The CPUE and Catch Composition of Fishing Nets used by the Fishers′ in the Lower Meghna River at Chandpur region, Bangladesh

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Abstract

The goal of the current study was to evaluate the catch per unit effort (CPUE) of various fishing nets, their catch composition, and the identification of fish biodiversity used in the Chandpur area's Lower Meghna River. According to the survey, six groups of fishing nets with mesh sizes ranging from 0.0 cm to 12.7 cm were used in the Chandpur district. Near about 0.0 cm to 0.3cm meshed set bag net, seine net and barrier net were found as detrimental to the fisheries community and the study also observed around all size groups of fishes were caught by these nets. The catches of multi-meshes set bag net were found highest 7.87±0.74 kg/fisherman/day in February followed by barrier net 5.41±0.32 kg/fisherman/day in January, gill net 5.21±0.45 kg/fisherman/day in June, others net 3.79±0.47 kg/fisherman/day from in November, seine net 3.24±0.24 kg/fisherman/day in January and 3.09±0.15kg/fisherman/day from drag net in December. The highest CPUE (kg/fishermen/day) was observed in the dry season (4.25±0.41) followed by monsoon (3.83±0.5). The ANOVA revealed a significant difference between the six groups of fishing nets used in the Chandpur area ($p < 0.05$), $F_{(5, 255)}$ = 21.906, $p = 0.00$, $\eta2 = 0.3$. The study revealed a total of 36 species of fishes within 20 families of 8 Order in the catches of 11 types of fishing nets under 6 major categories. The barrier net reported the largest number of species (32) among the various net, followed by the set bag net (25), seine net (22), gill net (13), other nets (11) and drag net (8). On the other hand, on a weight basis, Siluriformes (38.62%) is the most dominant order in the catch composition of fishing nets operated in the Lower Meghna at Chandpur region.

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Introduction
Bangladesh is endowed with vast open waters in the form of rivers, canals, estuaries, natural and man-made lakes, brackish waters, brackish-water impoundments and mangrove wetlands. The country is criss-crossed with 761 rivers and their tributaries (Rahman and Akhter, 2015). Among the three mighty rivers of Bangladesh Meghna, he a great importance in respect of fisheries and other hydrological and navigation benefits. The Padma River and the upper portion of Meghna River unite to form the Lower Meghna River, which is one of the world's broadest rivers and greatest estuary. Being one of Bangladesh's biggest rivers, the Meghna estuary is home to a huge number of fishing boats and equipment that are used for the commercial exploitation of the country's lucrative multi-species commercial fisheries. (Hossain et al., 2009; Hossain, 2011). In the whole Meghna River, 107 species of fish from 13 orders and 36 families were recorded in 2017, according to Pramanik et al. (both the Lower and Upper Meghna River). The river plays an importantinole on migration, spawning grounds, nursing groand unds, feeding grounds of Hilsa (*Tenualosa ilisha*) and other commercially important fish species. Bangladesh has one of the richest fish production resources in the world, and in 1983 they produced the third-most inland fish production in Asia (Kamal, 2014). With a total production of 42.77 lakh MT in FY 2017–18, Bangladesh is one of the world's top producers of fish. Bangladesh rated third in inland open water fisheries sector and fifth in global aquaculture output, respectively, in the FAO report "The State of World Fisheries and Aquaculture 2018.". As a single species, national fish hilsa has been providing the largest contribution to the nation's overall fish output which is around 12 percent (DoF, 2019). Hilsa is the major species of Lower Maghna River and for the conservation of this species govt. established a seasonal hilsa fry sanctuary locally called 'jatka sanctuarthe y' in Chandpur region. The Geographical Indication Registration Certificate for our national fish, the Hilsa, has been successfully obtained by Bangladesh.. 3.57 percent of the national GDP and 25.30 percent of the agricultural GDP come from this industry in 2017-18. (Yearbook of Fisheries Statistics of Bangladesh, 2017-18). Despite the fact that the majority of them are hilsa fisherman, the fishermen in Chandpur area are skilled in using a wide variety of fishing equipment and crafts to capture fish. '. According to Siddique *et al.*, 2013; Das and Banargii, 2000 and Moula *et al.*, 1993 observed the Meghna and its estuary are home to a huge number of fishing cratsf and equipment that are used for the commercial exploitation of the nation's fisheries resources.and contributed the total fish production of the country regularly. Catch per unit effort, or CPUE for short, is a quantitative approach that is often used as an indicator to measure the population's relative abundance (Harley et al., 2001, Maunder et al., 2006, and Lynch et al., 2012). Even though there hasn't been any study done on capture per unit effort (CPUE) of fishing equipment and crafts to determine the number of fish in the Lower Meghna River or the Chandpur area. As a result, the purposes of the current research were to investigate the CPUE of fishing nets and the catch composition of the various nets along the Lower Meghna River in Chandpur area.

MATERIALS AND METHODS
Study area and period
The current research was conducted in the section of the Lower Meghna River that is closely located to Bangladesh's Chandpur district. Three sampling sites were selected for data collection and these are - Chandpur sadar, Haimchar, and Char Vhoirabi (Figure1). The study area was surveyed from November 2018 to February 2019 and May 2019 to September 2019 because no fishing was done by the fishers' to collect sampling data due to the seasonal jatka sanctuary period (in March and April) and hilsa ban period (mainly in October, depending on lunar cycle) execution in each year.

Sampling sites

Figure 1 Sampling sites in Lower Meghna River at Chandpur districts

Data collection, Estimation of CPUE and catch composition of different fishing nets
In order to estimate the Catch Per Unit Effort (CPUE) of fishing nets and the catch composition of fishes by Catch Assessment Survey (CAS) during sampling periods on various fishing nets used in the Lower Meghna River in the Chandpur area, monthly sampling was carried out in selected sampling sites. Through firsthand observation of fishermen's catch, interviewing of fishers', by Focus Group Discussions (FGD), sampling and visiting of fish landing center; information on the kinds of fishing nets and the catch was gathered from fishermen at the fishing location. Different types of fishing nets were surveyed randomly on each sampling day. Using a single pan balance, the catch's variety and weight were approximated to the closest gram (g) and reported in compliance with fishing net standards. The whole catch of each kind of net was physically examined to determine the species composition, however sometimes the total catch was bought from the fishermen. Additionally, the samples were separated by species, and the weight of each species was noted. The species diversity was calculated by examining the species composition in each kind of net. For each kind of net, the proportion of species composition in the capture (measured in weight) was computed. Furthermore, the CPUE by gear type was evaluated. SPSS was used to examine the data (SPSS, Chicago, IL, USA).

RESULTS
Fishing nets
There were reported to be 11 different kinds of fishing nets used by fishermen in the Lower Meghna River in the Chandpur area, divided into six broad categories. (Table 1). The main compositions of the nets were Polyamide monofilament, Polyamide multifilament, Polypropylene or nylon rope and Polyamide tier cord. It was observed throughout the research period that the majority of fishermen caught hilsa during the hilsa fishing season using chandi jal (drift gill net) though some chandi jal and most of the chandi current jal and gulti jal were used in year round for catching hilsa. This kind of net's length and breadth vary from 500 to

2000 meters with widths of 8.0 to 15.0 meters, 250 to 1000 meters with widths of 6.0 to 10.0 meters, and 400 to 1000 meters with widths of 15.0 to 30.0 meters for chandi, chandi current and gulti jal respectively. Mesh size of these nets' ranges from 9.0cm to 12.7cm, 3.5cm to 6.0cm and 3.0cm to 8.0cm for chandi, chandi current and gulti jal respectively. From table 1, maximum 10.0-12.0cm mesh sized chap jal, 2.5-4.5cm mesh sized poma jal, 1.2-1.5cm mesh sized chewa jal and 0.25-1.3cm mesh sized moi jal was used for selective catching of cat fish, poa fish, chewa fish and chingri respectively. On the other hand, it was also found that the fishers' of Lower Meghna river used 0.1- 0.3cm mesh sized chorghera jal, 0.0-6.0 mesh sized behundi jal, 1.0-1.5cm mesh sized ber jal and minimum 0.0 mesh sized katha ber jal for catching all type of fish species.

TABLE 1 Various fishing nets operated In the Chandpur area's Lower Meghna River

Type of net	Bangla vernacular name	Mesh size (cm)	Total length (m)	Total width (m)	Fisher man for operat ion	Materials used for making net	Operat ion period	Target species
Gill net	Chandi jal	9.0-12.7	500.0-2000.0	8.0-15.0	4.0-6.0	Polyamide multifilament	Year round	Hilsa
	Chandi current jal	3.5-6.0	250.0-1000.0	6.0-10.0	2.0-4.0	Polyamide monofilament	Year round	Hilsa
	Poma jal	2.5-4.5	300.0-550.0	1.0-3.0	4.0-8.0	Polyamide multifilament	Oct.-June	Poa
	Chewa/ Kajoli jal	1.2-1.5	200.0-400.0	1.0-2.0	2.0-3.0	Polyamide monofilament	Oct.-June	Chewa
Seine net	Katha ber jal	0	400.0-650.0	7.0-8.0	8.0-10.0	Polypropylene or nylon rope	Nov.-June	All types of fishes
	Ber jal	1.0-1.5	500.0-1000.0	8.0-12.0	8.0-10.0	Polyamide multifilament	Nov.-May	All types of fishes
Drag net	Moi jal	0.25-1.3	2.7-3.0	1.8-2.5	1.0	Polyamide tier cord	Nov.-May	Chingri
Set bag net	Behundi jal	0.0-6.0 (6.0/5.5/3.5/2.5 /1.0/0.0)	17.0-40.0	12.0-20.0	2.0	Polypropylene or nylon rope	Year round	All types of fishes
Barrier net	Chorghera jal	0.1-0.3	1000.0-1550.0	6.0-8.0	2.0-4.0	Polypropylene or nylon rope	Oct.-June	All types of fishes
Others	Chap jal	10.0-12.0	400.0-600.0	15.0-25.0	4.0-6.0	Poly amide tier cord	Nov.-June	Cat fish
	Gulti jal	3.0-8.0	400.0-1000.0	15.0-30.0	8.0-10.0	Poly amide tier cord	Year round	Hilsa

CPUE of Lower Meghna River fishing nets in Chandpur
Monthly variations of CPUE (kg/fisherman/day) of different fishing nets
The term "catch per unit effort" (CPUE) refers to the quantity of fish obtained for a certain amount of fishing effort; in this case, weight was taken into account in the calculation and description. Table 2 shows the capture per unit effort (daily catch in kg/fisherman) per nets at the sample locations of the Lower Meghna River in the Chandpur district. The maximum CPUE of gill nets were reported throughout the research period as 5.21±0.45 kg/fisherman/day, 4.49±0.37 kg/fisherman/day and 4.28±0.4 kg/fisherman/day in June, August and September, respectively. The highest CPUE recorded from small mesh sized seine net were 3.24±0.24 kg/fisherman/day, 3.21±0.22 kg/fisherman/day and 3.09±0.23 kg/fisherman/day in January, December and February, respectively. The catches of multi-meshed set bag net were found highest 7.87±0.74 kg/fisherman/day in February and lowest 6.47±0.92 kg/fisherman/day in June. The barrier net got the maximum CPUE 5.41±0.32 kg/fisherman/day in January, 3.79±0.47 kg/fisherman/day from others net in November and 3.09±0.15kg/fisherman/day from drag net in December. Whereas the lowest catches were recorded in June of 3.64±0.31 kg/fisherman/day and 0.94±0.16kg/fisherman/day from barrier net and drag net respectively

and lowest catch 1.51±0.08 kg/fisherman/day were also recorded from others net in July. There was a significant difference among the six groups of fishing gear used in Chandpur region (Figure 2) by using one-way analysis of variance, F (5, 255) = 21.906, p = 0.00, η^2 = 0.3. The post hoc testing revealed significant differences between pairs of the mean CPUE (kg/fisherman/day) of gill net (M =5.095, S = 2.83) with seine net (M = 2.832, S = 0.426), set bag net (M = 7.126, S = 0.812), drag net (M = 2.306, S = 0.921) and others net (M = 3.289, S = 0.652) from each other at the level of $p < 0.05$. No detectable change was seen between the mean CPUE (kg/fisherman/day) of gill net and barrier net (M = 4.685, S = 0.709), seine net with drag net and others net, and also the barrier net with the others nets in post hoc testing at the level of $p > 0.05$ (Figure 2).

TABLE 2 Month-wise mean CPUE (kg/fisherman/day) of different fishing nets operated inthe Lower Meghna River in Chandpur region

| Net name	Mean ±SD (CPUE) (kg/Fisherman/day)								
	Nov	Dec	Jan	Feb	May	June	July	Aug	Sep
Gill net	3.78±0.46	4.01±0.61	3.7±0.64	3.81±0.45	4.22±0.52	5.21±0.45	4.04±0.51	4.49±0.37	4.28±0.4
Seine net	2.7±0.19	3.21±0.22	3.24±0.24	3.09±0.23	2.62±0.22	2.28±0.23	0	0	0
Set bag net	7.1±0.94	6.87±0.54	7.31±0.84	7.87±0.74	7.18±0.84	6.47±0.92	0	0	0
Barrier net	5.15±0.33	5.29±0.22	5.41±0.32	4.24±0.32	4.38±0.27	3.64±0.31	0	0	0
Drag net	2.94±0.33	3.09±0.15	2.80±0.41	2.83±0.25	1.23±0.08	0.94±0.16	0	0	0
0thers	3.79±0.47	3.49±0.42	2.93±0.19	3.21±0.35	2.91±0.35	2.7±0.32	1.51±0.08	1.95±0.12	1.78±0.18
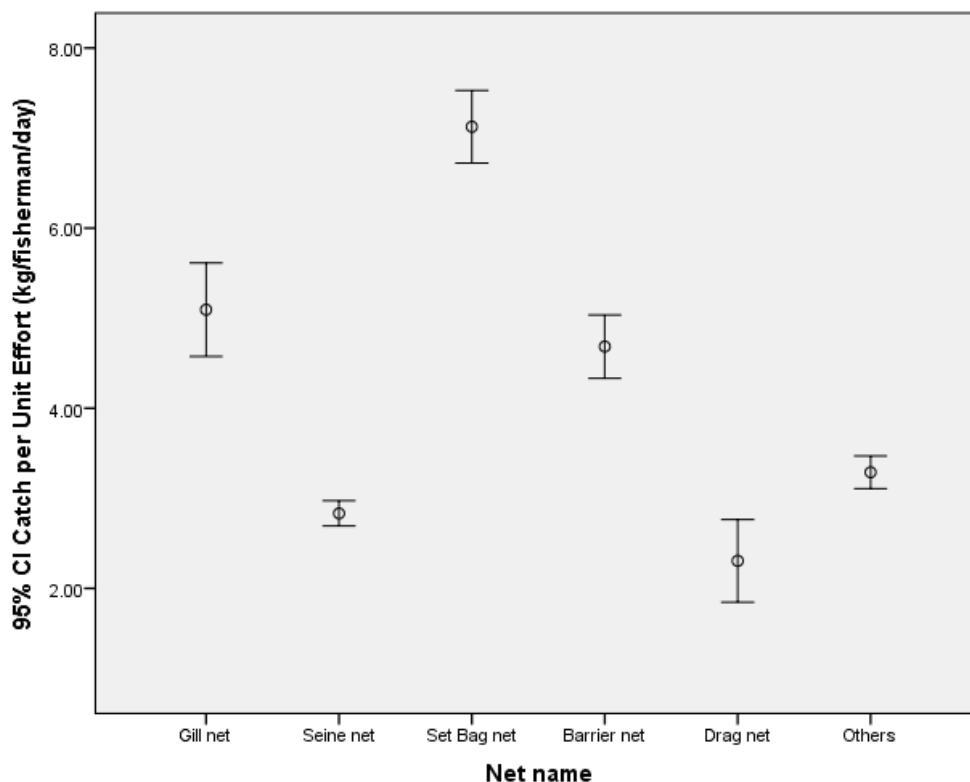
Figure 2 Mean CPUE (kg/fisherman/day) of different fishing nets operated in Lower Meghna River in Chandpur region

Seasonal variation impact on CPUE of different fishing nets operated in Chandpur region
Seasonally variations of CPUE were mentioned for the fishing nets in (Table 3). In long dry season the highest values of average CPUE were recorded 7.29±0.43 kg/fisherman/day from multi meshed set bag net followed by small meshed barrier net (5.02±0.53 kg/fisherman/day), others net (3.36±0.4 kg/fisherman/day), small meshed seine net (3.1±0.27 kg/fisherman/day) and drag net (2.92 ±0. 0.13 kg/fisherman/day). The highest values of average CPUE were recorded 6.83±0.5kg/fisherman/day from destructive multi meshed set bag net followed by 5.47±0.89 kg/fisherman/day, 4.01±0.52 kg/fisherman/day and 3.1±0.61 kg/fisherman/day in monsoon from gill net, barrier net and others net respectively. The average CPUE was higher in dry season (4.25±0.41 kg/fisherman/day) compare to the monsoon (3.83±0.5 kg/fisherman/day).

TABLE 3 Seasonal variation of CPUE (kg/fisherman/day) of different fishing nets in Chandpur region

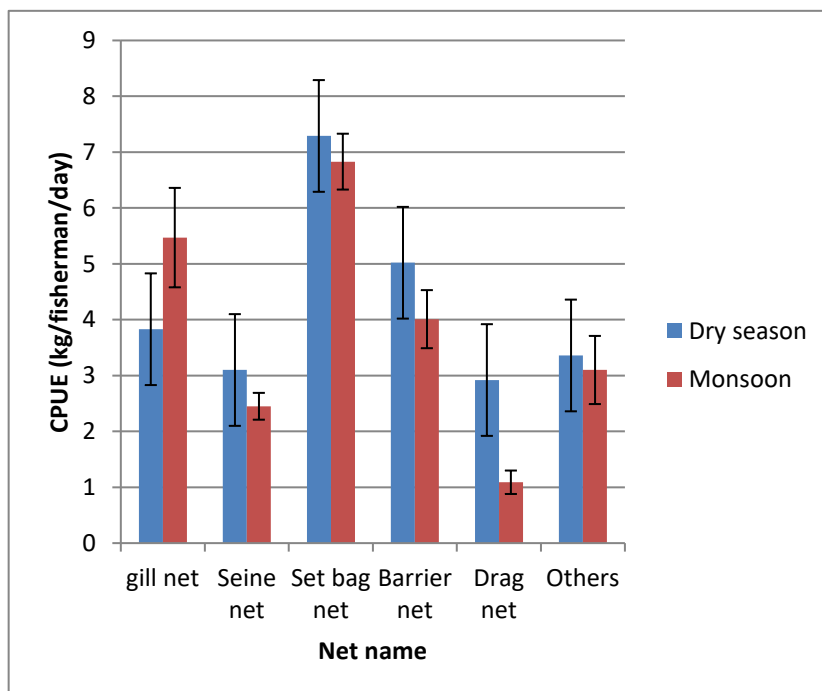| Type of net	Dry season	Monsoon
Gill net	3.83±0.71	5.47±0.89
Seine net	3.1±0.27	2.45±0.24
Set bag net	7.29±0.43	6.83±0.5
Barrier net	5.02±0.53	4.01±0.52
Drag net	2.92 ±0. 0.13	1.09 ±0.21
Others	3.36±0.4	3.1±0.61
Average	4.25±0.41	3.83±0.5

Figure 3 Seasonal average CPUE (kg/fisherman/day) of different fishing nets operated in Chandpur region

The catch composition of various fishing nets used in the Chandpur region's Lower Meghna River
In the period of the survey, fishermen in the Chandpur region's Lower Meghna River caught a total of 36 species of fish across 20 families and 8 orders (Table 4). The catches made with barrier nets had the highest number of species, with 32, followed by those made with set bag nets (25), seine nets (22), gill nets (13), others nets (11) and drag nets (8). The drag net had the fewest catches, with only eight, and was ranked last among the various types of nets (Table

4). Order-wise average catches composition (Table 5) of different fishing nets were consisted of Siluriformes (32.18%) followed by Perciformes (23.99%), Clupeiformes (18.31%), Decapoda (15.85%), Cypriniformes (7.73%), Cyprinodontiformes (0.83%), Tetraodontiformes (0.62%), and Syngnathiformes (0.48%). It was found that, during the study period the group of Siluriformes dominated over others groups of fishes in Lower Meghna River nearby the Chandpur region. The study also revealed most of the recorded fish species under 8 Order were caught by barrier net, set bag net and seine net among the nets (Figure 4). All size groups of fish like- small indigenous species to larger size of fishes and their spawn and fry were also caught by these nets, were harmful than those of others. The indiscriminating killing of these nets will be caused massive destruction of fish biodiversity of the river studied.

TABLE 4 Catch composition (kg/haul) by species reported from the catches of various fishing nets used in the Chandpur area

Order	Family	Fish species		Average catch composition (kg/haul)					
		Local name	Scientific name	Gill net	Seine net	Set bag net	Barrier net	Drag net	Others
Clupeiformes	Clupeidae	Ilish	Tenualosa ilisha	2.96	0.45	0.4	0.35	0	2.73
		Chapila	gudusia chapra	0	0.35	0.28	0.28	0	0
		Kaski	Corica soborna	0	1.2	0.28	0	0.003	0
Cypriniformes	Cyprinidae	Bata	Labeo bata	0	0.1	0.02	0.2	0	0
		Bhagna	Labeo boga	0	0.3	0.1	0.25	0	0
		Carp	Cyprinus sp.	0	0	0	1.5	0	0
		Chela	Salmostoma acinaces	0	0.18	0.16	0.23	0	0
		Punti	Puntious sp.	0	0.09	0.25	0.25	0.001	0
		Mola	Amblypharyngodon mola	0	0.15	0.18	0.16	0	0
		Dhela	Osteobrama cotio	0	0.1	0.06	0.14	0	0
		Sarpunti	Puntius sarana	0	0	0	0.38	0	0
Siluriformes	Bagridae	Tengra	Mystus vittatus	0.1	0.84	0.25	0.26	0	0
		Ayre	Mystus aor	0.75	0.48	0.4	0.66	0	1.95
		Rita	Rita rita	0.36	0.35	0	0.46	0	1.52
	Siluridae	Boal	Wallago attu	0	0	0	1.35	0	1.68
	Schilbeidae	Bacha	Eutropiichthys vacha	0.2	0.2	0.49	0.2	0	0.18
		Shilong	Silonia silondia	0.2	0.15	0.35	0.15	0	0.15
		Kajoli	Ailia coila	0.08	0	0	0	0	0
		Ghaura	Clupisoma garua	0.2	0.25	0.26	0.3	0	0
	Pangasiidae	Pangas	Pangasius pangasius	0	0	0.3	1.5	0	2.85
	Sisoridae	Baghayre	Bagarius bagarius	0	0	0	0.8	0	0
Cyprinodontiformes	Belonidae	Kakila	Xenentodon cancila	0	0.14	0.12	0.06	0.001	0
Syngnathiformes	Sygnathidae	Kumirer khil	Doryichthys cuncalus	0	0.12	0.06	0.07	0	0
Perciformes	Ambassidae	Chanda	Chanda nama	0	0	0	0.17	0.01	0
	Sillaginidae	Tular dandi	Sillaginopsis panijus	0.37	0	0.32	0.45	0	0.45
	Sciaenidae	Poa	Otolithoides pama	1.0	0.12	0.79	0.5	0	0.3
	Nandidae	Veda	Nandus nandus	0	0	0	0.62	0	0
	Mugilidae	Khorsula	Rhinomugil corsula	0	0	0.1	0	0	0
	Polynemidae	Taposi	Polynemus paradiseus	0	0	0.02	0	0	0
	Gobiidae	Gutum	Awaous gutum	0	0	0	0.26	0.002	0
		Bele	Glossogobius giuris	0.5	0.32	0.36	0.7	0.013	0.2
		Chewa	Pseudapocryptes lanceolatus	0.32	0.28	0.7	0.2	0.01	0
	Belontidae	Khalisha	Colisa fasciata	0	0	0	0.14	0	0
	Mastacembelidae	Salbaim	Mastacembelus armatus	0	0	0	0.4	0	0
Tetraodontiformes	Tetraodontidae	Potka	Tetraodon sp.	0	0.15	0.08	0.1	0	0
Decapoda	Palaemonidae	Chingri	Macrobrachium sp.	0.08	1.8	0.8	0.3	0.05	0.35

TABLE 5 Order-wise catch composition (%) from the catches of different fishing nets operated in Chandpur region

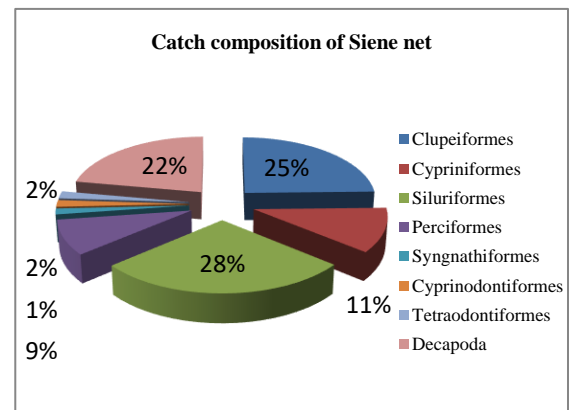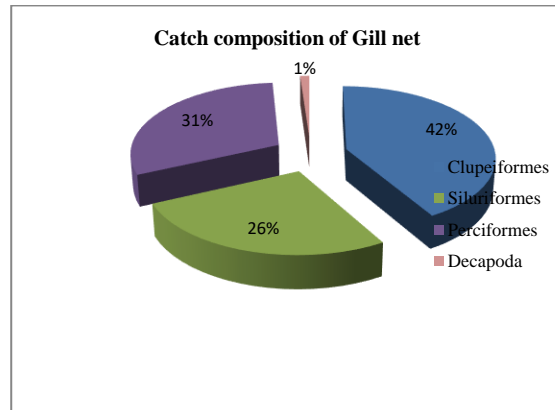| Fish Order	Gill net	Siene net	Set bag net	Barrier net	Drag net	Others	Average
Clupeiformes	41.6	24.64	13.47	4.71	3.33	22.09	18.31
Cypriniformes	0	11.25	10.8	23.23	1.11	0	7.73
Siluriformes	26.58	27.97	28.74	42.41	0	67.4	32.18
Perciformes	30.7	8.89	32.13	25.68	38.88	7.69	23.99
Syngnathiformes	0	1.5	0.84	0.52	0	0	0.48
Cyprinodontiformes	0	1.72	1.7	0.45	1.11	0	0.83
Tetraodontiformes	0	1.85	1.12	0.75	0	0	0.62
Decapoda	1.12	22.17	11.2	2.24	55.55	2.83	15.85
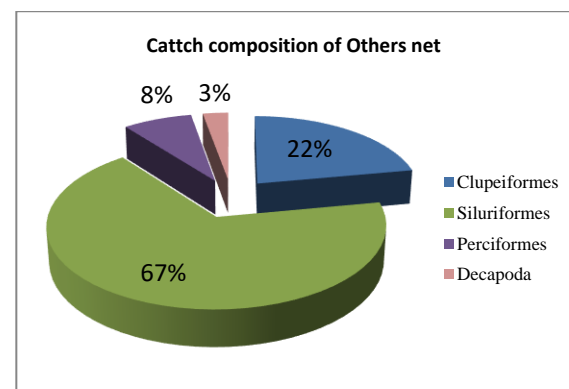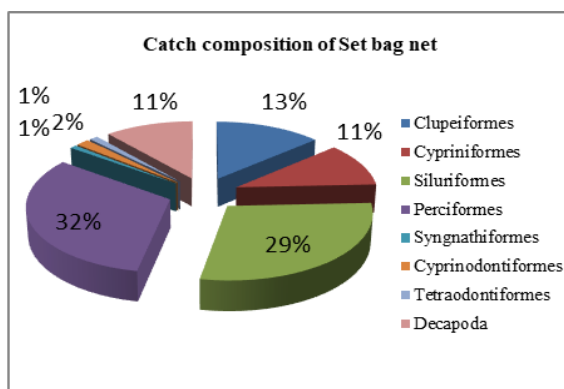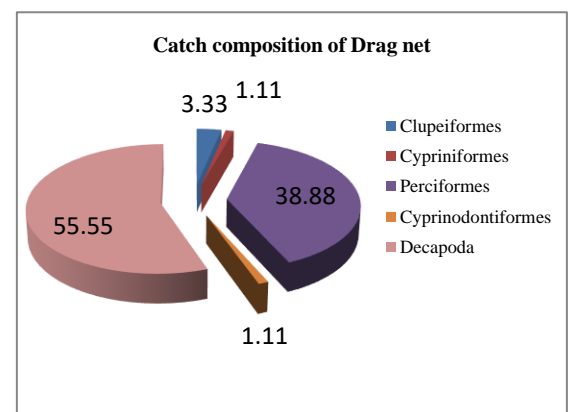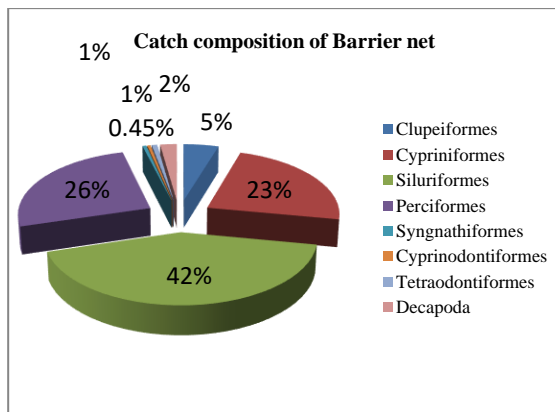
Figure 4 Order wise composition of the catches from various fishing nets, including the gill net, catch composition of siene net, catch composition of set bag net, catch composition of barrier net, catch composition of drag net, and catch composition of others net.

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Discussion
Fishing nets
The investigation found that a wide range of fishing nets was used all year round in the Chandpur district of the Lower Meghna River. While some of the nets were species-specific, others recorded the several species that were captured during the operation, demonstrating the multispecies aspect of the fishery (Table 1). According to reports, the same amount of fishing nets were seen near Lohalia (Ali et al., 2014) river and sixteen types of nets under seven major groups were found in operation in Upper and Lower Meghna river and in Padma river (Hasan *et al.*, 2014). Mondal et al. (2013) observed 8 different varieties of fishing nets, which is almost identical to Mia (2009)'s results that 6 different types of nets were used near the Meghna River at Ashuganj. In 2005, Kibria and Ahmed discussed the enormous diversity of traditional fishing gear used by both subsistence and commercial fishermen in Bangladesh's inland waterways, as well as their effects on the environment and fisheries. They discussed two different kinds of fish traps, seven different types of fishing nets from two different groups, and two different fishing methods. On the Agunmukha River, a total of 19 various types of fishing equipment were found, grouped into nine major categories (Rahman et al., 2017); in the Ramnabad River, eight major categories of fishing gear, including gill nets, seine nets, set bag nets, lift nets, cast nets, push nets, traps, and hook and lines, were observed (Ali et al., 2015) where the results of fishing nets are almost identical to those of the current investigation. Though there were some regulation on the mesh size of fishing nets but the fishers' are not interested to follow this. They used multidimensional fishing nets for fishing (Table 1). According to reports, Hilsa fishermen often utilized gill nets with a mesh size of 5 to 14 cm (Chantarasri, 1994). Siddique et al. claim that the 2013 chandi jal operated in the Megna River has an element size of 4 to 4.5 cm, a length of 650 to 700 meters, as well as a width of 10 to 12 meters, which is closest to the results of the current research. The size of the nets' mesh varies mostly according to the kind of fish that are being caught, the body of water, and the seasons. The findings of Siddique et al. (2013), who reported mesh sizes of 3.5 cm for poa jal, 0.5 to 2.3 cm for jagat ber jal, and 0.5 to 1.25 cm for behundi jal in the Meghna River estuary, were also validated by the results of this research. However, the Lohalia (Ali et al., 2014) and Tista (Khan et al., 2013) rivers also have the highest concentrations of fishing gear. However, fewer fishing equipment were identified in Dogger Beel and the Shitalakshya River (Siddiq et al., 2013). (Miah et al., 2010).

Catches per unit effort (CPUE) of different fishing nets operated in the Lower Meghna River in Chandpur region
Monthly variations of CPUE (kg/fisherman/day) of different fishing nets
The fishers' of Lower Meghna River used maximum types of Gill net for hilsa fishing from June to October in each year. Because within this time hilsa, the largest single fish species of Bangladesh come to the fresh water of Lower Meghna River estuary for spawning purposes (Rahman *et. al*, 2017). The study revealed the highest CPUE (kg/fisherman/day) of gill net within this time (Table 2). According to Mondal et al., 2013, the average CPUE for chandi jal (gill net) was 25.5 kg/unit/day. This was determined when each and every boat was counted as one unit within the research region. There were four fishermen on each boat in Lower Meghna estuary at Ramgati Upazilla under Lakshmipur District, which is the nearest similar result to the present study. The low water level in the river may be to blame for the fact that the dry season had the greatest CPUE (kg/fisherman/day) of tiny mesh-sized seine nets, barrier nets, and drag nets, as well as multi-meshes set bag nets, and also from other nets. The dry season lasted from November to February. The majority of these fishing nets were used for fishing during the dry season (November–June), and the CPUE of these nets was at its lowest

during the months of June and July (Table 2). The closest result was reported by Rahman et al., 2016 on CPUE of different gears. They discovered that the current jal (gill net) had the greatest CPUE in the kajal river (5-8 kg), while the moia jal (drag net) had the lowest CPUE (0.01-.06 kg) in Patuakhali district and Panchan *et al.*, 2013 found the average CPUE throughout the study was 2.1±0.4 kg/ fisherman/ day in Chi river in Thailand. The seining net had the greatest catch per unit effort (CPUE) in the beel fishery (39.20 kg/ gear/hour) during the month of January as disruptive fishing gear, while the gill net had the lowest catch per unit effort (0.83 kg/ gear/hour) in the Hakaluki haor area (Rahman et al., 2016). Sayeed et al., 2014 also found that the mean CPUE from gillnets, seine nets, and moi jal (drag nets) in the Chalan beel was 2.83 0.93 kg, 48.99 12.34 kg, and 3.03 1.76 kg, respectively. The finding that is most comparable to this one was reported by Hossain in 1998, who discovered that the Old Brahmaputra River had the greatest CPUE for nets, which was 2.75 kg/gear/day.

Seasonal variations of CPUE of different fishing nets
Among the six groups of fishing nets the highest values of average CPUE (kg/fisherman/day) were recorded from most of the nets in long dry season (Table 3) and It could be caused by the Chandpur area's Lower Meghna River's low water level. Similar result observed in the Prek Toal Core Area by Lindmark, 2016 and found the higher CPUE by weight in the low water season than in the high water season, which agreed with Fischer *et al.*, 2014. Similar to this research, Paighambari et al. (2018) observed that the CPUE (kg/100 hooks) during the spring season was higher (2.82 0.55 kg/100 hooks) than that for the winter (1.60 0.41 kg/100 hooks). Ghosh et al. (2017) and Saberin et al. (2018) partially concurred with the findings of the current study and discovered that CPUE was lower in an oxbow lake ecosystem during monsoon and post-monsoon seasons than during pre-monsoon seasons, while CPUE was highest and lowest for all types of gears and nets in the Old Brahmaputra River during the dry season in January, with 1.49 kg/gear and 2.44 kg/gear. During the study, only gill net has found the highest CPUE (kg/fisherman/day) in monsoon than the dry season. This may happen due to the highest abundance of hilsa fishery in Lower Meghna River in monsoon because a lot of hilsa flocks come to the Lower Meghna River for their spawning purpose (Rahman *et al.,*2017) and caught by the hilsa fishers′. Similar findings were made by Coulibaly et al. in 2018, who discovered that medium-mesh gill nets produced the maximum CPUE (11.12 kg/trip) over the prolonged wet season. According to Queirolo et al. (2009), the capture rate of the southern hake was higher in March (619.6 g per hook) and lower in September (234.3 g per hook), and these differences were statistically significant ($P < 0.05$).

The Lower Meghna River in the Chandpur area's fishing nets' catch composition In the Lower Meghna of Ramgoti upazila, the neighbor district of Laxmipur, Mondal et al., 2013, observed 16 species of fish caught by various types of fishing gear, which is in good accordance with Mia, 2009, who represented 20 species of fish in the Meghna River at Ashuganj Upazilla, but was less similar to the outcome of the current research. According to Pramanik et alresearch .'s from 2017, researchers found a total of 107 different species of fish in the Meghna river. These fish belonged to 13 different orders and 36 different families (Upper and lower Meghna). It may be due to most of the bigger sized cat fishes were caught in Chandpur region by using chap jal (Table 1) and during the study period the fish sampling was done in weight basis for analysis of catch composition. In the Karatoa River, Rabbani (2007) counted a total of 22 species of fish, among them the choto chingri. While Hossain, 1998 reported 19 species of fish in the ancient Brahmputra River in the captures of the gear, which is less comparable with the current research, Shahjahan et al. 2003 recorded 25 species of fish, included shrimp, in the Jamuna River. The Kajol River (Rahman et al., 2016) documented forty-one (41) ichthyospecies belonging to eleven (11) orders, twenty-four (24) families, and thirty-four (34)

genera. It was found that, during the study period the group of Siluriformes dominated over others groups of fishes in Lower Meghna nearby the Chandpur region. Although Perciformes was determined to be the most prevalent order in the whole (Upper and Lower Meghna) Meghna River, Pramanik et al. 2017 indicated that this order only made up 32% of the overall fish population. However, according to Rahman et al. (2016), in Hakaloki Haor, Siluriformes is the second-highest order after Cypriniformes, followed by Perciformes, Synbranchiformes, Osteoglossiformes, Clupeiformes, and Beloniformes.

AUTHOR CONTRIBUTIONS
T.A., Z.H., and M.M.R. developed the research idea and defined the analysis; T.A. collected the data from research sites; T.A. and M.M.R. analyzed the data; Z.H. supervised the study; T.A. generated the data and wrote the manuscript with significant contributions from all coauthors.

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