Original Research Article

Fishing Gears and Practices in the Bukbhora Oxbow Lake: Implications for Biodiversity Conservation in South-West Bangladesh

Abstract:

Bukbhora ox-bow Lake (*baor*) is one of the most renowned *baors* in the south west Bangladesh and supports diverse fisheries communities. The present study was conducted to identify the types of fishing gears and crafts including their mode of operation in fishing in the Bukbhora *baor* during the period from July 2023 to June 2024. A total of 18 fishing gears and crafts were recorded at different stations of the Bukbhora ox-bow Lake. Fishing gears were categorized as nets (8), traps (3), hooks and lines (3), wounding gears (2) and crafts (2). Among nets, highest mesh size recorded 5-8 cm in fash jal whereas the lowest was thela jal 0.25 cm. The highest fishing effort/day was found for Jhaki Jal (cast net) 13-15 and the lowest was recorded in case of current and punti Jal (01). Highest CPUE (kg/effort) was found in ber jal (15-18) and the lowest was found in Thela jal (1-1.5). Similarly seine net contributed to the highest catch (70.19%) and push net was the lowest (1.00 %). Maximum fishers had pieces of kochal (Seine net) and komar (drag net) 2-5 pieces and those were jointed together (each of 18 fishers groups separately work) during the harvesting period. Fishing (harvesting of carp species) started in November-December and completed on 30th June in each season. Based on the usage, the seine net was found as the most usable gear by the fishermen constituting 78.15% and fewer amount by traps. The highest price of fishing gear was observed in case of ber jal (about 1,00,000 BDT) and the lowest price was for punti jal (250-2500 BDT). Among 16 fishing gears 5 of these were found illegal in this study due to its mesh size and destructive behavior of fish biodiversity. Except some, majority fish species trapped in the recorded fishing traps were Small Indigenous Species, whereas fishing hooks and lines were used to catch carnivorous fish species mainly. Wounding fishing gears

were used for wounding large size fishes during heavy flood or when water level becomes low. This study showed that 40.91% fishers had their own fishing craft (dingi nouka) where 59.09% had no craft. It is recommended to strong implementation of all conservation guidelines and acts to prevent illegal fishing, seizing of destructive fishing gears and also protecting potential breeding habitats.

Key words: CPUE, Fishing gears, Mesh size, Small Indigenous Species, Conservation

Introduction:

Fish and fisheries have been an integral part of life of the people of Bangladesh from time immemorial; many aspects of the culture, economy and tradition are based around fisheries activities. Bangladesh has the third biggest aquatic fish bio-diversity blessed with enormous and exuberant fisheries resources in Asia, after China and India, with about 800 species in fresh, brackish and marine waters. Bangladesh is endowed with an extensive network of inland waterways, including estuaries, small and large rivers, *beel*s, *haor*s, *baor*s, canals, lakes, and seasonal channels (Ali et al., 2017). The *baor* fishery is one of the most popular fisheries resources due to its steadily rising production, which is expected to increase from 4698 MT to 12158 MT (2006–2023) (DoF, 2024). This type of fishery requires very little or no feed at all as feed is the most expensive input in aquaculture (Begum et al., 2017). The primary sources of Bangladesh's constant freshwater supply are the ancient, winding bends in the river (Haque et al., 2015). The Baor, also known as the Oxbow Lakes, are semi-closed bodies of water in the south-west region of Bangladesh that are produced by dead arms of rivers in the Ganges delta (Farid, 2013). There are about 600 *baor*s in the southwest part of Bangladesh comprising 5,671 ha and 29 *baor*s are being managed under some sorts of culture practices initiated by the DoF and very few of the rest are under the management of fisher's cooperatives or NGOs (DoF, 2024).

The skill of fishing involves capturing not just fish but also other aquatic creatures (Sreekrishna et al., 2001). In addition to being a source of food for humans, fishing supports a substantial portion of rural society's livelihood and nutritional security (Hameed et al., 2000). In these inland water bodies, prevalent fishing activities include hand picking, dewatering, overfishing, undersized fishing, haphazard fishing, fishing during the nesting season, and so on (Das et al., 2023). Moreover, the biodiversity of the freshwater fish species is declined due to the intense human intervention resulting in niche loss and declination and as a result, many fish species have become highly endangered (Rahman et al. 2012).

The choice of fishing gear, method of operation, number of fishermen, fishing intensity, and level of exploitation all has a significant impact on the future of the fishing industry (Mia et al 2017). Modernized crafts have advancement to capture and transport fishes as well (Rahman et al 2017) which influences the fish biodiversity greately (Rahman et al 2016). Thus, the evaluation and information about fishing gears and crafts are necessary to emplace developmental measures about smooth fishing among fisherman's community (Baleta et al 2017) from any area. Numerous researches rose regionally to report the biodiversity of fishers and fishing gears (Azam et al 2014; Ali et al 2015; Rahman et al 2015; Rahman et al 2017) to understand the fishing status deeply.

Numerous groups of fishing crafts and gears are operated in *baor* for commercial fishing exploitation (Rahman et al 2016) having different shapes and sizes to capture various sizes of fish species (Azam et al 2014). The shape and size of the gear depends on the locality, types of water body, different operation area, depth of water and availability of target species to be caught (Flowra et al. 2013). The major categories of fishing gears that are regularly used in Bangladesh can be counted as the following: fishing nets, fishing traps, hooks and lines, wounding gears and

fish aggregation device (Chakraborty et al 1995) where various types of materials are used to make these fishing gears (Hameed and Boophendranath, 2000).

According to Ghosh and Biswas (2017), the catch per unit effort (CPUE) is a recognized measure of the abundance and consumption of fisheries and can be used to calculate the number of fishing units in a sustainable fishery. It also measures stock density, physical and financial productivity, and the efficiency of a fishing operation. It is expected that CPUE will reflect the fraction of the fish population used as the relative abundance index (Karim et al 2019).

Since, *Baor* is one of the natural stocks of native fish species especially SIS in south western part of Bangladesh, the biodiversity of this *baor*s could be negatively affected by using harmful fishing gear and fishing system. Many researchers have studied fishing gear in different water body *i.e* river (Saberin et al., 2018, Tikadar et al., 2021); *haor* (Mia et al., 2017, Yeasmin et al., 2021)

However, the impact of fishing gear used in *baor*s on biodiversity is largely understudied. The literature outlining the description, mode of operation, and classification of *baor* fishing gear is particularly illuminating. Such information is critical for developing effective management practices for the *Baor*'s commercial fisheries. Unreliable research has been done on the diversity and productivity of fish in the *baor*. In this conception, the present research was taken to reveal some aspects including different types of fishing gears operated in *baor*s with their mode of action, CPUE, catch composition of various gears, the significant reasons for the eradication of fish fauna and find out some recommendations to enhance the fish biodiversity and conservation of the *baor*s in Bangladesh.

MATERIALS AND METHODS

Study area and duration

Bukbhora Baor (23.1759° N, 89.1170° E) is one of the prominent oxbow lakes located in Jashore Sadar Upazila. The lake is linked to the Kopothakho River by a canal spreading around 7 kilometres (4.3 mi), known as Katakhal. The present study was conducted fortnightly for a period of twelve months from July 2023 to June 2024. Investigations were conducted at five sampling stations on the basis of more fishermen in those areas. Data was collected personally through face to face interviews using well-structured questionnaire and cross-check.

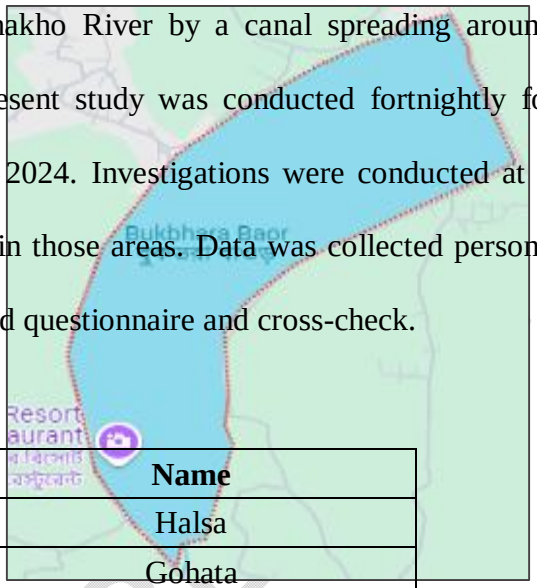

Table 1: Sampling stations of the study

Sampling station	Name
Site 1	Halsa
Site 2	Gohata
Site 3	Chanduita bazar
Site 4	Mathbari
Site 5	Ichhapur

Catch per unit effort (CPUE) and gear efficiency:

The catch per unit effort (CPUE) of the angling gears were taken dependent on the weight of fish discovered amid an angling day (kg $gear^{-1}haul^{-1}$) for the various species consolidated and the gear efficiency (kg $gear^{-1}person^{-1}haul^{-1}$) additionally assessed based on the weight of fish got and a number of individuals drew in with each fishing gear per hour.

Figure 01. Map showing the study area

Collection of primary data

Data were gathered by direct catch assessment survey (CAS) and fishing effort survey (FES) conducted at the study sites. The fishing gears were overviewed by direct physical perceptions and dependent on participatory rural appraisal (PRA), questionnaire interview (QI), focus group discussion (FGD). Focus group discussion (FGD) refers to objective focusing informal discussions with small groups (6–12) of people, generally with same vocation or belonging to same level of community. Ten (10) FGD were made where participants were fisherman of young, middle and old ages. The QIs and FGDs were led with a semi-organized and pre-trialed questionnaire. A total of thirty fishermen in the chosen *baor* area were surveyed using a basic random sampling procedure and questionnaire interviews in order to gather data. The interview was conducted with fisherman either at their homes or at their fishing locations. Data were collected from fishermen, aratdar, fish landing center, labor and direct observation of fishing gears at the time of operation and from the local fishing gear market. Data about fishing gear with their mesh size, operation mode, building materials, fish species caught, were the principal

and common type of net used in the season etc. and data about operation of fishing craft with their size, shape etc. were collected by Questionnaire interviews (QI).

Study on fishing gears

Fishing gears operated at selected *baor* by fishermen were studied by direct physical observation. A measuring scale was used as a tool to measure mesh size of existing fishing gears. Direct observation was conducted to record data on fishing gear like shape and mesh size (cm) of fishing gears. Information about the price of fishing gear, species catch by individual gear, catch per unit effort (CPUE)/day and operation period of individual fishing gear were collected through interviewing with fishermen.

Secondary data

After regular field study, the primary data were compared with the available secondary data to make a precise and composite picture of the present study area. Books, Journals, Upazila Fisheries Officer (UFO) etc. were used to modify, cross-check and accurate the information. The collected gears were assorted under various major classes followed by Ahmed (1971). Fish samples captured by different gears were identified and then taxonomically characteristics followed by Talwar and Jhingran (1991) and Rahman (2005).

Data processing and analysis

All the data were accumulated to analyze the findings. Tabular technique was applied by using simple statistical tools such as percentages and averages. For processing and analyzing the data "Microsoft Excel-2013" was used.

RESULTS

The fishery of the ox-bow lakeis multispecies and multigear in nature. Fishermen use numerous types of fishing gears for fishing based on seasons and water depth of the *baor*. Variation in net types, lengths as well as mesh sizes of the net varying based on the fishermen choice, economic conditions of the persons involved in fishing practices and also the abundance of fish. Categorization of different fishing gear with their shape, respective mesh size, major species caught, price, catch per unit effort (CPUE) and operation period in the *baor* are showed in Table 2. About eight (08) various types of fishing gear were classified under six major classes and these were gill net (current jal, puti jal, fash jal), seine net (ber jal), Drag net (komar Jal), lift net (vashal jal), push net (thela jal), cast net (jhaki jal), three types of fish traps (Charo, bitte, ghuni), three types of hook and lines gears (chip borshi, dhawn borshi, nol borshi), two types of wounding gear (koach, teta) and two types of fishing crafts (kosha, dinghi) were found for catching fishes in the following *baor* (Table 2,4).

Fishing gear efficiency and CPUE of gears in the Baor

In the present study the fishing gear efficiency using CPUE and fishing effort of the various fishing gears operated in the Bukbhora *baor* was recorded and data were presented in Table 2. Along with all types of gears most of the fishers use nets where about 78% fishermen use seine net and only 1% use push net. Among other gears types wounding gear, hooks and lines and traps occupy 0.5%, 0.35%, 0.12%, respectively (Figure 2).

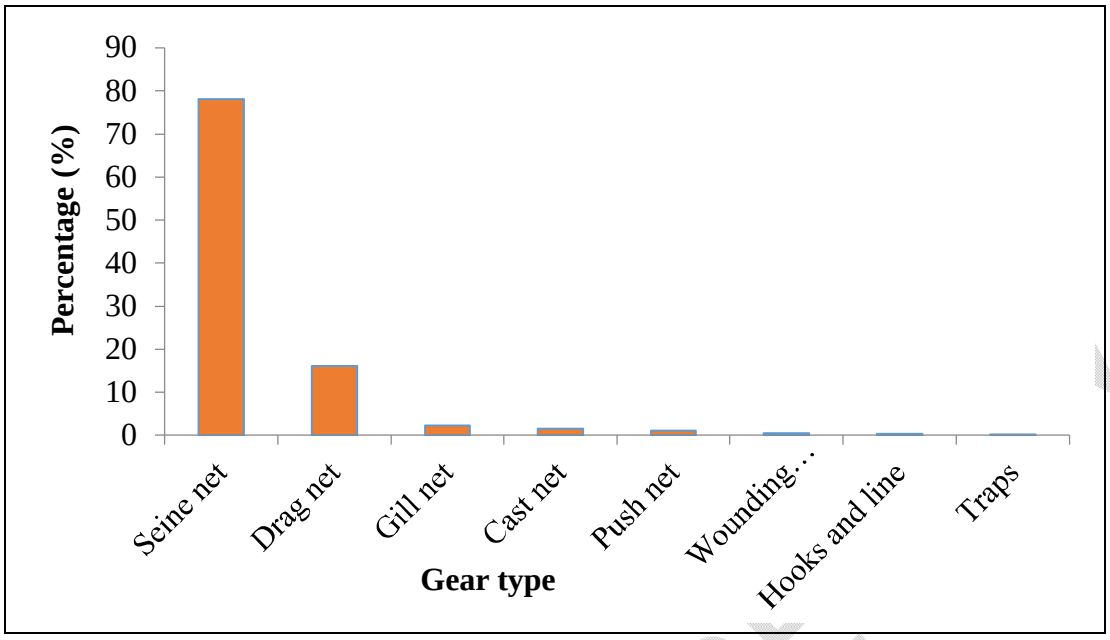

Figure 02: Fishing gear used by fishermen in the *baor*

Table 2: Different fishing net with their mesh size, shape, price, and major species caught, CPUE and operating period in *Baor* at Jashore, Bangladesh

Type of fishing	Gear		Description/Size		Mesh size (cm)	Shape and Materials Used	Fishing effort/ day	CPUE (kg gear^{-1}haul^{-1})	Main Fishing period	Catch Composition	Construction cost (BDT/net)
	English name	Local name	Length (m)	Breadth (m)							
Kochal	Seine net	Ber jal	80-110	15-20	2.30-5.00	Rectangular, Nylon twine	02	15-18	Oct-Dec Feb-mar May-Jun	Rui, Catla, Silver carp, Mola, Tit puti	About 1,00,000
Komar	Drag net	Moi/Komar jal	300-400	9-10	3-4	Rectangular, Nylon twine	4-5	02-2.5		Bele, Taki, Puti,Tengra, baim	1,500-4,000
Push	Push net	Thela jal	-	-	0.25-0.50	Triangular, Cod twine with bamboo frame	7-8	01-1.5	Over the year	Puti, Taki, Bele, Chapil, Icha chingri	1,500-2,500
Cast	Cast net	Khepla/Jhaki jal	8-10	8-10 (round diameter)	0.5-1.4	Conical,Nylon twine	13-15	<1.50	July-septembe r	Punti,chapila,colisa, Silver carp, Rui, Catla, koi	2,000-4,500
Lift	Lift net	Khora /Veshal jal	12-15	10-12	0.5 Centre ; 1.5 Front	Square, Nylon twine	05	01-1.5	June-Aug &Oct-Dec	Bata, Punti, mola, tengra, Koi	9,000-10,000
Gill netting	Gill net	Current jal	50-150	1.0-1.5	1.0-3.00	Rectangular, Nylon twine	01	08-10	Round the year	Puti,Taki, shing, magur tengra, Bele, Koi	3,500-6,000
		Fash jal	10-12	2-5	5-8	Rectangular, Mono-filament nylon	02	10-12		Puti, Taki, Shing, Bele, Icha chingri	3,500-6,500
		Puti Jal	20-30	0.5-1.0	2.0-3.0	Rectangular, cotton twine or monofilament	01	04-05		Punti, Bele, Gulsha, Koi,Taki	250-2500

***Jal= Fishing net; BDT= Bangladeshi Taka (currency); CPUE= Catch Per Unit Effort.**

Gear wise catch composition:

It was observed that huge number of fishes was caught by seine net (Ber jal) and the rare species were damaged through these bulk catches and it is considered as one of the most detrimental gears compared to others. Among these seine net contributed to the highest catch (70.19%) and push net was the lowest (1.00 %).

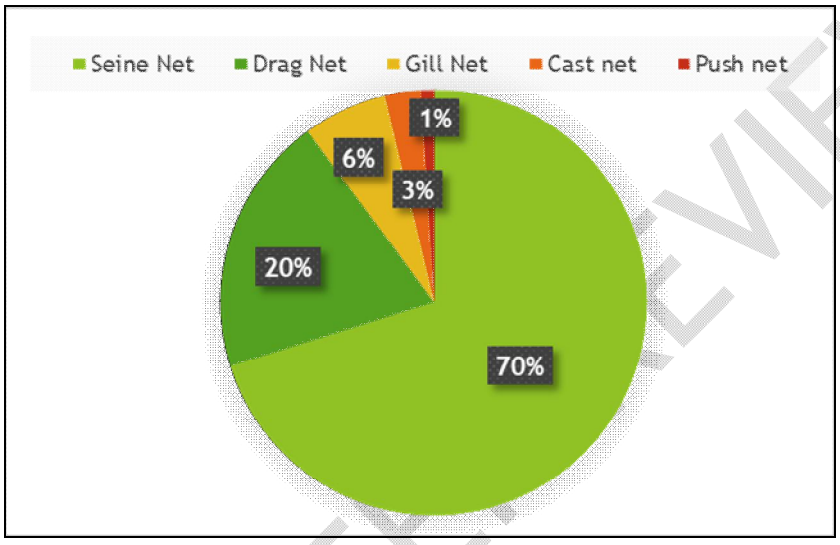

Figure 03. Contribution of gears to catch in *baor*

Table 03. Total catch and contribution of gears to catch of Bukbhora *baor* (Nov-Jun)

Gear Type	Total Catch/Day (kg)	Probable fishing time (Days)	Total Catch (8 Months) (Kg)	Total catch (%)
Seine Net	1797	90	161735	70.19
Drag Net	505		45417	19.71
Gill Net	163		14678	6.37
Cast net	70		6290	2.73
Push net	26		2304	1.00
Total			**230424**	**100**

Catch per Unit Effort (CPUE) of *Baor*

The catch per unit effort (CPUE) is the average daily catch per gear type standardized per fishing unit. CPUE is influenced by several factors, primarily the type of gear used and its efficiency, how many hours it is operated for in a day, weather conditions, and location of fishing. CPUE varies between gears and years in different *baor*s.

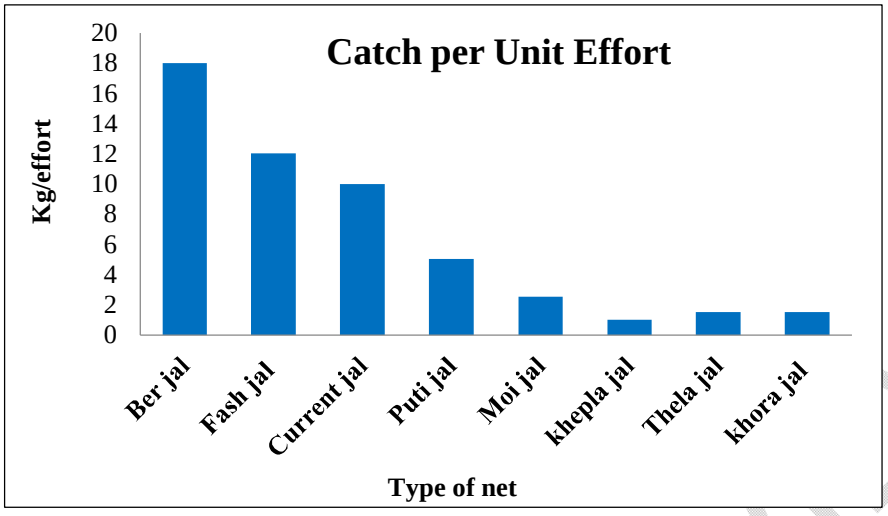

Figure 04. Catch per Unit Effort (CPUE) of different fishing nets

Fishing Traps: This type of fishing gear was made from bamboo plate with twine. Fish traps are not considered as destructive gear until it creates any barrier on the migratory route of fish. Relatively small sized wild fishes were voluntarily trapped in this type of gear. Different types of fishing traps were operated in shallow region of the *baor* during the study period.

Charo / Vair: Vair is a Long box like trap with a door extending from its base to its apex used in shallow portion of the *baor*. Made of split bamboo sticks tied with creeper or cane. Small opening at the apex for collecting fish. In front of Vair a barrier is created with split bamboo made Bana. The trap checked up every one or two hour interval. Usually operated 1 to 12 hrs/day in the month of July to January.

Ghuni/Kholsun: Rectangular box shaped. Made of split bamboo tied with jute rope or cane. Kholsun consists of two doors from its apex for fish opening. Small opening present at its apex for collect the fish. Usually it set in shallow part of the *Baor* with the help of bamboo pole or tree branches during early morning or evening**.**

Bitte: Basket shaped, made of split bamboo with two or three entrances. There is an opening on the trap for collecting fish. The trap is sunken (1 to 1.5 feet below from water surface) in shallow, where small current is present during early morning and evening. Checked up every one or two hour interval.

Table.4 Different fishing techniques operating in Bukbhora *Baor*

Fishing Traps operating in Baor									
Type of gear	**Local name**	**Description**			**Mesh size (cm)**	**Materials used**	**Fishing period**	**Number of trap used/unit**	**Major fish caught**
		Length (cm)	**Height (cm)**	**Breadth (cm)**					
Trap	Bitte	45	25	25	0.8	Steel wire	Jun-Aug	15-30	Punti, Koi, Baim, Punti, Tengra, Katchki, Mola, Chanda, Khalisha
	Charo/vair	40		15	1.0-1.5				Rui, Catla, Punti, Koi, Baim, Tengra, Katchki, Mola, Boal, Gozar, Shol, Taki
	Ghuni/ Kholsun	25-40	9-20	9-20	0.2-0.5			20-30	Baim, Koi, Punti, Tengra, small prawn

Hook and lines operating in *Baor*						
Type of gear	**Name of gear**	**Number of hook per line of lift**	**Bait used**	**Catch/ Haul (kg)**	**Fishing period**	**Major fish caught**
Hook and line	Dhawn borshi	Several hundred	Earthworm	0.25- 2	June-Sep	Shol, taki, tengra, punti, boal etc
	Nol/Dhap borshi		Small live fish, earthworm, small frog etc.	0.25- 1.5	June-Jan	Shol, taki, tengra, boal etc
	Chip borshi	1 hook	Small live fish, earthworm, small frog etc.	0.03- 0.05	All seasons except rainy day and winter	Koi, Shing, Punti, Tengra and some carp species

Wounding gears used in *Baor*						
Type of gear	**Name of gear**	**Length (m)**	**No. of iron sticks**	**Catch/ Haul (kg)**	**Fishing period**	**Major fish caught**
Spear/Harpoon (Wounding gear)	Koach	1-3	10-20	1-2	Jul-Jan	Rui, Catla, Kakila, shol, boal, ayre, gazar, baim
	Teta	1.5-2.1	6	0.5-2	Jul-Jan	Taki, Boal, Shol, Bele

Fishing crafts used in *Baor*								
Craft name	**Size (m)**			**Shape of bottom**	**Persons need to operate**	**Boat type**	**Life span (years)**	**Using gears**
	Length	**Height**	**Width**					
Kosha	8-10	1-2	2-4	Flat	2-3	Non mechanized	4-5	Khepla jal, Puti jal, Current jal
Dinghi	5-6		2-3	Rounded	5-6			Ber jal, fash jal, veshal jal

Table. 05. Size selectivity characteristics of some important fishing gears

Fishing Gear System	Size Selectivity
Gill nets	High
Hook and lines	High
Seine Net	Low
Entangling nets	Average to low
Fishing traps	High

Fish of the Cypriniformes order was most commonly caught in fishing gears. Their percentage of being caught was 76%. Perciformes order in 72% fishing gear, Siluriformes order were caught in 68% fishing gear, Synbranchiformes order in 52% fishing gear and Beloniformes (35%). Like this, Osteoglossiformes and Clupeiformes both order were caught in 12% fishing gear.

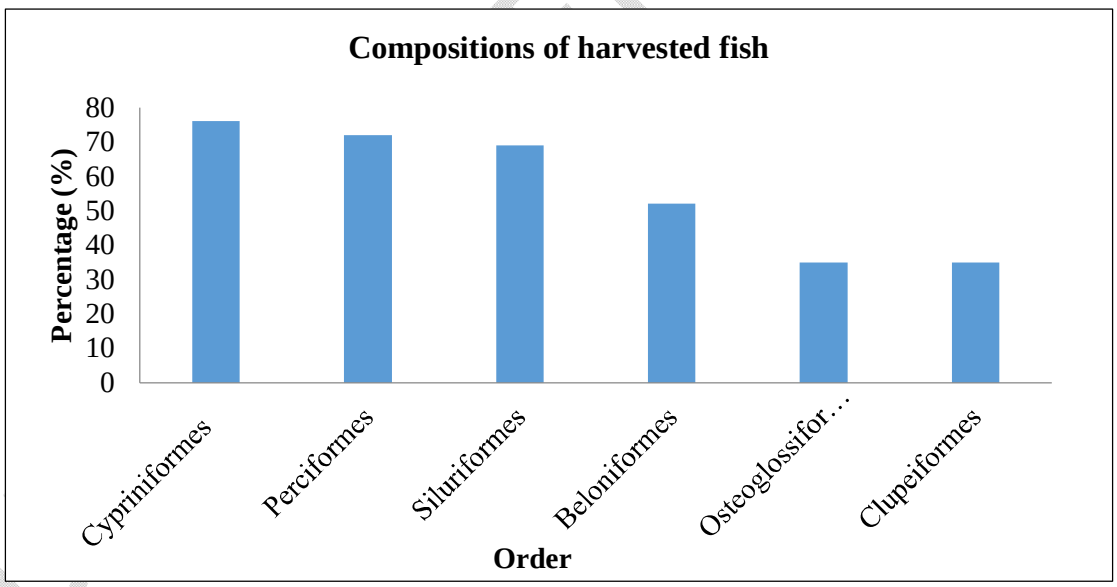

Figure 05. Compositions (%) of different categories of fish harvested with different fishing gear

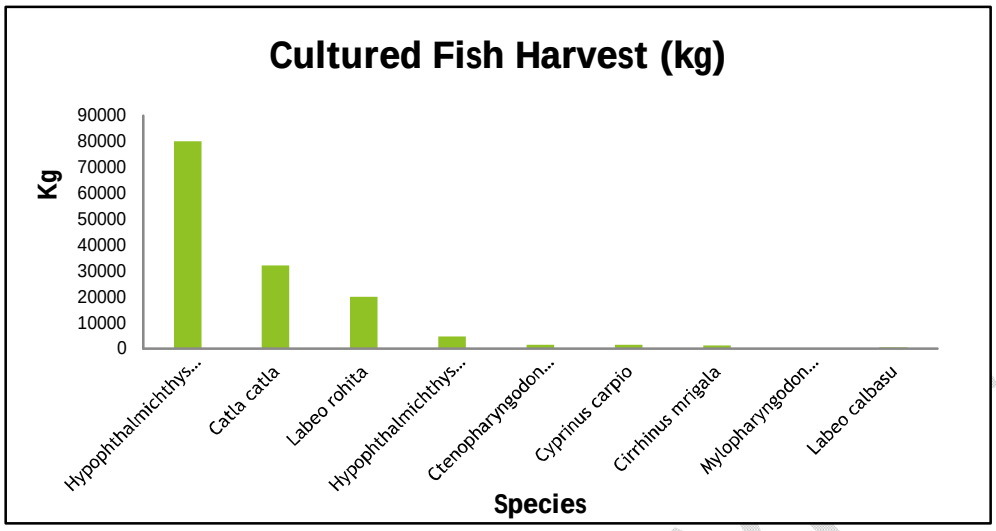

Figure 06. Cultured fish harvested with different fishing gear

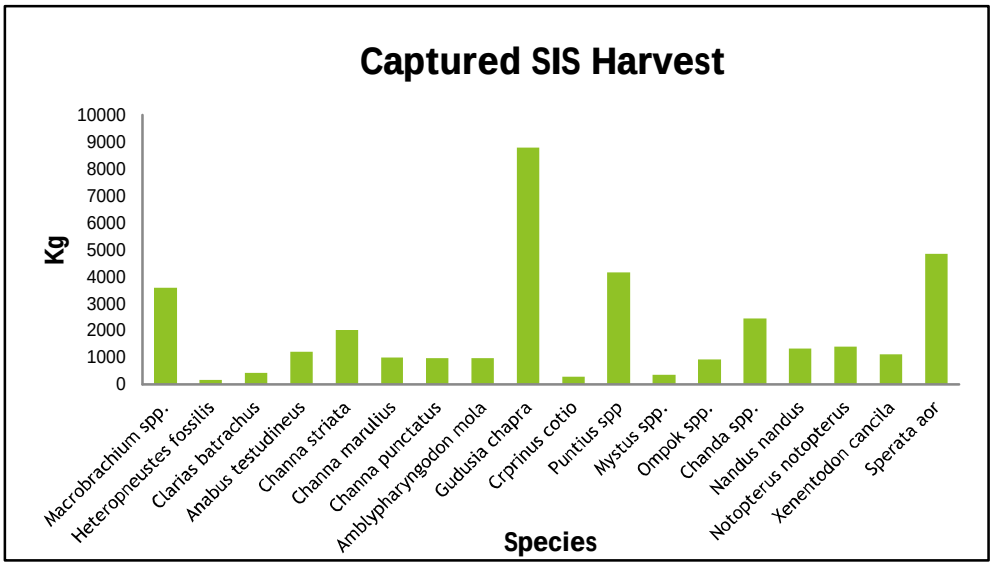

Figure 07. Captured fish (SIS) harvested with different fishing gear

DISCUSSION

About eight (08) various types of fishing gear were classified under six major classes , where three types of fish traps, three types of hook and lines gears, two types of wounding gear and two types of fishing crafts) were found for catching fishes in the following *baor* (Table 2,4). Adjacent to many researcher such as Nurullah et al. (2005), Ahmed and Hambrey, (2005); Ahmed, (2008); Sayeed et al., (2014) studied on the different fishing techniques performed in open water bodies like beels and rivers. Majumdar et al., (2020) stated that 15 different types of fishing gears (8 major categories) are used for fishing by the fishermen at Chinadi Beel. Similarly, Flowra et al. (2011) and Rahman et al. (2015) who acknowledged 16 different gears under 7 categorizes that supported the present findings. Nonetheless Rahman et al. (2016) and Jaman et al. (2019) found total seven and eighteen major types of fishing gears defined in the Payra River, respectively. Furthermore, Tikadar et al., (2021) found 10 unique gears under 4 categories to operate in the Gorai River. Ferdoushi (2018) reported that total of thirty (30) different types of fishing gears including 10 fishing nets, 9 fishing traps, 9 wounding gears, 2 fish aggregating devices and hand fishing were employed to catch fishes in Ashura beel. Siddiq et al. (2013) conducted a study on Dogger beel and mentioned 5 types of fishing nets, 3 fishing traps, 2 hooks and 2 spears.

Different types of carp species (locally known as '*Raja Mach'*) were used to culture (fry are released and then harvest when these are the marketable size). Furthermore, various types of non-stocked fishes especially SIS were found in *Baor* which were reared and reproduced naturally (locally known as '*Rani Mach'*). Captured SIS Chapila (*Gudusia chapra*) and cultured fish Catla (*Catla catla*) were found the highest harvested fish. The terms kochal (Seine net) and komor (drag net) fishing were local name in the study area, which were mostly used for fishing the carps. Initially, the kochal jal (seine net) is operated for 5 to 10 days and by this time the

runaway fish took shelter into bush parks (locally called komor) that set in nearby areas. At that stage, the fishers were stopped operating the kochal jal and started fishing in the komors by encircling those with komor jal (drag net). Maximum fishers had pieces of kochal jal and komor jal (2-5 pieces) and those were jointed together (each of 18 fishers groups separately work) during the harvesting period. Komor fishing (drag netting) was principally adopted as a method to catch the remaining fishes in the *baor* after kochal fishing. Different fishing gears such as entangle net of selective mesh size, borshi, ghuni/britti etc. were used for SIS harvesting. But now-a-days, these SIS species are going to be disappeared despite of their limited ability to reproduce naturally due to environmental degradation as well as habitat degradation.

Based on the usage, the seine net was found as the most usable gear by the fishermen constituting 78.15% followed by drag net (16.05%) among total gear type. The fishermen also used gill net (2.32%), cast net (1.51%), push net (1.00%), wounding gear (0.50%), hooks and line (0.35%) and traps (0.12%). The result stated that the seine net was highly preferable gear by the fishermen. This investigation recorded that maximum amount of species caught by seine net (ber jal) and few amount by traps. . Seine net was the most destructive gear as large amount of fishes were caught per tow by it and there is every possibilities to extinct the rare species if this gear are used in the early breeding season. The choice of fishing gears by the fishermen depends on many factors like types of fish species available and the physical condition of the baor. Biswas et al. (2009), Sharif et al., (2016), Biswas et al., (2021) also reported that kochal (seine net) fishing were widely used for fish harvesting in different *baor*s of jashore region. From Ramnabad River, Ali et al. (2015) noticed the maximum utilization of seine net (60%) and gill net (20%), additionally the lesser utilization were found in lift net (0.6%), cast net (1.2%), push net (1.8%) and trap (0.6%).

Different shapes of fishing gears were enlisted such as rectangular shape (ber jal, current jal), conical shape (jhaki jal), square shape (khora jal) and triangular shape (thela jal) with mesh size ranged from 0.5 to 10 cm, in the study area. Rahman et al. (2017) found the highest mesh size for gill net (10 cm) and the lowest size push net (0.5 cm) in the Agunmukha River, which concurs well with the present findings. 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 was strictly prohibited. Among 16 fishing gears 5 of these were found illegal in this study due to its mesh size and destructive behavior of fish biodiversity. Among those banned nets, current jal, ber jal, fash jal, puti jal were found the most destructive behavior towards fry fish. The government in 2002 banned the production, marketing, import, storage, transport and use of current jal by amending the Protection and Conservation of Fish Act 1950. Fry fish of almost all species were caught in this net. Only Komar/moi jal, jhaki jal were announced as legal gear by the authority. 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. A plenty of different sizes of fishes were indiscriminately caught by this nets round the year. Consequently, many fish species are being disappeared from the open water bodies, which are in agreement with the findings of the present study. Appropriate administrative activities would be crucial to implement measures to control destructive gears, particularly gears that capture threatened species.

Selecting an appropriate mesh size of fishing nets based on the size of the target species helps improve selectivity and minimize by catch (Bhanja et al., 2022). By avoiding overexploitation of non-target species and minimizing habitat damage, selective fishing practices support the livelihoods of fishing communities (Liang et al., 2014). In present study, Gill nets and hook &

lines were demonstrated high size selectivity among all the gears used in fishing which relates with Madhu (2018).

In the present findings, the price of fishing gears were ranged from BDT 250-1, 00,000 (Table 2). The highest price was observed in case of seine net (ber jal: about 1, 00,000 BDT) and the lowest price was for punti jal (250-2500 BDT) (Table 2).

According to Portt et al. (2006), Efficiency of gears varies with its type. The maximum CPUE was recorded for ber jal 15-18 kg/effort depending on its massive dimension and mesh size where the CPUE of fash jal, current jal, puti jal, komar/moi jal, khepla jal, thela jal, khora jal was found 10-12, 08-10, 4-5, 02-2.5, <1.50, 01-1.5, 01-1.5 kg/effort, respectively which was fewer than ber jal and greater than any other gear (traps, hooks and line, wounding gears). Maximum fishing efforts per day were correlated with the highest catch composition of any fishing gear. Table 2 represents the highest fishing effort done by those fishing gears which are easy to handle and require less fishermen such as jhaki jal, thela jal, moia jal and khora jal.

However, most of the fishermen caught fish species by using ber jal, komar jal, current jal, thela jal to bring their livelihood. Fishing (harvesting of carp species) started in November-December and completed on 30th June in each season. Fishermen caught fish throughout the year but comparative higher amount fish was caught during winter season (November to January) which was agreed with Farid et al. (2013).

Mainly the fishermen operate their trap in rainy season when the water flows of the *baor* are much higher. Different types and sizes of trap are used by the fishermen and it's completely depending upon the target species and their sizes that they would be caught, water depth and seasonality. The operation method of these traps are more or less similar. Due to easy operating

method and cheap rate, marginal fishermen widely used these trap for commercial and household consumption purposes.

Fishermen use different types of crafts differ in length, breadth, depth, shape and size from region to region of the country. The crafts or boats are built traditionally by the rural carpenters according to their individual plan with planks. It is also difficult to classify them according to the net used because fishermen used the same boat for operating different nets. Most of the fishing boats are manually operated by using paddles and pole propulsion with or without sails. Kosha nauka (plain bottom) are used in low tide area which are non-mechanized and used to catch small fishes. In high tide area the dingi used to catch fishes. This study showed that 40.91% fishers had their own fishing craft (dingi nouka) where 59.09% had no craft.

Conclusion:

Size of the gear, mesh size, craft and fisherman required for operation vary with the fishing method and targeted fish species. It depends on season, water level, size of fish, fishing area and availability of fisherman. In order to reverse the trend and ensure sustainability of fish production various measures for protection, conservation and management of fisheries resources have been adopted time to time by the Government. Biodiversity management strategies should be taken to prevent illegal fishing, seizing of destructive fishing gears and also protecting potential breeding habitats. Extensive research on biodiversity and fishing gears are much crucial to know the variations of biodiversity and livelihood of the fishermen community for their development and sustainable fishery management. Additionally, Mass awareness must be required to protect the threatened fish species from being extinct from this wetland; also fishermen and by protecting various fish fauna resources. It is recommended to strong

implementation of all conservation guidelines and acts to stop illegal catching practices and pollution in the ox-bow lakes.

CRediT authorship contribution statement

Anik Talukdar: Conceptualization, Data curation, Formal analysis, Investigation, Methodology, Software, Writing –original draft. **Amrita Shaha:** Formal analysis, Investigation, Methodology, Writing – review & editing. **Nasima Begum:** Formal analysis, Investigation, Methodology, Writing – review & editing. **Rakibul Islam:** Writing – review & editing. **Akhery Nima:** Writing – review & editing

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Conflicts of Interest:

The authors have no conflicts of interest to declare.

Ethics Committee Approval:

The authors affirm that ethical approval is unnecessary for this study.

Disclaimer (Artificial intelligence)

Author(s) hereby declare that NO generative AI technologies such as Large Language Models (ChatGPT, COPILOT, etc.) and text-to-image generators have been used during the writing or editing of this manuscript.

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