar	Piali/Morar/Morari	VU	NE	R	36.56
Cypriniformes	Cyprinidae	Chela cachius	Chhep Chela	VU	LC	R, FP	20.29
Synbranchiformes	Syngnathidae	Microphis deocata	Kumirer Khil/Kota Kumirer Khil	VU	NT	R, ET	1.52
Clupeiformes	Clupeidae	Gudusia chapra	Chapila/Korti/Chalpa	VU	LC	R, FP	237.54
Cypriniformes	Cyprinidae	Pethia ticto	Tit punti	VU	LC	FP, HS	364.54
Siluriformes	Bagridae	Sperata aor	Ayre	VU	LC	R	189.81
Synbranchiformes	Synbranchidae	Monopterus cuchia	Kuichcha/Kuichcha Baim	VU	VU	FP	309.86
Siluriformes	Bagridae	Sperata seenghala	Golsha/Golsha Tengra	VU	LC	R	537.48
Siluriformes	Siluridae	Wallago attu	Boal	VU	NT	R, Migratory	1,143.99
Habiganj							**Boro Paikka Beel**
Siluriformes	Sisoridae	Bagarius bagarius	Bagha Ayre/Bagair	CR	NT	R	3.00
Cypriniformes	Cyprinidae	Tor tor	Mohashol/Mohal	CR	NT	R	7.15
Synbranchiformes	Mastacembelidae	Mastacembelus armatus	Boro Baim/Shal Baim	EN	NE	R	229.13
Siluriformes	Siluridae	Wallago attu	Boal	VU	NT	R, Migratory	31.58
Clupeiformes	Clupeidae	Gudusia chapra	Chapila/Korti/Chalpa	VU	LC	R, FP	1.22
Cypriniformes	Cyprinidae	Chela cachius	Chhep Chela	VU	LC	R, FP	1.64
Osteoglossiformes	Notopteridae	Notopterus notopterus	Foli/Kanila/Fotol/Vali/Foloi	VU	LC	FP	3.37
Synbranchiformes	Synbranchidae	Monopterus cuchia	Kuichcha/Kuichcha Baim	VU	VU	FP	42.02
Cypriniformes	Cyprinidae	Pethia ticto	Tit punti	VU	LC	FP, HS	1,995.06
Habiganj			**Choto Beri Beel**				
Cypriniformes	Cyprinidae	Labeo nandina	Nandil/Nandina	CR	NT	R	2.83
Siluriformes	Siluridae	Ompok pabo	Pabda	CR	NT	FP	123.84
Cypriniformes	Cyprinidae	Tor tor	Mohashol/Mohal	CR	NT	R	125.58
Cypriniformes	Cobitidae	Botia dayi	Rani/Cheka/Bou	EN	NE	R	17.96
Osteoglossiformes	Notopteridae	Chitala chitala	Chitol	EN	NT	R	19.25
Synbranchiformes	Mastacembelidae	Mastacembelus armatus	Boro Baim/Shal Baim	EN	NE	R	11.20
Cypriniformes	Cyprinidae	Crossocheilus latius	Tatkini	EN	LC	HS, R	102.20
Perciformes	Channidae	Channa marulius	Gazar/Gazal	EN	LC	FP	148.89
Clupeiformes	Clupeidae	Gudusia chapra	Chapila/Korti/Chalpa	VU	LC	R, FP	1,507.14
Cypriniformes	Cyprinidae	Pethia ticto	Tit punti	VU	LC	FP, HS	194.14

Order	Family	Scientific name	Local name	BS	GS	Habitat	Wt (kg)
Osteoglossiformes	Notopteridae	Notopterus notopterus	Foli/Kanila/Fotol/ Vali/Foloi	VU	LC	FP	248.97
Siluriformes	Siluridae	Wallago attu	Boal	VU	NT	R, Migratory	919.44
Habiganj	**Kutiara Beel**						
Siluriformes	Siluridae	Ompok pabo	Pabda	CR	NT	FP	41.11
Siluriformes	Siluridae	Ompok bimaculatus	Kani Pabda/Boali Pabda	EN	NT	FP	116.63
Cypriniformes	Cobitidae	Botia dario	Cheka/Bou	EN	LC	FP	9.77
Cypriniformes	Cobitidae	Botia dayi	Rani/Cheka/Bou	EN	NE	R	23.02
Cypriniformes	Cyprinidae	Megarasbora elanga	Elong	EN	LC	R	5.70
Cypriniformes	Cyprinidae	Tor putitora	Puti tor/Mohasher	EN	NT	R	2.14
Perciformes	Channidae	Channa marulius	Gazar/Gazal	EN	LC	FP	13.58
Synbranchiformes	Mastacembelidae	Mastacembelus armatus	Boro Baim/Shal Baim	EN	NE	R	536.82
Siluriformes	Pangasiidae	Pangasius pangasius	Pangus	EN	LC	R, ET	2.33
Clupeiformes	Clupeidae	Gudusia chapra	Chapila/Korti/Chalpa	VU	LC	R, FP	188.81
Cypriniformes	Cyprinidae	Chela cachius	Chhep Chela	VU	LC	R, FP	201.45
Cypriniformes	Cyprinidae	Pethia ticto	Tit punti	VU	LC	FP, HS	112.84
Osteoglossiformes	Notopteridae	Notopterus notopterus	Foli/Kanila/Fotol/ Vali/Foloi	VU	LC	FP	27.79
Siluriformes	Bagridae	Sperata aor	Ayre	VU	LC	R	6.20
Siluriformes	Bagridae	Sperata seenghala	Golsha/Golsha Tengra	VU	LC	R	28.10
Siluriformes	Siluridae	Wallago attu	Boal	VU	NT	R, Migratory	61.34
Synbranchiformes	Synbranchidae	Monopterus cuchia	Kuichcha/Kuichcha Baim	VU	VU	FP	1.55
Habiganj	**Silarag Group Fishery**						
Siluriformes	Siluridae	Ompok pabo	Pabda	CR	NT	FP	31.19
Cypriniformes	Cobitidae	Botia dario	Cheka/Bou	EN	LC	FP	21.77
Siluriformes	Siluridae	Ompok bimaculatus	Kani Pabda/Boali Pabda	EN	NT	FP	8.57
Cypriniformes	Cobitidae	Botia dayi	Rani/Cheka/Bou	EN	NE	R	257.22
Osteoglossiformes	Notopteridae	Chitala chitala	Chitol	EN	NT	R	13.95
Perciformes	Channidae	Channa marulius	Gazar/Gazal	EN	LC	FP	128.40
Siluriformes	Bagridae	Rita rita	Rita/Ritha	EN	LC	R	440.24
Siluriformes	Schilbeidae	Clupisoma garua	Ghaura	EN	NE	R	626.63
Siluriformes	Siluridae	Ompok pabda	Modhu Pabda/Paiva/Pabda	EN	NT	FP	52.32
Synbranchiformes	Mastacembelidae	Mastacembelus armatus	Boro Baim/Shal Baim	EN	NE	R	242.90
Siluriformes	Pangasiidae	Pangasius pangasius	Pangus	EN	LC	R, ET	18.41
Siluriformes	Bagridae	Sperata aor	Ayre	VU	LC	R	119.27
Siluriformes	Siluridae	Wallago attu	Boal	VU	NT	R, Migratory	4,410.35

Order	Family	Scientific name	Local name	BS	GS	Habitat	Wt (kg)
Clupeiformes	Clupeidae	Gudusia chapra	Chapila/Korti/Chalpa	VU	LC	R, FP	225.80
Osteoglossiformes	Notopteridae	Notopterus notopterus	Foli/Kanila/Fotol/Vali/Foloi	VU	LC	FP	33.51
Cypriniformes	Cyprinidae	Pethia ticto	Tit punti	VU	LC	FP, HS	200.77
Siluriformes	Bagridae	Sperata seenghala	Golsha/Golsha Tengra	VU	LC	R	166.12
Synbranchiformes	Synbranchidae	Monopterus cuchia	Kuichcha/Kuichcha Baim	VU	VU	FP	2,352.51
Brahmanbaria	**Satbila Fishery**						
Siluriformes	Siluridae	Ompok pabo	Pabda	CR	NT	FP	36.26
Synbranchiformes	Mastacembelidae	Mastacembelus armatus	Boro Baim/Shal Baim	EN	NE	R	8.44
Perciformes	Channidae	Channa marulius	Gazar/Gazal	EN	LC	FP	53.96
Siluriformes	Schilbeidae	Clupisoma garua	Ghaura	EN	NE	R	2.64
Cypriniformes	Cyprinidae	Crossocheilus latius	Tatkini	EN	LC	HS, R	2.99
Siluriformes	Siluridae	Ompok pabda	Modhu Pabda/Paiva/Pabda	EN	NT	FP	4.78
Osteoglossiformes	Notopteridae	Notopterus notopterus	Foli/Kanila/Fotol/Vali/Foloi	VU	LC	FP	142.85
Cypriniformes	Cyprinidae	Pethia ticto	Tit punti	VU	LC	FP, HS	38.80
Clupeiformes	Clupeidae	Gudusia chapra	Chapila/Korti/Chalpa	VU	LC	R, FP	234.63
Siluriformes	Siluridae	Wallago attu	Boal	VU	NT	R, Migratory	113.07
Siluriformes	Bagridae	Sperata seenghala	Golsha/Golsha Tengra	VU	LC	R	16.02

Appendix-2

1. Open catch monitoring format

হাওড় অঞ্চলের বন্যা ব্যবস্থাপনা ও জীবনমান উন্নয়ন প্রকল্প (HFMLIP)
মৎস্য আহরণ মনিটরিং প্রশ্নমালা
HFMLIP-LGED/ /The WorldFish

১) জলমহালের কোড ঃ- ।..... ।..... । ..... । ২) মৎস্য আহরনের ক্ষেত্রের নাম ঃ - .....

৩) তথ্য সংগ্রহকারীর নাম ঃ - ..... ৪) নমুনা সংগ্রহের তারিখ ঃ- ।..... ।..... ।..... ।..... ।..... ।..... ।

৫) মৎস্যজীবীর নাম ঃ - ..... ৬) গ্রামের নাম ঃ -.....

৭) মৎস্য আহরণ ক্ষেত্র থেকে বাড়ীর দুরত্ব (কিঃমিঃ)ঃ ।..... ।..... ।..... ।..... । ৮) ছকপত্রের ক্রমিক সংখ্যা ঃ- ।..... ।..... ।

৯) (১) সার্বক্ষণিক মৎস্যজীবী ঃ..... (২) খন্ডকালীন মৎস্যজীবী ঃ ..... (৩) সাবসিসটেন্স মৎস্যজীবী ঃ.....(৪) জমির পরিমান (শতক).....

১০) মৎস্যজীবী কর্তৃক আজকে ব্যবহৃত সরঞ্জামের বিবরণ ঃ-

ক্রঃ নং	জালের স্থানীয় নাম	জালের প্রকার ভেদ (ক্যাটাগরী)	জালের বিবরণ (হাত)			জালের ফাঁস (ইঞ্চি)	মোট সংখ্যা (হুক/জাল)	মোট মৎস্যজীবীর সংখ্যা	পানির গভীরতা (হাত)
			দৈর্ঘ্য	উচ্চতা	ব্যাস				
১।									
২।									

১১) গত এক সপ্তাহে কতদিন ও কত রাত মাছ ধরেছে ঃ- ..... দিন ..... ।..... । রাত ঃ-..... ।..... ।

১২) মাছ ধরার সরঞ্জামাদির মালিকের সংখ্যা ঃ- কতজন মাছ ধরে ঃ- ..... ।..... ।..... । কতজন মাছ ধরে না ঃ- .... ।..... ।..... ।

১৩) মাছ ধরার অধিকার কোডঃ- (১) বি ইউ জি এর মাধ্যমে টাকা প্রদানের ভিত্তিতে (২) বি ইউ জি কে টাকা/ইজারা প্রদানের মাধ্যমে (৩) বি ইউ জি এর নিকট মাছ বিক্রির মাধ্যমে (৪) মাছের ভাগ প্রদানের মাধ্যমে (৫) বি ইউ জি কর্তৃক নিযুক্ত দৈনিক মজুরির ভিত্তিতে (৬) স্বাধীনভাবে/ইচ্ছামত মাছ ধরা যায়।

১৪) গত রাত থেকে মাছ ধরার সময় ঃ-

মাছ কখন ধরতে আরম্ভ করেছে ঃ- ।..... ।..... ।..... ।..... । কখন মাছ ধরা শেষ করেছে ঃ ।..... ।..... ।..... ।..... ।

মাছ ধরতে মোট কত সময় লেগেছে ঃ- ।..... ।..... ।..... ।..... ।

বর্তমানে আহরিত মাছ ধরতে কত সময় লেগেছে ঃ।..... ।..... ।..... ।..... । আর কত সময় মাছ ধরবে ঃ . ।..... ।..... ।..... ।

১৫) মোট মাছের পরিমান (কেজি) ঃ- ।..... ।..... ।..... ।..... । কি পরিমান মাছ বিক্রি হয়েছেঃ ।..... ।..... ।..... ।..... ।

যে মাছ বিক্রি করা হয়েছে তার দাম ঃ ।..... ।..... ।..... ।..... ।.... । কি পরিমান মাছ বিক্রি করা হবে (কেজি)ঃ ।..... ।..... ।..... ।.... ।

১৬) গতকল্য ধৃত মোট মাছের পরিমান (কেজি) ঃ- ।..... ।..... ।..... ।..... । কি পরিমান মাছ বিক্রি হয়েছেঃ ।..... ।..... ।..... ।..... ।

যে মাছ বিক্রি করা হয়েছে তার দাম ঃ ।..... ।..... ।..... ।..... ।.... ।

১৭) খাওয়ার মাছের পরিমান (কেজি)ঃ- ।..... ।..... ।..... ।..... ।

খাওয়ার মাছে বড় মাছের পরিমান (কেজি)ঃ

বড় মাছের নাম	কোড	ওজন (কেজি)

খাওয়ার মাছে গুঁড়া মাছের পরিমান (কেজি)ঃ

ছোট মাছের নাম	কোড	ওজন (কেজি)

১৮) আজ মাছ ধরা বাবদ খরচ ঃ-নগদ খরচ (জাল মেরামত, জ্বালানী, পরিবহন) ..... টাকা ঃ- ।..... ।..... ।..... ।

মাছের অংশ প্রদান / মাছ ধরা বাবদ ফি ..... %/ টাকা ঃ- ।..... ।..... ।..... ।..... ।

যে সব অংশীদার মাছ ধরে না কিন্তু সরঞ্জামাদির জন্য আহরিত মাছের শতকরা কতভাগ দিতে হয় ঃ- .....% ।..... ।..... ।

১

১৯) নমুনা সংগ্রহের সময় মৎস্যজীবি কর্তৃক আহরিত মাছের পরিমান ঃ

প্রজাতির নাম	প্রজাতির কোড	মোট পরিমান (কেজি)*	নমুনা/ওজনকৃত মাছ		দৈর্ঘ্য (ইঞ্চি)		
			মোট সংখ্যা	মোট পরিমান (গ্রাম)	ছোট	বড়	গড়

* প্রয়োজনবোধে মোট মাছের পরিমান থেকে প্রজাতির শতকরা ভাগ বের করা যাবে।

মন্তব্য ঃ

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2. Major catch monitoring format

হাওড় অঞ্চলের বন্যা ব্যবস্থাপনা ও জীবনমান উন্নয়ন প্রকল্প (HFMLIP)

মৎস্য আহরণ মনিটরিং প্রশ্নমালা (গ্রুপ ফিশিং)

HFMLIP-LGED/ /The WorldFish

১) জলমহালের কোড ঃ- ।..... ।..... । ..... । ২) মৎস্য আহরনের ক্ষেত্রের নাম ঃ - .....

৩) তথ্য সংগ্রহকারীর নাম ঃ - ..... ৪) নমুনা সংগ্রহের তারিখ ঃ- ।..... ।..... ।..... ।..... ।..... ।

৫) মৎস্যজীবীর নাম ঃ - ..... ৬) গ্রামের নাম ঃ -.....

৭) হুকপত্রের ক্রমিক সংখ্যা ঃ- ।..... ।..... ।

৮) মৎস্যজীবী কর্তৃক আজকে ব্যবহৃত সরঞ্জামের বিবরণ ঃ-

ক্রঃ নং	জালের স্থানীয় নাম	জালের প্রকার ভেদ (ক্যাটাগরী)	জালের বিবরণ (হাত)			জালের ফাঁস (ইঞ্চি)	মোট সংখ্যা (হুক/জাল)	মোট মৎস্যজীবীর সংখ্যা	পানির গভীরতা (হাত)
			দৈর্ঘ্য	উচ্চতা	ব্যাস				
১।									
২।									

৯) মাছ কখন ধরতে আরম্ভ করেছে ঃ- . ।..... ।..... ।..... ।..... কখন মাছ ধরা শেষ করেছে ঃ ।..... ।..... ।..... ।..... ।

১০) মাছ ধরতে মোট কত সময় লেগেছে ঃ- ..... ।..... ।..... ।..... ।

১১) মোট মাছের পরিমান (কেজি) ঃ- ।..... ।..... ।..... ।..... । কি পরিমান মাছ বিক্রি হয়েছেঃ ।..... ।..... ।..... ।..... ।

১২) যে মাছ বিক্রি করা হয়েছে তার দাম ঃ ।..... ।..... ।..... ।..... ।..... ।..... । কি পরিমান মাছ বিক্রি করা হবে (কেজি)ঃ ।..... ।..... ।..... ।..... ।

১৩) মাছ ধরার অবস্থা :এর মধ্যে কোনটি(টিক দিন)

বি-ইউ-জি নিজেরা মাছ ধরেছে	
স্থানীয় মৎস্যজীবীরা মাছের অংশ ধরেছে	
স্থানীয় মৎস্যজীবীরা মজুরীর বিনিময়ে মাছ ধরেছে	
স্থানীয় মৎস্যজীবীরা মাছ ধরার অধিকার অর্জন করেছে	
বি-ইউ-জি কর্তক ভাড়া করা মৎস্যজীবীরা মাছ ধরেছে	

মাছের অংশ নিয়ে থাকলে মৎস্যজীবীরা কতভাগ পেয়েছে----- ---

যদি মজুরীর বিনিময়ে মাছ ধরে তবে মৎস্যজীবীরা কত ভাগ পেয়েছে----------টাকা---------- --

মাছ ধরতে বি-ইউ-জি এর খরচ কত টাকা ----------টাকা----------

মাছ ধরতে মৎস্যজীবীদের অন্যান্য খরচ কত টাকা----------টাকা----------

প্রজাতির নাম	প্রজাতির কোড	মোট পরিমান (কেজি)*	মোট টাকা	খাবার মাছ(কেজি)	নমুনা/ওজনকৃত মাছ		দৈর্ঘ্য (ইঞ্চি)		
					মোট সংখ্যা	মোট পরিমান (গ্রাম)	ছোট	বড়	গড়

* প্রয়োজনবোধে মোট মাছের পরিমান থেকে প্রজাতির শতকরা ভাগ বের করা যাবে।

মন্তব্য ঃ

3. Gear survey monitoring format

HAOR FLOOD MANAGEMENT AND LIVELIHOOD IMPROVEMENT PROJECT (HFMLIP)
GEAR SURVEY BEFORE CATCH ASSESSMENT SURVEY
HFMLIP-LGED/ WorldFish

1. Site code. : ..... 2. Name of waterbedy :.....
3. Date of survey: ..... 4. Name of data collector: .....
5. Section of waterbody: 1 2 3 or location of survey: .....
6. Survey period: Start time: ..... End time: .....

Gear type		No. observed		Total
		Active fishing	Landing from fishing	
Gill net				
Seine/drag net				
Set bag net				
Lift net	Large			
	Smaller			
Cast net				
Push net				
Trap unit				
Long line				
Hook and line				
Spear				
Katha/brush pile				
Kua				
Other gear (name*)				

5. Section of waterbody: 1 2 3 or location of survey: .....
6. Survey period: Start time: ..... End time: .....

Gear type		No. observed		Total
		Active fishing	Landing from fishing	
Gill net				
Seine/drag net				
Set bag net				
Lift net	Large			
	Smaller			
Cast net				
Push net				
Trap unit				
Long line				
Hook and line				
Spear				
Katha/brush pile				
Kua				
Other gear (name*)				

* In case of new fishing describe the operation mode.
C:\A New Work\A.HILIP\Questionnaires\HILIP- Questionnaires\gear Survey.doc

4. Water quality monitoring format

Haor Flood Management and Livelihood Improvement Project (HFMLIP)
Water Quality Parameter Data Sheet
HFMLIP-LGED/ The WorldFish

1. Waterbody code: ..... 2. Name of waterbody: .....

3. Date of collection: ..... 4. Name of collector: .....

Parameters Type	Value	Unit
Water Temperature		°C
Water Transparency		cm
Water Level		m

Haor Flood Management and Livelihood Improvement Project (HFMLIP)
Water Quality Parameter Data Sheet
HFMLIP-LGED/ The WorldFish

1. Waterbody code: ..... 2. Name of waterbody: .....

3. Date of collection: ..... 4. Name of collector: .....

Parameters Type	Value	Unit
Water Temperature		°C
Water Transparency		cm
Water Level		m

Figure 166. Result Dissemination Workshop in LGED Bhaban Dhaka Bangladesh

Figure 177. Result Dissemination Workshop in LGED-Sunamganj,Netrakona, Habiganj & Kishoreganj.

Figure 188. Water quality monitoring at HFMLIP waterbody

Figure 199. Open catch monitoring at HFMLIP waterbody

Figure 20. Major catch monitoring at HFMLIP waterbody

Figure 20. Fish sanctuary establishment & tree plantation activity by HFMLIP

Figure 22. Result Dissemination Meeting with BUG Members at waterbody level