VARIATION AND AVAILABILITY OF FISHING GEARS AND CRAFTS USED BY THE FISHER ADJACENT TO SARIAKANDI FISH PASS, BOGURA, BANGLADESH

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Roll No.: 0120/08

Registration No.: 860

Session: 2020-2021

A thesis submitted in the partial fulfillment of the requirements for the degree of Master of Science in Fisheries Resource Management

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JUNE 2022

Authorization

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This is to certify that we have examined the above Master's thesis and have found that is complete and satisfactory in all respects, and that all revisions required by the thesis examination committee have been made

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ACKNOWLEDGEMENTS

Bengali rivers. In addition, his cousin Naimur Anwar has always accompanied him throughout the whole field investigation.

Last but not least, the author also wants to emphasize how grateful he is to his parents and friends for their support, blessings and sacrifice.

The Author

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Abstract

Despite the meaningful significance of artisanal fishing in the Jamuna and Bangali river adjacent to Sariakandi Fish Pass, understanding of the fishing gears and techniques utilized is inadequate and out of date. Little is known about various fishing gears and crafts by fishermen in those rivers. A survey of 48 artisanal fishermen from 4 unions (Fulbari, Kajla, Kornibari and Kutubpur) of Sariakandi Upazila, Bogura was conducted to address these issues. The required data for this study were collected from October 2021 to March 2022. In addition to conducting structured questionnaires for the fishermen, the survey also involved conducting unstructured interviews with the local leader of the fisher communities and with the Upazila Fisheries Officer. A total of 9 major groups of fishing gear were found. Those were gill net, cast net, hook and line, drag net, lift net, seine net, purse net, trapping gear and wounding gear. Among them gill net (24%), drag net (20%) and trapping gear (20%) were most common. Motorized and non- motorized boats were the type of craft often utilized in the area, although ownership among fisherman varies. Fishers who employed two or more fishing gears and crafts belonged to a co-operative society. The usage of some illegal fishing gears was also addressed. Among those illegal gears, there were some gears which were leading to the destruction of all aquatic biodiversity including fish. The ecology of the Jamuna and Bangali rivers was being significantly impacted by the combined use of all legal and illegal fishing gears. To stabilize the situation, it is imperative to effectively stop the use of illegal fishing gears and crafts. Ensuring good use of the remaining fishing gears and crafts would provide the biodiversity of the Jamuna and Bangali rivers and the socioeconomic standing of the fishermen a new dimension.

Keyword: Fish Pass, Fishing gear, Fishing craft, Illegal fishing gear, Aquatic biodiversity

Chapter: 01

Introduction

Bangladesh is a river-rich country. In Bangladesh, there are several rivers. Some are major, while others are minor. Bangladesh's rivers, having one of the world's greatest systems, are the country's pride. Though Bangladesh is a small country, approximately 700 rivers and their tributaries and distributaries run across the country, covering a total distance of roughly 24,140 kilometers (Wazed, 1991).

This whole river system is a boon for the fisheries resources of Bangladesh. A huge contribution of our economy comes from fisheries resources. According to the Department of Fisheries (DoF), Bangladesh, aquaculture accounts for 57.38 percent of total fish output (The Financial Express, 2021). Not only that, the contribution of rivers in Bangladesh is unique in all aspects of communication, livelihood or spread of folk culture.

The Jamuna and the Bengali rivers play a vital part within the river framework of North Bengal. These two rivers can be seen together in Sariakandi Upazila, Bogura. A fish pass was constructed in this upazila in 1990-91, however it was destroyed by water current pressure. In 1999-2001, BWDB rebuilt it once again. River Bank Protection Project was the name of the Sariakandi Fish Pass project. Near Debdanga in Kutubpur union of Sariakandi Upazilla, Bogra, the Sariakandi Fish Pass connects the Jamuna river (west bank) with the Bangali river (east bank) (Parween, 2010)

A fish pass is a hydraulic/ pressure driven structure that helps fish to get around barriers on their approach to breeding grounds and other migratory habitats upstream (Ghosh, 2014). The concept of a fish pass was designed in Bangladesh within the 1990s and four fish-friendly structures and fish burrows have since been built (Zaman and Naser, 2019).

'Sariakandi Fish Pass' is a fish friendly structure that connects the river Jamuna and the river Bangali. Since then, the movement of fish between the two rivers has become easier and the aquatic biodiversity has changed dramatically. The Bangali River's water volume and fish species have grown since the fish pass was built (De et al., 2011, Zaman, 2018). In the Bangali river prior to the establishment of the fish pass, a total of 12 fish species

belonging to eight families were recorded. (Mondol et al., 2006). After the development of the fish pass, an increase in the number of fish species was noticed in the water body of the fish pass region. A total of 69 fish species have been identified, divided into 9 orders and 26 families. Cypriniformes (22 species) is the most prevalent order among them (Zaman and Naser, 2019)

Naturally fishing competition has also increased and various fishing gears and crafts are being used. These gears and crafts have also changed over time. Changes have also come to disobey the law. So in most cases this fishing competition is not bringing positive results. This study attempts to identify what fishing gears and crafts are used in the area.

Research has been done on what is being caught in those gears, what is the efficiency of the gears. Besides, other relevant data has also been presented and an attempt has been made to determine the natural fishing culture in the region. Attempts have also been made to find out how much prosperity and how much damage this culture brings. The study also discusses the possible way out of the adverse situation by calculating the profit and loss.

1.1 Significance

There are several studies those have conducted in the Jamuna and the Bangali river area adjacent to Sariakandi Fish Pass, Bogura. But there is a little study about the variation and availability of fishing gears and crafts in the Jamuna and Bangali river area adjacent to Sariakandi Fish Pass, Bogura. From previous research, only the names of a few gears can be known very briefly. But any details about it can't be found. That fish pass has a great influence on the availability of various fish species. But fishing gears and crafts also have a linkage with the natural stock of various fish species. Use and restriction of those fishing gear regulate the aquatic species variability of Jamuna and Bangali river in the study area. This study will guide the proper use of fishing gear and craft in the concerned area. It will also identify illegal fishing gears and indicate how they will be managed.

1.2 Objectives

The purpose of the investigation and kinds of knowledge that result from it are included in the research or study objectives. The objectives of this study:

- ✓ To identify the categories of crafts and gears used by the fishers in Jamuna and Bangali river in Sariakandi.
- ✓ To understand the impact of those gears and crafts on the fish and aquatic species diversity.
- ✓ To investigate about the crisis of present fisheries status in Sariakandi Fish Pass region and to understand the common perception of the fishermen and local leaders about the fisheries in their respective areas.

Chapter: 02

Literature Review

It is important to review prior research activity on similar issues before performing a research using experimental methodology. The following is a survey of relevant literature for the current study project:

2.1 Fisheries status of Sariakandi Fish Pass, Bogura:

Fish pass is such type of structure that helps to facilitate upstream and downstream migration of fish. In order to aid fish migration between the Jamuna river and the Bangali river, Sariakandi Fish Pass was built in 2001 at Sariakandi upazila under Bogura district. (Bangladesh Water Development Board-BWDB, Sariakandi Upazila, Bangladesh). Before establishment of fish pass about a total of 12 fish species comprising 8 families were noted in the Bangali river. (Mondol et al., 2006). After establishment of the fish pass an increase of fish species had observed in the water body of fish pass area. There is a record of a total of 69 fish species under 9 orders and 26 families. Among those Cypriniformes (22 species) is the most dominant order (Zaman and Naser, 2019).

2.2 Livelihood status of fisher community in the area adjacent to Sariakndi Fish Pass:

Most of the fishermen of this area belong to the age groups of 30 to 50 years (about 58%). Over 56.5% of the fishermen solely depend on fishing as it is their main occupation. Besides fishing about 23.5% fishermen were engaged in agriculture, 9% in daily labor activities, 5% in livestock rearing and 6% in small business. Most of the fishermen (55%) have kacha house with tin roofing. Approximately 32.5% have house with straw roof, 9.5% have semi-paka house and as it were 10% of the individuals have paka house. Larger part of the fishers (45%) in Sariakandi fish pass area had medium annual income (61,000-1,20,000 TK) annual income whereas 23% of the fishermen had low (35,000-60,000 TK) annual income. Above 1,20,000 income indicates the higher annual income and 32% of the fishermen belong to this group. (Mondal et al., 2016)

2.3 Impact of Sariakandi Fish Pass on fisheries diversity of Bangali river, Bogra, Bangladesh:

The Sariakandi fish pass was created in 2001 in Sariakandi Upazila, Bogra, to assist fish passage between the Jamuna and Bangali rivers. Because the river runs through Sariakandi Upazila in Bogra district, many people in this area rely on the river's fishery resources. However, Fish pass has a favorable influence on fish variety in the Bangali river, according to the current study. As a result of this fish pass, the movement of fish in the Jamuna and the Bengali rivers has become easier and many endangered species of fish are still surviving in the fight for their survival as a result of this fish pass (De et al., 2011).

2.4 Hydraulic impact on fish migration in Sariakandi Fish Pass of Bangladesh:

In Bangladesh, the notion of a fish pass is relatively new. The major goal of the Sariakandi fish pass Project was to convey fish fry, spawning, and hatchlings from the Jamuna River to the Bangali River. The Sariakandi fish pass Project is required for the development of dominant fish species such as catfish and small fish. The structures will also help in the carp fishes' efficient development. The major goal of the Sariakandi Fish Pass project was to transport fish fry and hatching from the Jamuna to the Bangali rivers. This study also discovered that the project region has seven primary categories of migratory species and that the fish pass is helping to expand fishery resources in the study area. (Ghosh, 2014)

2.5 Fish species using the fish passage between Jamuna and Bangali river at Sariakandi, Bogura:

A fish pass is a hydraulic construction that allows fish to get over obstacles on their way to spawning grounds and other upstream migratory habitats (IUCN, 2002). In Bangladesh, the concept of a fish pass was developed in the 1990s and four fish-friendly buildings and fish passages have been created since then (Zaman and Naser, 2019). The study was carried out to determine the current status of migratory fishes using the fish passages from the Bangali to the Jamuna river systems during flood season. The Bengali

River's water volume and fish species, as well as fish variety and biomass, have grown since the fish pass was built.

According to the study, a large number of vulnerable species use the fish pass, indicating that the fish pass facilitates faunal interchange across rivers. Fish-friendly water factors included depth, velocity, and flow. According to the study, 30 vulnerable species (IUCN, 2015) crossing fish pass, with 9 species globally threatened and likely to become extinct in the near future owing to poor management. Fish pass contributed in enhancing the fish variety in the Jamuna river by introducing fish from the Bangali river system, according to this research. (Zaman and Naser, 2019).

2.6 Status of fisher community of Jamuna river in Sariakandi, Bangladesh:

The fishermen of Sariakandi Upazila, as well as the whole fishing community next to the river, rely heavily on the river's fisheries and livelihood. This river is extremely essential in terms of providing cash, creating jobs and sustaining the poor fishing community's livelihood. However, there is little information about the state of the fishing community in Sariakandi Upazila.

The fishermen's socio-economic situation in the Sariakandi Upazila along the Jamuna river was not good. Many conveniences were taken away from the fisherman. Educational growth is not sufficient due to a need of mindfulness as well as the low income of the fishermen's families. The researched regions are located far from town and because there is no close market, they must rely on wholesalers and intermediaries to sell their fish. As a result, they did not receive the exact price for the fish that they should have received. The DoF's establishment of a proper fish market near the study area might be a solution to their plight (Mondal et al., 2016).

2.7 Operational management of Sariakandi Fish Pass:

The research was taken out at the Sariakandi fish pass's surroundings. This is Bangladesh's largest fish pass. This is a vertical slot construction with three vents each containing 16 pools (4.2m x 4.8m). Each pool has an opening of 0.7m.

The structure's geometry, such as L/b (L the length of each chamber and b the aperture), W/b (W the width of the chamber), yolb (Yo depth of flow), Froude number,.6.h

(difference in water levels between two adjacent pools), etc., have a significant impact on the velocity in a slot. A hydraulic examination reveals that a pool has normal flow patterns. While the head variations between the Jamuna and Bangali Rivers are over 0.5 m, recorded velocities at individual pool entrances are substantially greater than the tolerated limits (e.g., response, cruising, and darting speeds) of juveniles of all local and migratory fish species. There are insufficient places for fish to rest. Because the pool's length and breadth are insufficient. The conventional length-to-pool-opening and pool-width-to-pool-opening ratios should be ≥10 and ≥8, respectively, to ensure modest velocities at the pool openings. As a result, energy dissipation inside the pool will be high, providing additional resting space for the fish. The fish pass's predicted energy dissipation rate per unit volume is 71.3 W/m3 (Biswas, 2007)

2.8 Analyses of supply chain of fish captured from the Jamuna river in Bangladesh:

During the two-year period from January 2016 to December 2017, a research was undertaken in two districts, Bogura and Sirajgang, to explore the marketing channel and system of fish harvested from the Jamuna river in Bangladesh. Fish caught in the Jamuna river were sold in three different markets: auction market/arat, wholesale market, and retail market. In the retail market, the highest price of fish was recorded for *Wallago attu* (BDT 560/kg), followed by BDT 500/kg for *Tenualosa ilisha* and *Bagarious bagarious*, and the lowest price was recorded for five small indigenous species (SIS) *Tetraodon cutcutia*, *Chanda nama, Parambassis lala, Parambassis ranga*, and *Esomus danricus*. (Amin and Nabi, 2019)

Reduced fishing areas, decreased daily harvest of fish per fisherman, settling influence by unlawful seasonal fishers, Lack of market knowledge and negotiating strength, inadequate fish storage and preservation equipment in fishing vessels and markets, fish waste brought on by rotting during transportation, sanitation, drainage and management issues inside market zones were all major constraints in the fish marketing channels.

Chapter: 03
Materials and Methods

Planning is one of the most significant aspects of completing a thesis. The strategy will be developed once the study's justification has been determined and the current literature has been properly assessed. When writing a scientific publication, it is necessary to not just disclose the study's findings, but also to list the processes used to arrive at those findings. The latter is referred to as the scientific manuscript's "Materials and Methods" section. It should be detailed in sufficient detail to allow a competent colleague to replicate it.

3.1 The study area:

The study area was the adjacent area to Sariakandi fish pass. Sariakandi fish pass also known as Debdanga Sluice Gate locally. With that fish pass the Jamuna and the Bangali river were connected. This area was located between 24°83' and 24°88' N latitudes and between 89°56' and 89°62' E longitudes, This fish pass was a vertical slot type fish pass which is also most recent and modern one. This fish pass was rectangular in shape with the length of 92.4 meters and width of 15 meters (Plate- 01). This pass also includes three separate and parallel passages (IUCN, 2002). This was a unique connecting of those above two rivers. Using this fish passage a big number of fish moved from one habitat to another. So adjacent area of this fish pass had become an appropriate field of fishing. The study area includes four unions of Sariakandi Upazila. Those were Fulbari, Kajla, Kornibari and Kutubpur union.

a   b

Plate 01: View of the research location: a. Aerial view; b. Vertical slot type fish pass

3.2 Research design:

The entire research was carried out in accordance with a flowchart (Figure 01). To make the overall framework of the research, several important procedures were organized according to the flowchart below:

```
┌─────────────────────────────────────────┐
│      Identifying of the research arena   │
└─────────────────────────────────────────┘
                     ⇩
┌─────────────────────────────────────────┐
│       Setting objectives of the research │
└─────────────────────────────────────────┘
                     ⇩
┌─────────────────────────────────────────┐
│          Selection of the study area     │
└─────────────────────────────────────────┘
                     ⇩
┌─────────────────────────────────────────┐
│        Identification of target groups   │
└─────────────────────────────────────────┘
                     ⇩
┌─────────────────────────────────────────┐
│      Design and testing of questionnaire │
└─────────────────────────────────────────┘
                     ⇩
┌─────────────────────────────────────────┐
│               Data collection            │
└─────────────────────────────────────────┘
                     ⇩
   ┌──────────────┐        ┌──────────────┐
   │ Primary data │ ⇔      │ Secondary data│
   └──────────────┘        └──────────────┘
                     ⇩
┌─────────────────────────────────────────┐
│         Data processing and analysis     │
└─────────────────────────────────────────┘
                     ⇩
┌─────────────────────────────────────────┐
│              Report writing              │
└─────────────────────────────────────────┘
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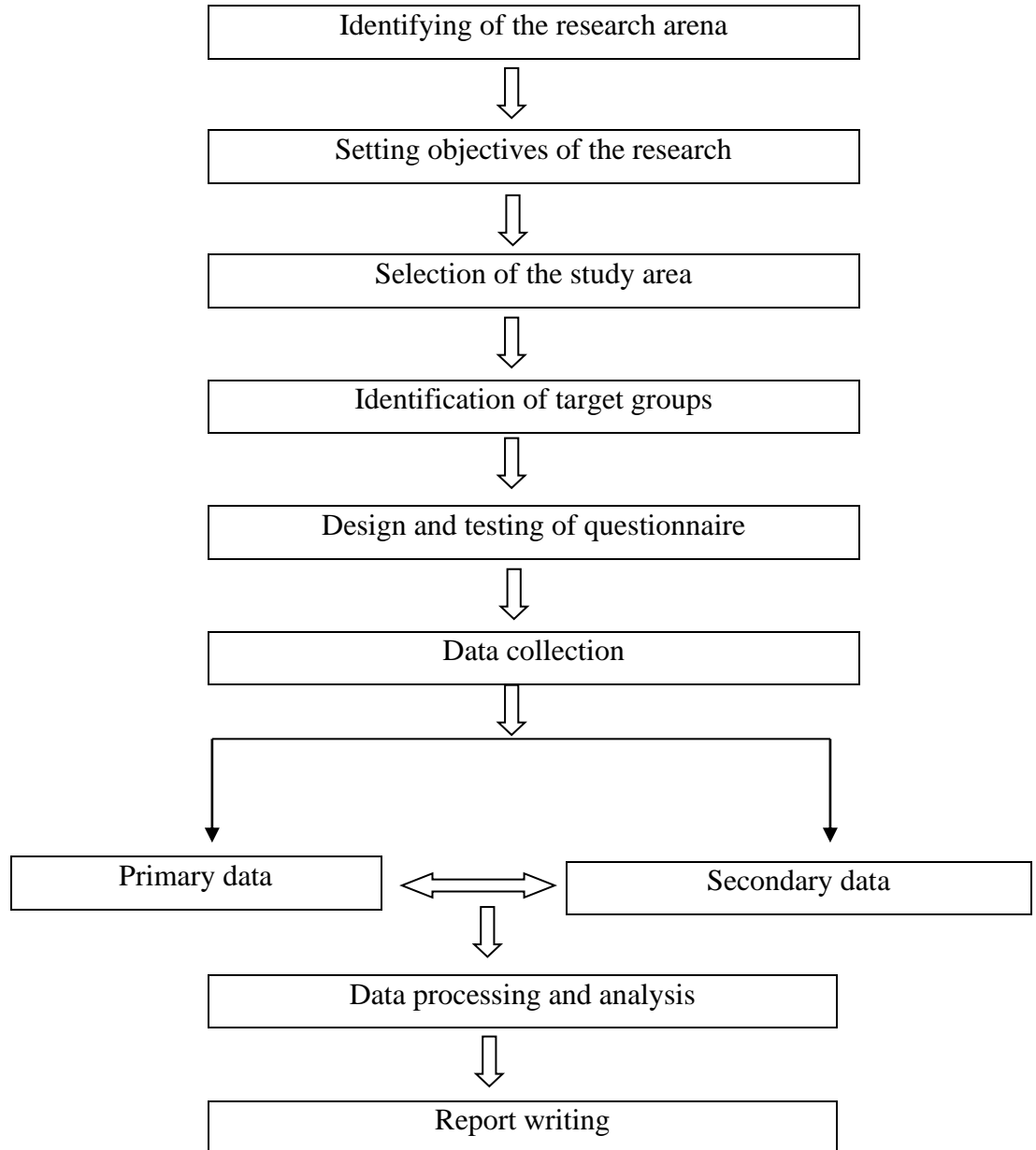
Figure-01: Flowchart of the research design

3.3 Sampling procedure:

For the data collection simple random sampling method was used. This sampling method was chosen because in this sampling method each individual fisherman had an equal chance or probability of being selected for interview. This sampling method reduced the selection bias. That simple random sampling was done among four unions of those are adjacent to Sariakandi Fish Pass- Fulbari, Kajla, Kornibari and Kutubpur union. 48 fishermen were selected randomly to obtain the result of simple random sampling. All those fishermen took part in fishing activities in the above mentioned unions adjacent to the fish pass.

3.4 Questionnaire design:

A questionnaire is necessary for gathering accurate data. Before gathering information, a structured questionnaire was created. The purpose of these sorts of questionnaires was to collect descriptive data about fishing gears and crafts. The questionnaire was created based on information such as gear availability, target species captured by gears and gear's Catch Per Unit Effort (CPUE).

3.5 Data Collection

3.5.1 Data collection method:

The required data for this study were collected from October 2021 to March 2022. The data collection procedure was done via use of a questionnaire and also with unstructured interviews. The questionnaire was a structured questionnaire. (Appendix 1). This structured questionnaire was used to collect information from 48 artisanal fishermen from 4 unions of Sariakandi upazila. Unstructured interviews were also made to extract more information about fishing gears and crafts used in Sariakandi fish pass area.

For the study, sampling at the adjacent fish pass area, Focus Group Discussion (FGD) and inhabitant interview were considered as the procedural methods. A total of four FGDs were conducted and each group contains 5 to 7 fishermen. The interview process of fishermen was made at different sites such as their home, their co-operative association or at the fishing site. (Plate 02)

a   b

Plate 02: Interview process- a) Individual interview, b) Focus Group Discussion

After interview of fishermen cross-check interviews were also used with key informants. The interviews were cross-checked with the head of local fishermen co-operative association and with the Upazila Fisheries Officer of Sariakandi Upazila (Plate 03).

Plate 03: Meeting with Upazila Fisheries Officer

Below mentioned data collection equipment were used to complete a desired data collection:

a. Questionnaire interviews
b. Field study
c. Photographs
d. Key informant interviews
e. Secondary literature

3.5.2 Data processing and analysis:

The data collected by various data collection method were accumulated, edited and finalized carefully. After that the processed data were analyzed by Microsoft Excel Office 2019. Relevant tables and graphs were also prepared according to the objective of the study for clear understanding.

Chapter: 04

Result

After collecting data from various primary and secondary sources, an authentic image of fishing gears and crafts in the area was found. Not only fishing gears and crafts, but also many other relevant issues had come up.

4.1 Fishing gears used in the study area:

Figure 02 represents the type and percentage of fishing gears used by fishermen in Jamuna and Bangali river adjacent to Sariakandi fish pass. A total of 9 different gear types were identified in the study area as a total. Among those types gill net, drag net and trapping Gear were most common. Besides those types, cast net, hook and line, lift net, seine net, wounding gear also existed (Plate 04, 05, 06, 07, 08, 09, 10, 11 and 12). The most common gear type used by fishers was gill net. This type of gear occupied about 24% of the total number of gears used in the study area.
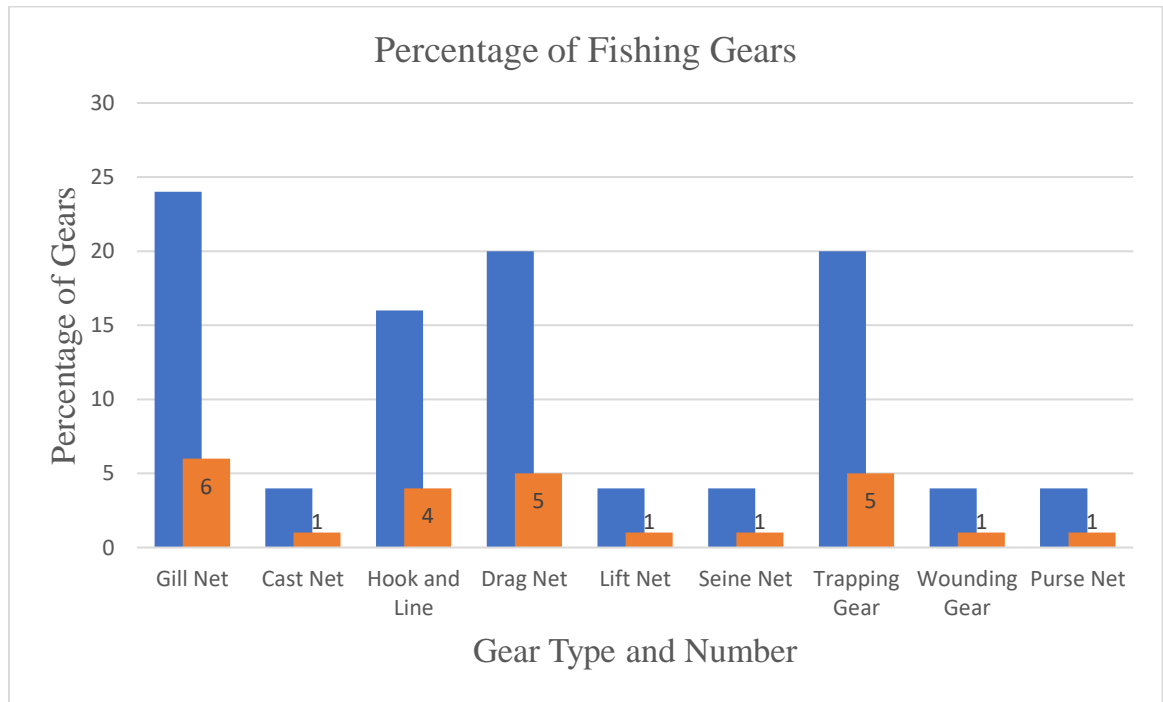
Figure 02: Type of fishing gear found in the study area

a   b   c

d   e   f

Plate 04: Gill net- a) Current Jal, b) Fash Jal, c) Pangti Jal,

d) Guti Jal, e) Rock Jal, f) Sursuri Jal

a   b   c

d   e

Plate 05: Drag net- a) Tana Jal, b) Thela Jal, c) Moshari Jal,

d) Moia Jal, e) Lathi Jal

14

a	b	c

d	e

**Plate 06: Trapping gear- a) China Duari, b) Chandi Bair, c) Polo,
d) Darki/ Dhial, e) Bair**

a	**b**

c	**d**

**Plate 07: Hook and Line- a) Chip Borshi, b) Wheel Borshi, c) Tana Borshi, d) Daun
Borshi**

Plate 08: Cast net- Toira Jal

Plate 09: Lift net- Dhormo Jal

Plate 10: Seine net- Ber Jal

Plate 11: Purse net- Suti Jal

Plate 12: Wounding gear- Koch/ Teta

(Here, the term "Jal" in Bengali relates to the word "Net.")

The majority of the fishers had more than one gears. More than 80% of respondents (Figure 03) possessed between one and three gears, which were often of different types.
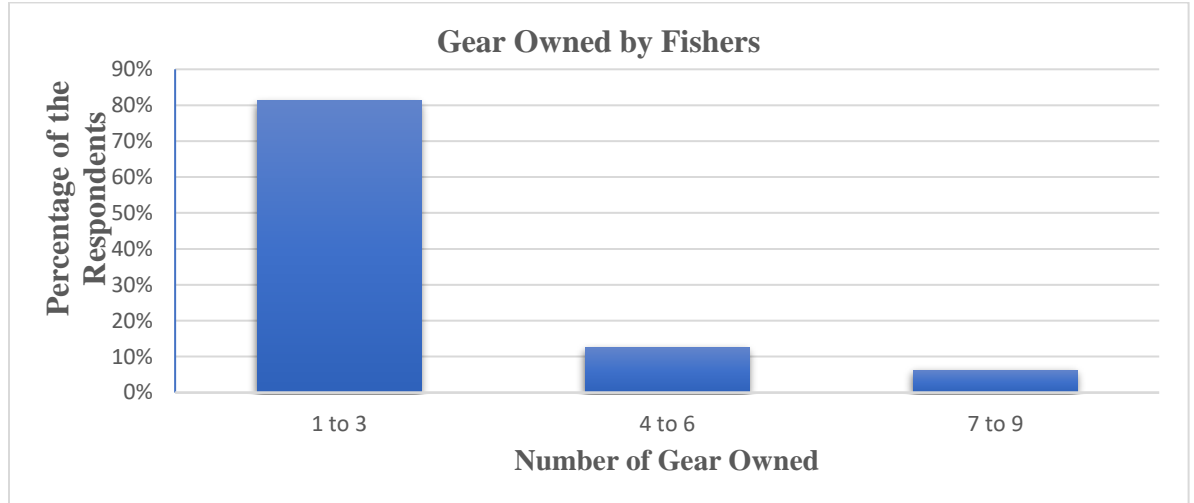
Figure 03: Number of fishing gear per fisher in the study area

A fisherman had one gill net, one drag net and one set of trapping gear; for example. Fewer other fishers had gear ranging from 4 to 6, and 7 to 9 (figure 03). Many of the fishermen in the study area built their own gear for saving the extra cost.

4.2 Efficiency of various fishing gears with species composition and fisher's preference:

Various types of gear, their mesh size, target species, number of people operate, operating period, CPUE (kg/ effort) were recorded (Table 01).

Table 01: Various fishing gears with species composition and efficiency

Category	Types of Gears	Name of the Gears	Mesh (cm)	People Operate	Target Species	CPUE		Period
						Kg/ effort	Mean	
	Cast Net	Jhaki Jal/ Toira Jal	0.5-1.5	1	Mola, Sar Punti, Jat Punti, Tit Punti, Rui,	1-3	2	Throughout the year

Fish Net					Katla, Bata, Dhela, Koi, Poa, Boal, Baila, Baim, Kecho Baim			
	Gill Net	Current Jal	1-1.5	1-2	Jatka Ilish, Punti, Chanda, Tengra, Baim, Guchi, Bacha, Koi, Kholisha, Batashi	5-6	5.5	Throughout the year
		Fash Jal	-7	2-3	Rui, Catla, Mrigel, Carpio, Bagha Air, Pangash	1-5	3	Throughout the year
		Pangti Jal		1-2	Puti, Tengra, Kholisha, Chanda, Mola, Kaski	0.25-1	0.625	Throughout the year
		Guti Jal	4-5	3	Rui, Catla, Mrigel, Carpio	8-10	9	November-March
		Rock Jal	5-8	1-2	Tengra, Punti,	1-2.5	1.75	November-March

					Baim, Poa, Kali baush, Air			
		Sursuri Jal	1-3	2-3	Sorali, Small Species (SIS)	0.25-4	2.125	November-March
	Drag Net	Tana Jal	0.5-1.5	2	Kholisha, Punti, Tengra, Chanda, Kaski	0.25-1	0.625	Throughout the year
		Thela Jal	0.5-1.2	1	Icha, Koi, Gulsha Tengra, Poa, Punti, Baim, Kecho Baim	0.5-1.5	1	Throughout the year
		Moshari Jal	0.3-1	2	Fish fry and fingerling	0.25-0.5	0.75	June-October
		Moia Jal	0.5-1	2-3	Fingerling, Bash patari, Icha, Kakila, Gulsha Tengra, Tengra	0.5-4	2.25	Throughout the year
		Lathi Jal/ Khola Pangti	0.2-1.2	2	Taki, Punti, Koi, Tengra, Shol, Baim,	0.5-1	0.75	Throughout the year

					Kuchia, Kali baush, Mrigel			
	Lift Net	Dhormo Jal	1-2.5	1	Taki, Shol, Tengra, Baim, Gulsha Tengra, Punti,, Chital, Foli, Potka	0.5-1	0.75	June-October
	Seine Net	Ber Jal	0.2-0.8	7-10	All types of fish species	5-10	7.5	Throughout the year
	Purse Net	Suti Jal	4-6	3-4	Punti, Tengra, Kakila, Chanda, Pabda, SIS	3-4	3.5	June-October
Trapping Gear		ChainaDuari	1.2-1.5	2-3	All types of fish and aquatic species	Catch / Haul (kg) 2-4	Mean Catch / Haul (kg) 3	June-October
		Chandi Bair	-	1	Rui, Katla, Boal, Taki, Shol, Gojar	1-2	1.5	April-November
		Darki	-	1	Punti, Chanda, Tengra, Kholisha	1-2	1.5	April-November
		Bair	-	1	Chanda,	1-1.5	1.25	April-

					Potka, Punti, Guchi Baim, Kholisha, Gulsha Tengra			November
		Polo	-	1	Taki, Shol, Gojar, Boal, Magur, Rui, Kalibaush	0.5-2	1.25	January-March
Hook and Line		Chip Borshi	-	1	Baim, Punti, Tengra, Gulsha Tengra, Kecho Baim	0.03-0.05	0.04	Throughout the year
		Tana Borshi	-	1-2	Shol, Gojar, Boal, Bagha Air, Baim, Kecho Baim	0.25-1	0.625	Throughout the year
		Daun	-	1-2	Boal, Shol, Gojar	0.25-2	1.125	Throughout the year
		Wheel Borshi	-	1	Shol, Gojar, Bagha Air, Baim, Boal, Punti,	0.25-1.5	0.875	Throughout the year

				Tengra			
Wounding Gear		Teta	-	1	Taki, Shol, Koi, Shing, Magur, Kuchia, Kecho Baim	0.5-2	1.25	October-May

In the study area Sar punti (*Systomus sarana)*, Jat punti (*Puntius sophore*), Kali baush (*Labeo calbasu*, Rui (*Labeo rohita*), Katla (*Gibelion catla*), Silver Carp (*Hypopthalmichthys molitrix*), Dhela (*Osteobrama cotio*), Tengra (*Mystus vittatus*), Gulsha Tengra (*Tengara mystus*), Batasi (*Pseudeutropius atherinoides*), Kajuli (*Ailia coila*), Bansh patari (*Ailia punctata*), Chanda (*Chanda nama*), Gojar (*Channa marulius*), Shol (*Channa striatus*), Taki (*Channa punctatus*), Bele (*Glossogobius giuris*), Koi (*Anabas testudineus*), Boal (*Wallago attu*), Pabda (*Ompok pabda*), Khalisha (*Trichogaster fasciata*), Guchi Baim (*Mastacembelus pancalus*), Poa (*Lepidocephalichthys guntea*), Kaski (*Corica soborna*), Iilsa (*Tenualosa ilisha*), Shing (*Heteropneustes fossilis*), Magur (*Clarius batrachus*), Bagha Air (*Bagarius bagarius*) etc. fish were caught in large quantities.

Fish of the Cypriniformes order was most commonly caught in fishing gears. Their percentage of being caught was 76%. Siluriformes order were caught in 68% fishing gear and Clupeiformes order were caught in 16% fishing gear. Like this, Osteoglossiformes order in 12% fishing gear, Mugiliformes order in 16% fishing gear, Perciformes order in 72% fishing gear, Synbranchiformes order in 52% fishing gear, Anguiliformes order in 12% fishing gear and Tetraodontiformes order was caught in 8% fishing gear (figure 04).
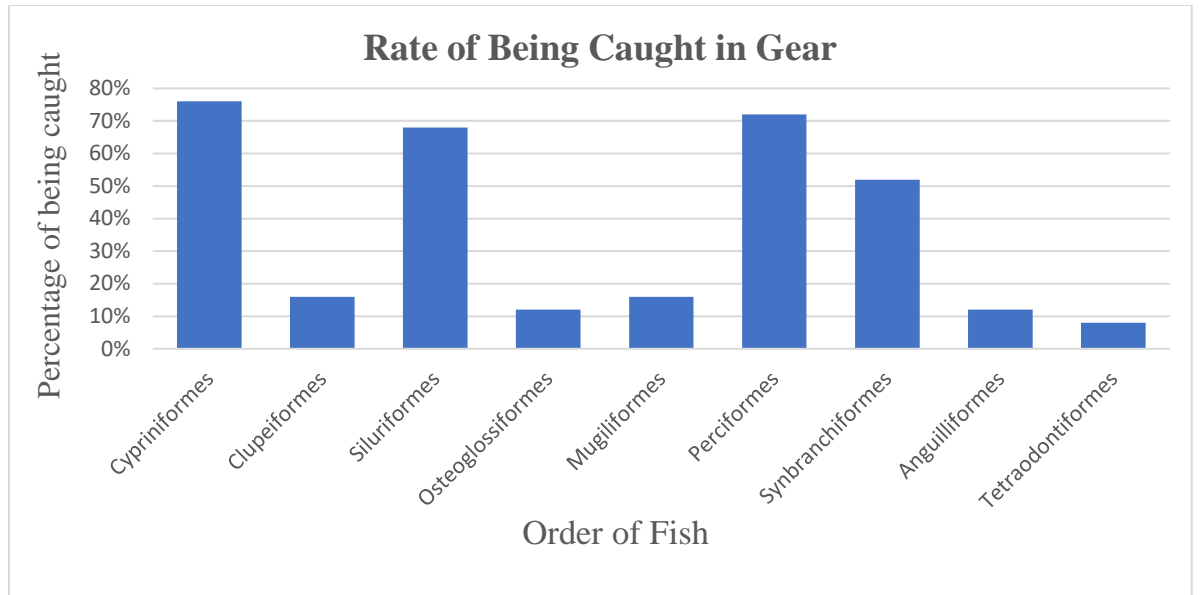
Figure 04: Catching rate of fish of different orders in fishing gear

The average CPUE (kg/effort) of the 15 fishing nets identified was calculated; it stood at 2.74. The average CPUE of 15 nets were categorized into three classes as follows: (Table 02) and (Figure 05)

Table 02: Range of CPUE of different fishing gears

Serial	CPUE within 1-3	CPUE within 4-6	CPUE within 7-9
01	Toira jal	Current Jal	Guti Jal
02	Fash Jal	Suti Jal	Ber Jal
03	Pangti Jal		
04	Rock Jal		
05	Sursuri		
06	Tana Jal		
07	Thela Jal		
08	Moshari Jal		
09	Moia Jal		
10	Lathi Jal		
11	Dhormo Jal		
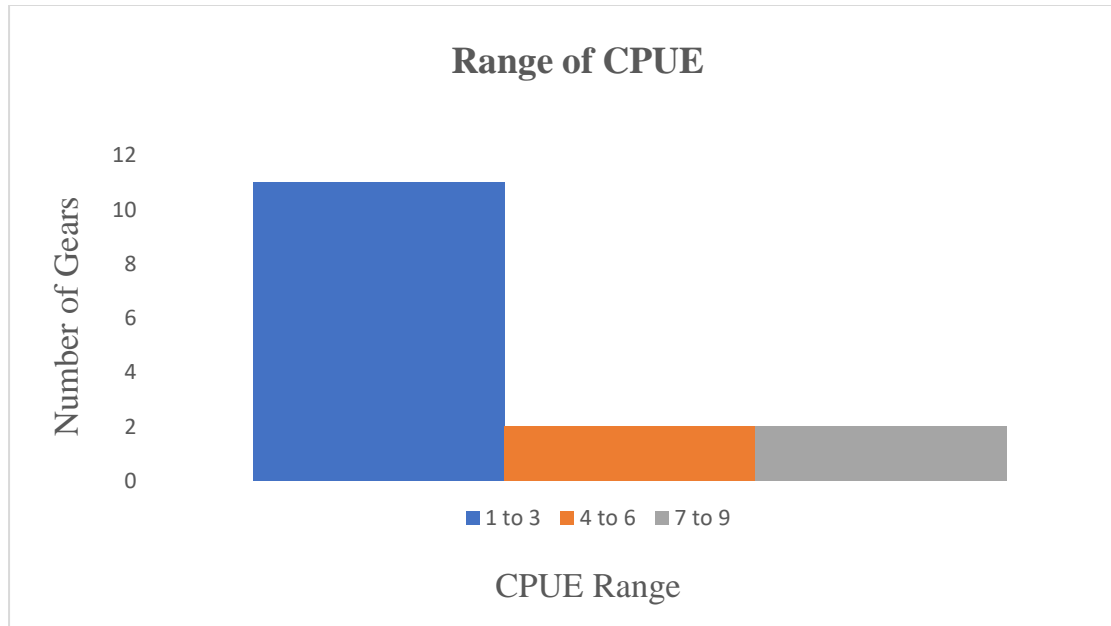
Figure 05: Range of CPUE of different fishing gears

The average Catch Per Haul (kg) of 10 fishing gears were categorized into three classes as follows (Table 03)-

Table 03: Range of catch per haul (kg) of different hook and line, trapping gear and wounding gear

Serial	Catch Per Haul (kg) within 0-1.0	Catch Per Haul (kg) within 1.1-2.0	Catch Per Haul (kg) within 2.1-3
01	Chip Borshi	Chandi Bair	Chaina Duari
02	Tana Borshi	Darki	
03	Wheel Borshi	Polo	
04		Daun Borshi	
05		Teta	
06		Bair	

The average CPUE or Catch/Haul (kg) of different trapping gears, hook and line were calculated, the result was 1.24. These gears were classified in the same way that fishing nets were classified on the basis of Catch/Effort (kg) (Figure 06)-
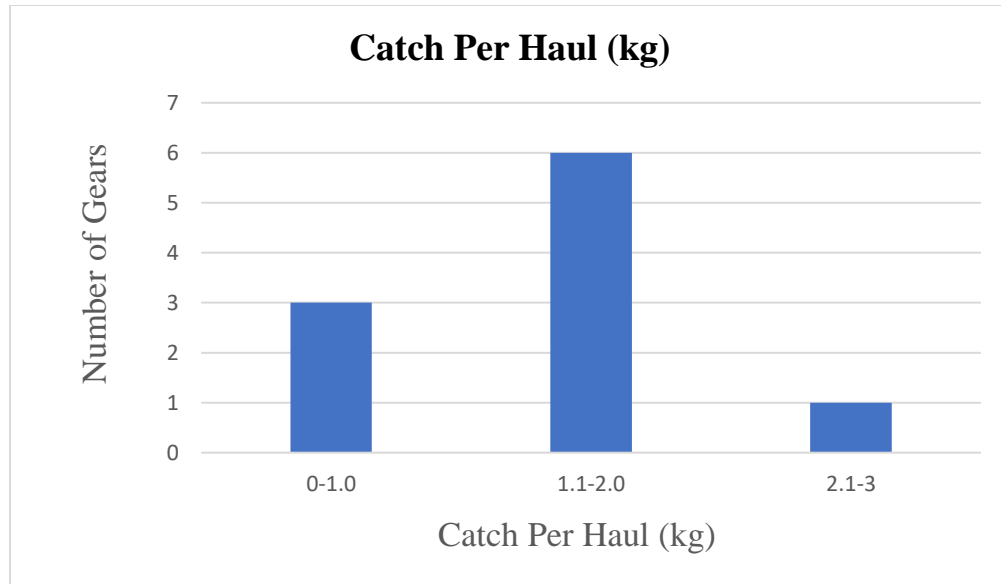
Figure 06: Range of catch per haul (kg) of different hook and line, trapping gear and wounding gear

4.3 Illegal and destructive fishing gears:

Fishermen in the study area used about 25 fishing gears for fishing. Ber jal, current jal, china duari, moshari jal, suti jal were prohibited in the study area. The amount of damages to these forbidden nets varied. The most common destructive gear was the China duari Jal. Other banned nets included current jal, ber jal, moshari jal and suti jal.

However, the biggest concern was fishing with 'electric shock'. This was a system where an inverter machine was used. The inverter machine used a battery of about 24 volts and this machine converted DC to AC. A stick was inserted into the water with the positive line of electricity on the head of stick and the negative line in the water. In this way the electricity that was carried in the water electrified 15-20 feet of aquatic area. As a result of this electrification, all the fish and aquatic organisms of that place died.

4.4 Various appliances

When fishing in the study area, fishermen carried different types of appliances with them. This was for the purpose of keeping trapped fish in the appliances. Mostly bamboo was

used to make those one. Two different kinds of bamboo pots or appliances were observed: 'Khari and Kholui' (Plate 13).

<center>a   b</center>
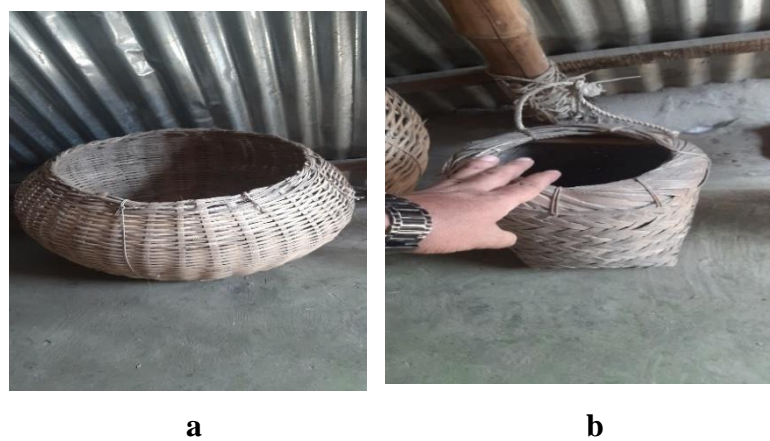
Plate 13: Traditional fish appliances used in the study area- a. Khari; b. Kholui

4.5 Fishing crafts used in the study area:

There were two types of fishing craft found (Plate- 14). The most popular form of fishing craft in the study area was the motorized Kosha nouka (boat). Locally those boats were known as 'Shallow Michine-er Nouka'. Most Kosha boats had a flat bottom with no clearly defined matting. The boat had no hood, but a deck constructed of bamboo splits, hardwood planks or a mix of the two. 81% of respondents said they use a motorized fishing boat. The remaining 19% of fishermen did not have access to motorized fishing boats (figure 07). Usually they used Dinghy Nouka for fishing most of the time. Only 10 percent of them had their own boat. Most persons who bought motorized boats, on the other hand, did not do it alone. The majority of the time, they acquired the boat in two or three shares. According to the fishermen, a third form of boat known as a 'Dhashkor-er Nouka' was also employed. However, the use of this boat was very low in the study area. It was totally composed of wood and was smaller than a dinghy boat. A maximum of 2-3 persons could stay in this type of boat while fishing.
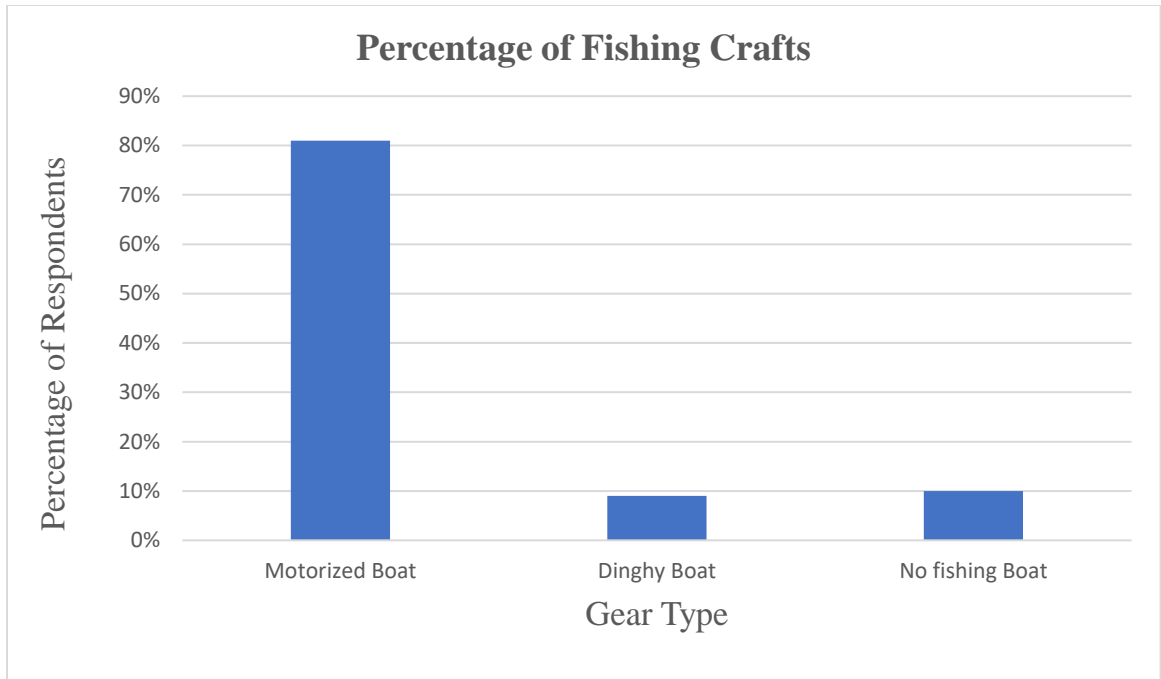
Figure 07: Percentage of fishing crafts owned by fishers

a   b

Plate 14: Fishing craft- a) Motorized boat, b) Dinghy nouka (boat)

(Here, the term "Nouka" in Bengali relates to the word "Boat.")

Of those who had boats, 76.92% had one boat. The remaining 23.08% of the fishers had two boats each (Figure 08)
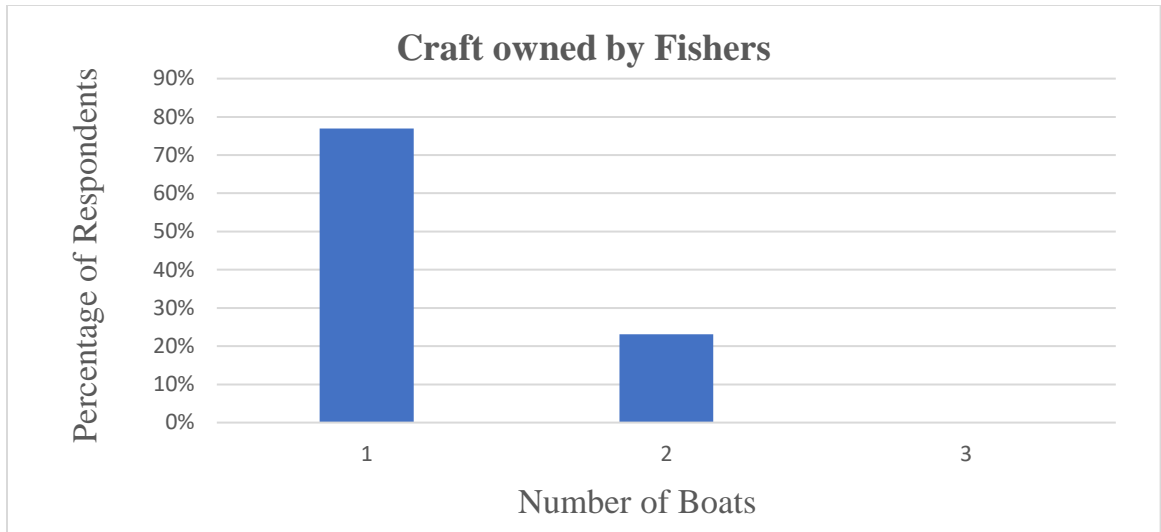
Figure 08: Number of craft owned by fishers

According to the fishermen at the study area, the craft's durability varied. 46% of respondents predicted durability of two years, while 26% of fishermen predicted that the durability of the boats was one year (figure 09). 16% of fishermen estimated the life of boats to be 3 years and similarly 9% of them estimated the lifespan to be 4 years. Roughly after this period the boats had to be repaired completely for reuse.
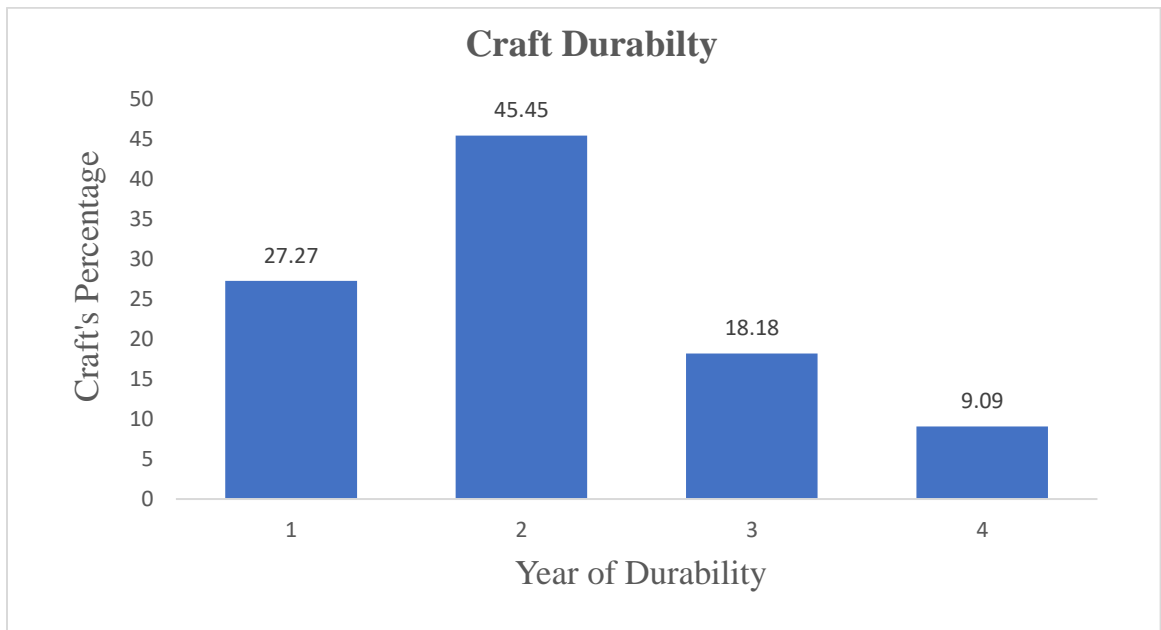
Figure 09: Fishermen's perceptions of boat durability (years) in the study area

4.6 Fisher's socio-economic features with organizational membership:

About 90% of the fishermen were members of the local fishermen's co-operative association. As members of the association, they conducted various activities. They were used to meet once a week and deposited money in the association at a fixed rate once a month. According to the head of the association, this money was deposited keeping in view the future needs of the fishermen and was also used in that way. Apart from this, the association also helped the Upazila Fisheries Office to prevent fishermen from fishing illegally during different ban periods.

However, there was a difference of opinion among the fishermen regarding various activities of the association and the protection of the rights of the fishermen. Fishermen had also claimed that the government assistance available through VGF (Vulnerable Group Feeding) card during the ban period was insignificant compared to the need.

Chapter: 05
Discussion

There was some difficulty obtaining historical information about fishing gears and crafts surveyed in the study area, but these issues had little impact on the current study. There has been almost no research on fishing gears and crafts in this area. There has been little research, but their fields are different. Those researches and their themes are mentioned in Chapter 02.

Despite these shortcomings, the general descriptive analyses and individual respondent analyses of the fishermen in the area of Sariakandi fish pass revealed trends in gear and craft use, species composition and related socio-economical characteristics.

5.1 Fishing gears:

During prior assessment of fisher community of this area, Mondal et al. (2016) identified some of these gears. They were very briefly referring to a total of 20 fishing gears. In the present context, this study has identified 25 fishing gears in the study area. These include 6 gill nets, 5 drag nets, 1 cast net, 1 lift net, 1 seine net, 1 purse net, 5 trapping gears, 4 hook and line and 1 wounding gear.

Gill net was the most significant and widely used fishing gear among fishers. Because they were effective, reasonably priced, and capable of catching more economically valuable fish than other artisanal gears. However, different types of gill nets were used in different parts of the Jamuna river. Islam et al. (2016) identified 3 types of gill net in the Jamuna river of Sirajganj Sadar area. But in the study area of Sariakandi upazila 6 types of gill net were identified. Among them 1 net was illegal. That was current jal.

According to Islam et al. (2016), there were different numbers of fishing gear in the Jamuna river near Sirajganj Sadar Upazila. In this area, only 2 types of drag net were found. Those were Thela jal, Moiya jal (drag net). But in Bogura district, fish biodiversity had increased in Jamuna and Bangali river due to the construction of fish pass. As a result, 5 types of drag net were used in the study area. Islam et al. (2016) also mentioned the type of cast net with lower mesh size (0.4 cm). That could cause a risk to aquatic

biodiversity of Jamuna river in Sirajganj part. But in the study area, the mesh size of cast net (local name: Toira jal) was relatively large (0.5-1.5 cm). But this current study result about seine net was identical to the result of Islam et al. (2016). Ber jal (a type of seine net) with 0.5 cm mesh size was used throughout the year in the Jamuna river of Bogura and Sirajganj district. According to Islam et al. (2016), 4 types of hook and line were used in Jamuna river in Sirajganj sadar upazila, which were same in Jamuna and Bangali river of Sariakandi upazila area, Bogura. But in Sirajganj part of Jamuna river no purse net, wounding gear, trapping gear and lift net usage information was found, which were being used in the study area of Jamuna and Bangali river.

5.2 Fishing crafts:

Fishing crafts of the study region were divided mainly into two parts. Namely: motorized and non-motorized (Plate-13). A motor (locally called a shallow machine) was mounted on a motorized fishing boat. According to the fishers, it costs 30,000-100,000 tk. to build a motorized boat. Dinghy nouka (boat) were also used which were non-motorized (section 4.2). But according to Flowra et al. (2011), four types of fishing craft were used in adjoining district Natore.

5.3 Fishing gear and craft selection:

According to Portt et al. (2006), Efficiency varies with gear type. In Sariakandi fish pass area, the efficiency of the gear was found to be the most important determinant element in the choice of fishing gear, followed by appropriateness of gear to capture targeted species, fishing season and cost. For example, after the ber Jal (7.5 kg/effort), the mean CPUE of the gill net was higher than the mean CPUE of other fishing gears. For this reason, the use of these two types of nets was the most in the study area.

5.4 Proliferation of illegal and destructive fishing gears:

According to Food and Agriculture Organization (2019), International plan of action to prevent, deter and eliminate Illegal, Unreported and Unregulated fishing in Bangladesh, fishing net with lower mesh or fishing by means of electrification was strictly prohibited. In the study area among 25 fishing gears 5 of these were illegal. Among those, the most

destructive gear was 'China Duari.' It's mesh size was less than 4.5 cm. Basically it was not a net. It was a kind of trap which destroyed all types of eco-friendly aquatic organisms. Other banned nets include current jal, ber jal, moshari jal and suti jal. Moshari jal haf the most destructive behavior towards fry fish. Fry fish of almost all species were caught in this net. According to Paul et al. (2021), Jamuna river in the Sirajganj area also faces the destructive behavior of moshari jal which destroyed the juvenile fish.

However, the biggest concern was fishing with 'electric shock'. By electrification of this illegal device, all the fish and aquatic organisms of that place died. If the fishing practice with electric shock is not stopped, the area will soon lose its aquatic biodiversity completely. Upazila Fisheries Officer Mr. Golam Morshed also acknowledged the issue of such illegal fishing and pointed out the context of supervision of his office to stop these illegal activities

5.5 Status of fisheries:

According to Paul et al. (2021), fishing during spawning season, over exploitation, utilization of non-particular fishing gears were responsible for the declining of fish in Jamuna river of Sirajganj area. Similar result was observed in the study area as well. Different fish were found in the study area mainly under 9 orders and 26 families (Zaman and Naser, 2019). The discovery is that catch of those fishes was decreasing as a result of overfishing and the use of destructive fishing gear. The usage of tiny mesh size nets had resulted in the capture of small fish, possibly indicating a fish reduction in that area. However, one of the most serious management issues according to the fishers was the government's lack of oversight of fishing activity. The lack of proper fishery governance in the whole river area demonstrated that there was a lack of effective action and true cooperation between the fishers and the government when it comes to fishing gear use, fish species diversity, fishermen income, fish market operation and overall fishery management

5.6 Challenges identified:

According to fishermen's statement and various previous researches, some challenges emerged in the study area:

- ✓ Fish stocks have been declining since the use of various illegal fishing gear. This poses a serious threat to the livelihood of the fishermen.
- ✓ The price of fishing gear and related instruments has also increased significantly. Fishermen's gears are sometimes heard to be stolen.
- ✓ There is also inequality in receiving government assistance during the ban period. Some fishermen told that during the enlistment of fishermen, attempts were made to verify their political identities and resort to nepotism.
- ✓ The biggest complaint of the fishermen is the long running ban period. According to their claim, they are suffering financially at this time. The government assistance available through the Upazila Fisheries Office is also insufficient. As a result, prolonged ban period leaves them and their families helpless.
- ✓ Besides, getting the right price for fish is another challenge. Fishermen are often financially disadvantaged by the tyranny of middlemen.

Chapter: 06
Conclusion

The research aimed to examine fishing gears and crafts in the Jamuna and the Bangali river adjacent to Sariakandi fish pass. The study also looked at how officials and fishermen generally saw the state of the fisheries at the moment and the difficulties they were having. Based on the study's findings and recommendations for more research, this section offers the conclusion.

Going back to the research topics that were first stated for this study, it is now able to demonstrate that the fishermen in the study region employ a variety of fishing gear, but just two types of boats. Gill nets are a crucial and popular form of fishing equipment in the research region. The study also indicate that most fishermen are not confined to a single piece of gear. Fishers change tactics probably as a result of local species variety and seasonal changes. The likelihood of the fishermen switching gears while fishing was not thoroughly examined.

Fishermen in the area mostly employ motorized fishing boats. Fishers do not switch between craft like they do between gear kinds. Even though motorized boats are more expensive, most fishermen like them since they are effective and can go great distances.

Efficiency, which they defined as the capacity or competency of fishing equipment to produce a specified catch without wasting energy, is the primary determining factor in the selection of gear. Size and price are deciding considerations when selecting a craft. Due to the diversity of species, different types of gear are used depending on the species being pursued.

The Fish Pass area is now experiencing falling fish catches as a result of aquatic biodiversity declining in recent years, according to the fishers' understanding of the situation. Some of them blamed a lack of surveillance of fishing operations and insufficient government control for the fall in fish populations. This viewpoint ran counter to that of the majority of fishermen, who believed that the lack of credit facilities and the high cost of new fishing equipment were the greatest obstacles to the growth of the fisheries in the Jamuna and Bangali rivers adjacent to Sariakandi Fish Pass.

Chapter: 07
Recommendations

The amount of human intervention in the riverine area in a certain location affects the aquatic biodiversity of rivers. The usage of fishing gears and crafts heavily rely on human intervention. So the legitimate use of fishing gears and crafts plays a huge role in conserving biodiversity. The socio-economic condition of the fishermen is also revealed by their utilization of these gears and crafts. For appropriate use of gears and crafts, several things might be suggested. The creation of a comprehensive fisheries system in the area is anticipated as a result of these proposals:

- ✓ Different mesh sizes might exist for the same kind of net. Such as Ber Jal (net) with a fine mesh or Ber Jal with a coarse mesh. Special consideration should be given in this instance to the fishermen's usage of big mesh size nets.

- ✓ At different times of the year, there are several ban periods in the study area. Fishing is entirely prohibited at that time. The VGF (Vulnerable Group Feeding) card then used to provide a variety of government assistance. However, fishermen have consistently criticized the help as being insufficient. Due to this, despite the restriction, many fishermen still go fishing. Therefore, it is anticipated that the rate of illegal fishing during the prohibition period will significantly reduce if the quantity of government aid to fishermen can be raised.

- ✓ It is crucial that all fishermen will be aware of which traditional nets are allowed and which are not in the study region. The rigorous legal regime will be applied to the use of illegal fishing gear must also be made clear to fishermen.

- ✓ To make it simpler to promote diverse fishing techniques in a moral and sustainable way and to include all stakeholders in participatory fisheries management, authority will improve the DoF's fisheries extension services.

✓ It is important to constantly execute administrative operations against illegal fishing gears and crafts. The warning that breaking the law would result in harsh punishment must be made very apparent to fishermen who do so.

✓ In the study region, several terrible and inhumane behaviors, such as fishing with electric shock are practiced. To put an end to this horrific crime and swiftly punish the culprits, the administration will act immediately. This will alert other illegal fishers to the situation and encourage them to follow the law.

✓ In order to prevent anyone from purchasing or manufacturing illegal fishing gears or crafts, Jele Polli (the fishers locality) will be regularly supervised. To oversee the application of rules, legislation, and management procedures, a fisheries magistrate should be established.

✓ For the purpose of manufacturing legal fishing gears and crafts, the authorities should enable the provision of public and private micro-credit. Technical supports will also be provided to fishermen for storing and repairing their fishing gears and crafts. If government or non-government groups support fishermen, it is reasonable to assume that the fishermen will refrain from engaging in illegal fishing operations.

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Questionnaire on
Variation and Availability of Fishing Gears and Crafts Used by the Fisher Adjacent to
Sariakandi Fish Pass, Bogura, Bangladesh

1. General Information:
1.1 Name of respondent: …………………..……………………
1.2 Address:
Village: ……………….... Union: …………………….....
Upazila: ……………….. District: …………………….
1.3 Mobile no: …………………………
1.4 Sex: ☐ **Male** ☐ **Female**

2. Checklist for Key Informant Interview (KII) of Fishers:
2.1 How long you are engaged in fishing activities?
……………………………………………………………………………………………
2.2 Where do you go for fishing? How far it is?
……………………………………………………………………………………………
2.3 What is the quantity of fish you caught per day/per unit time (kg)? (Species-wise catch)
……………………………………………………………………………………………
2.4 Which species is most abundant in which specific area? (Month-wise abundance)
……………………………………………………………………………………………
2.5 Which species is less abundant in which specific area? (Month-wise abundance)
……………………………………………………………………………………………
2.6 What is the cost of per day fishing?
……………………………………………………………………………………………..
2.7 What is the price of each kg fish (different species)?
……………………………………………………………………………………………
2.8 Which variety is of high demand?
……………………………………………………………………………………………
2.9 Which variety is of low demand?
……………………………………………………………………………………………
2.10 Over the last 5 years has your income from fishing changed?
1= increased ( ) 2= decreased ( ) 3=stayed the same/stable ( ) 4=Not sure ( )
Why ?
……………………………………………………………………………………………
2.11 Are you a member of a fishers association?
1= Yes ( ) 2= No ( )
2.12 Do you own a fishing boat?
1= Yes ( ) 2= No ( )
2.13 Do you own a fishing net only?
1= Yes ( ) 2= No ( )

2.14 Do you catch hilsa fish?

1= Yes ( ) 2= No( )

If not, then why?

……………………………………………………………………………………….

3. Information on Fishing Gear and Craft:
3.1 Fishing Gear:

Sl. No	Name of Gear	Target Fish Species	Fishing Period (month) & Location	Construction Cost	Length, Width and Mesh Size	Gear Efficiency (kg/gear/hr/person)
01	Chandi Jal - 1 (চান্দি জাল-১; ছোট ফাঁস)					
02	Chandi Jal - 2 (চান্দি জাল-২; বড় ফাঁস)					
03	Guti Jal (গুটি জাল)					
04	Current Jal (কারেন্ট জাল)					
05	Behundi Jal (বেহুন্দি জাল)					
06	Poa Jal (পোয়া জাল)					
07	Chapri Net (চাপড়ি জাল)					
08	Chewa net (চেওয়া জাল)					
09	Chai jal(চাই জাল)					
10	Hooks (বড়শি)					
11	Moi Jal (মই জাল)					
12	Masheri Jal (মশারী জাল)					
13	Khot Jal (খোঁট জাল)					
14	Kachki Jal (কাচকি জাল)					
15	Bata/goara (বাটা জাল)					
16	Pona Jal					

	(পোনা জাল)				
17	Charghera Jal (চর ঘেরা জাল)				
18	Cast net (ঝাঁকি জাল)				
19	Khota Jal (খোঁটা জাল)				
20	Scoop net (ঠেলা জাল)				
21	Drag net (চিংড়ি জাল)				
22	Lift net/ Khora/ Bheshal Jal (খরা জাল/ভেসাল)				
23	Other (Specify) (অন্যান্য)				

3.2 Fishing Craft:

Name of the craft: ………………………………… Type: Motorized/Manual

Length: ………………… Width: …………………

Operating area: ………..………………… Depth: ………………………………

#Haul/Day: …………………… People operate: …………………….....................

Construction Cost: ………………………….. Durability: ………………………

4 Hilsa trends and status (ইলিশের প্রাপ্তি/ গতি এবং অবস্থা)

4.1 How does hilsa vary throughout the year/with season? (সারা বছর এবং মৌসুমে ইলিশ মাছের কেমন প্রাপ্তি হয়?)

	Peak season (ভরামৌসুম)	Lean Season (প্রাপ্তিমৌসুম)
a) Average catch per fishing trip(kg) [প্রতি ট্রিপে গড়ে মাছ ধরার পরিমাণ (কেজি)]		
b) Fish size (1=S 2=M 3=L) (মাছের সাইজ)		

c) Presence of eggs/fries (ডিমের/ পোনার প্রাপ্তি) (1=Plenty 2=few 3=none)		

4.2 Over the last 5 years, has your hilsa catch?
1= Increased ( ) 2=decreased ( ) 3=stable( ) 4= Don't know ( )
4.3 Over the last 5 years hilsa abundance has?
1=increased ( ) 2= decreased ( ) 3= stable ( ) 4= don't know ( )

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