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Gears specific Catch Per Unit Effort (CPUE) with special reference to declining causes of ichthyofauna in the Kajal River of Southern Bangladesh

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Abstract

The Kajal River is a coastal water body, having vast aquatic biota which situated at Rangabali upazila under Southern district of Patuakhali in Bangladesh. Different types of fishing gears have been operated in the river to capture aquatic resources especially fishes which were investigated by employing participatory rural appraisal (PRA) such as focus groups (FGD), key informant interviews (KIA) with fisher's community fishing in the river for a period of 8 months from March 2015 to October 2015. A total of fifteen (15) fishing gears under seven (7) major groups of net were identified. Estimated CPUE of various gears was found highest (5-8 kg) for Current jal and lowest (0.01-.06 kg) for Moia jal. In total, forty three (43) species were recorded belongs to eleven (11) orders, twenty four (24) families and thirty four (34) genera in the catches of different gears. Among the 43 species, 20, 13, 4 and 6 were to be found as available, less available, rare and very rare, respectively. A total of seven (7) vulnerable, two (2) endangered and two (2) critically endangered species were obtained out of 43 species. But these numbers are increasing day by day due to both natural and manmade causes. Therefore, necessary measures should be taken to conserve the species from near extinction.

Keywords: Conservation, CPUE, Extinction, Fishing gears, Fisheries biodiversity, Mesh size, Kajal River.

1. Introduction

Bangladesh, the world largest deltaic region, lies in the northeastern part of South Asia, is exceptionally endowed with a vast variety of flora and fauna due to its unique geophysical location (Nishat *et al.* 2002) ^[1]. The pride of Bangladesh is its rivers with one of the largest networks in the world which is the habitat of at least 265 freshwater fish species (Rahman 2005) ^[2]. Being a country of rivers and floodplain with a high potential of aquatic resources, fish plays a very important role in daily life of many people in Bangladesh. Fish alone donates 60% animal protein intake (DoF 2015) ^[3] which solves malnutrition related problem. Coastal fisheries are one of the major contributors to inland fish production in Bangladesh. Numbers of coastal water bodies are prominent in Southern region of which Kajal River is the most imperative, located at Rangabali upazila under Patuakhali district. A small piece of land rise from river beds in Rangabali upazila labeled as Char Kajal from which the river is characterized as Kajal River. The river has many distributaries which serve as the migration route of migratory species of fishes especially hilsa as well as the place of other important species. So fishing is a common practice in terms of livelihood and nutrition ingestion for fisher's community around the coast of the river. Numbers of scientific based investigation has been held on various aspects of fishes on different water bodies ^[7-18, 20-22] throughout the country. But no attempt has yet been identified on fishing gears and fish folk diversity of Kajal River to make acquainted the existing fisheries resource with potential impacts and declining causes of fish species. Diverse stresses like natural calamities, excess harvesting, agricultural runoff, siltation and different restricted fishing gears have been operated on fishes in very detrimental ways which reach the fish under threat. Biodiversity and its conservation are treated as one of the major issues of enabling sustainable use of natural resources. Therefore, it is necessary to carry out scientific based work on available fishing gears including their mesh size, catch per unit effort (CPUE), fisheries biodiversity, conservation status of available

fishes, breeding seasons and some potential impacts responsible for reducing fish fauna to represent a baseline data to shelter the fisheries diversity to near extinction of the river. Considering all the current issues, the objectives of the study addressed to identify fishing gears with their mesh size, fishing effort, CPUE, catch per day, fisheries biodiversity, conservation status, breeding seasons and the major causes of extinction of fish fauna of the Kajal River at Patuakhali district in Bangladesh.

2. Materials and Method

2.1 Sampling site

The present study site i.e., Kajal River, located at Rangabali upazila under Southern district of Patuakhali in Bangladesh (Figure 1). The upazila falls in between 21 °46' and 22 °05'N latitudes and 91 °15' and 90 °37'E longitudes and bounded by Amtali and Galachipa upazilas on the north, Bay of Bengal on the south, Galachipa and Char fasson upazilas on the east, Amtali upazila on the west. The sampling was carried out fortnightly i.e., twice in a month for a period of 8 months from March 2015 to October 2015.

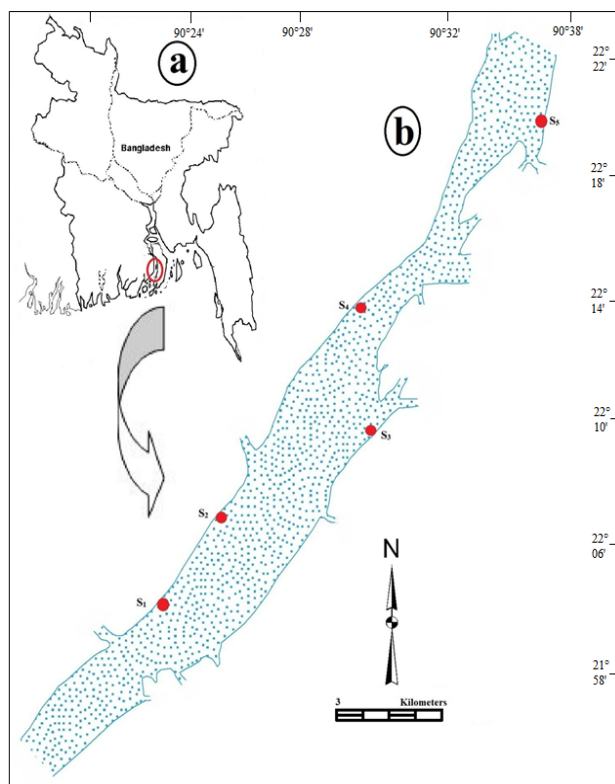


Fig 1: Geographical location of study area; (a) map of Bangladesh and (b) map of Kajal River with five sampling stations (S₁, S₂, S₃, S₄ and S₅ manifested as red rounded)

2.2 Methodology

The fishing gears were surveyed based on participatory rural appraisal (PRA) such as focus groups discussion (FGD), social mapping and cross checking key informant interviews (KIA) with fisher's community fishing in the river. The mesh size of the gears was estimated using a centimeter scale (CRESCENT, Made in China). The fishing gears were categorized under different major groups followed by Ahmed (1971) [4]. Freshly

caught unsorted samples of different gears were weighted by digital balance and pan balance to know the catch composition and finally expressed in kg.

For the study of fisheries biodiversity of Kajal River 10 fishermen were hired temporarily (two from each station) and samples were collected mainly from badha jal, current jal, jagat ber jal and moia jal as well as others gear available in the present study area. Fish samples were also collected from the local fish landing centers and fish markets from previously contacted fishermen.

For laboratory study, 30% of the total catch was taken in each sampling day, covering all the representatives and preserved in 10% buffered formalin solution in leveled plastic jars according to size and species. In the laboratory, the collected specimens were identified to species level with the help of standard taxonomic keys of Talwar and Jhingran 1991 [5], Nelson 1994 [6], Rahman 2005 [2] and Hossain *et al.* 2007 [7].

2.3 Analysis of findings

For the analysis of present findings statistical analyses were carried out using Microsoft Excel 2007 and Statistical Packages for Social Sciences (SPSS) version 16.0.

3. Results and Discussion

3.1 Fishing gears

Generally fishing gear is one kind of equipment which used for harvesting of aquatic resources especially fish. (Rahman *et al.* 2015) [8]. From the survey, overall fifteen (15) fishing gears have been explored which belonged to 7 major groups of net such as gill nets (punti jal, poa jal, current jal and cheua jal), seine net (jagat ber jal), fixed purse nets (badha jal and char jal), cast nets (jhaki jal), push nets (moia jal and thela jal), traps (temai, anta and polo) and hook and line (chhara barshi and chhip barshi).

However, same numbers of fishing gears were also observed from Lohalia (Ali *et al.* 2014) [9], Meghna river (Siddique *et al.* 2013) [10] and Tista river (Khan *et al.* 2013) [11]. But lower numbers of fishing gears were recorded from Dogger Beel (Siddiq *et al.* 2013) [12] and Shitalakshya river (Miah *et al.* 2010) [13].

Mesh size of the nets are changed mostly depending on targeted fish species as well as water body and also seasons. From table 1, maximum (5.08-7.62 cm) and minimum (0.508 cm) mesh size was found in case of current jal and moia jal under the group of gill net and push net, respectively. Similar result related to mesh of gears also reported from others studied (Siddique *et al.* 2013, Rahman *et al.* 2014) [10, 8].

Figure 2 represents catch per day of respective fishing gears of Kajal River. From the figure highest catch composition was found for current jal was 13 kg/day followed by Jagat ber jal (12.5 kg/day) and badha jal (11.5 kg). The catch composition of punti jal, poa jal, cheua jal, char jal, jhaki jal, moia jal and thela jal was 1.5 kg/day, 5.5 kg/day, 2.25 kg/ day, 6 kg/ day, 5.5 kg/day, 0.5 kg/ day and 2.75 kg/day, respectively. The lower catch composition was measured for temari trap (0.37 kg/day). Sayeed *et al.* (2014) [14] also observed the mean CPUE from gillnet, jhakijal, seine net, thela jal, lift net, traps, wounding gears, moijal, hook and line and sutijal was 2.83 ± 0.92, 2.05 ± 0.81, 48.99 ± 12.34, 2.60 ± 1.56, 2.66 ± 1.46, 4.69 ± 2.11, 1.83 ± 1.07, 3.03 ± 1.76, 3.11 ± 1.76 and 224.54 ± 126.89 kg, respectively in the Chalan beel.

Table 1: Illustration of available fishing gears with their mesh size, fishing effort, catch composition and major species caught from Kajal River

Gear types	Local name*	Mesh size (Cm)**	Fishing effort/ day	CPUE*** (kg/ effort)	Catch/ day		Major species caught****
					(kg/day)	Mean	
Gill net	<i>Punti jal</i>	1.27-2.2	2	0.5-1	1-2	1.5	<i>Punti, Tengra, Khailsa</i>
	<i>Poa jal</i>	3.048-5.08	2-3	1-3	2-9	5.5	<i>Poma, Koi, Ayr</i>
	<i>Current jal</i>	5.08-7.62	2	5-8	10-16	13	<i>Ilish, Koral, Boal, Ayr</i>
	<i>Cheua jal</i>	1.27-2.2	1-2	0.5-2	0.5-4	2.25	<i>Cheua, Punti, Bele, Tengra</i>
Seine net	<i>Jagat ber jal</i>	0.508-1.27	1-2	5-10	5-20	12.5	All species
Fixed purse nets	<i>Badha jal</i>	2.54-3.81	2-3	4-5	8-15	11.5	All species
	<i>Chaar jal</i>	0.508-1.02	1-2	2-5	2-10	6	All species
Cast nets	<i>Jhaki jal</i>	0.508-1.02	30-40	0.1-0.2	3-8	5.5	<i>Punti, Mola, Kachki, Cheua, Potka, Taki</i>
Push nets	<i>Moia jal</i>	0.508	10-15	0.01-.06	0.1-0.9	0.5	Fish fries and fingerlings
	<i>Thela jal</i>	0.508-1.02	40-50	0.05-0.1	1.5-4	2.75	<i>Mola, Kachki, Punti, Tengra, Khalisha, Darkina</i>
Traps	<i>Temai</i>	-	2	0.12-0.25	0.24-0.5	0.37	All small species
	<i>Anta</i>	-	2-3	0.2-0.5	0.4-1.5	1.9	All small species
	<i>Polo</i>	-	50-100	0.01-0.02	0.5-2.0	1.25	<i>Taki, Boal, Shol</i>
Hook and line	<i>Chhara Barshi</i>	-	1-2	0.5-1.5	0.5-3	1.75	<i>Taki, Shol, Boal, Koi</i>
	<i>Chhip Barshi</i>	-	15-30	0.03-0.05	0.45-1.5	1.95	<i>Koral, Boal, Shol, Gozar</i>

*Jal= Fishing net, **Cm= Centimeter, ***CPUE= Catch per Unit Effort, ****Local name of fish

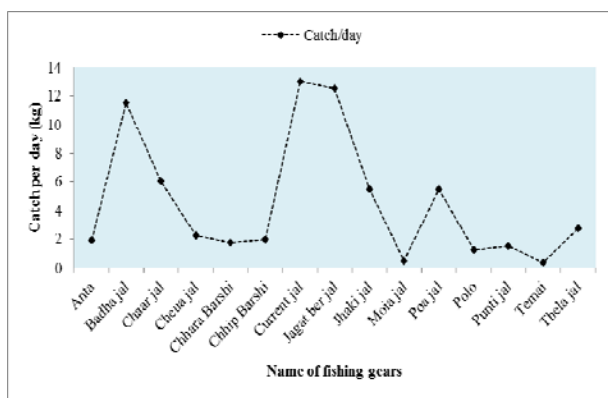


Fig 2: Representation of catch composition per day by respective fishing gears

3.2 Fisheries assemblages

Forty one (41) ichthyospecies belonging to 11 orders, 24 families and 34 genera have been recorded in the Kajal River which presented with their scientific name; common name and occurrence status (table 2 and table 3). Among the different fish orders, Beloniformes, Myliobatiformes, Pleuronectiformes, Synbranchiformes and Tetraodontiformes contains only one species (for each) belonging to single genera and family. Clupeiformes have 3 species with 3 genera under Clupeidae family; Cypriniformes includes 8 species belonging to 6 genera under 2 families; Osteoglossiformes contains 2 species under 1 genera and 1 family; Perciformes was represented by 13 species belonging to 12 genera under 9 families; Siluriformes contributes 7 species having 5 genera of 4 families; Decapoda by 5 species under 2 genera of 2 families. Higher number of fishes were listed by different workers (Islam *et al.* 2015, Chakraborty *et al.* 2007, Mohsin *et al.* 2014, Rahman *et al.* 2015) [15-18] from different water bodies of the country. But lower number of species were also observed (Miah *et al.* 2010, Ehshan *et al.* 2007) [13, 18]. Breeding seasons were also studied in the fishes of Padma river (Hossain *et al.* 2005) [7].

Figure 3 illustrates the availability of fish species identified of Kajal River. From the figure, 20 species were found as available, 12 less available, 4 rare and 6 species very rare. Islam *et al.* (2015) [15] documented 50 species were available,

34 species less available, 21 species rare and 9 species were very rare from Payra River.

A total of 54 native freshwater fish species of Bangladesh have been declared as threatened species by IUCN, Bangladesh (2000) [19]. Among them, 11 species were identified as threatened from Kajal River. Figure 4 represents threatened fin fish species in the present study area. Out of 37 species of fin fishes 7, 2 and 2 species were belonged to vulnerable, endangered and critically endangered, respectively recorded from Kajal River. However, Mohsin *et al.* (2014) [17] detected 2 critically endangered, 3 endangered and 5 vulnerable fish species from Andharmanik River. Galib *et al.* (2013) [20] also recorded 10 vulnerable, 10 endangered and 6 critically endangered species from river Choto Jamuna. Chandra (2009) [21] identified 11 vulnerable, 26 endangered and 10 critically endangered from Mymensingh which was much higher than present finding. Threatened species are increasing day by day in every river. Kajal River is not beyond them. These are mostly occurred due to both natural and manmade causes.

Natural causes of fish declination are

- Natural calamities like flood during rainy season which affects water quality parameters and destroying brood fishes.
- Siltation, that cause reduction of water flow which resulted reduction of nursery and spawning ground
- Changes in river course

Manmade causes are

- The non-stationary gears like jagat ber jal, jhaki jal and moia jal towed over the sediment during fishing which can reduce habitat complexity may lead to changes in the associated fish assemblages and perturb benthic communities.
- The direct physical contact of fishing gears with the substratum can lead to the re-suspension and fragmentation of sediments and biogenic substrata. The re-suspension, transport and subsequent deposition of sediment may affect the settlement and feeding of the biota. Sediment re-suspended as a result of bottom fishing will have a variety of effects including: releasing

nutrients held in the sediment, exposure of anoxic layers, release of contaminants, increasing biological oxygen demand and smothering of feeding and respiratory organs.

- Stationary gears especially gill nets cause ghost fishing if the net is being lost. The mesh of gill nets could become entangled on bottom features and cause damage upon retrieval.
- Water pollution from domestic activities, pesticide and agriculture wastage destroy the feeding, breeding and nursery ground of fishes and indiscriminate use of fishing gear.

The findings were supported by (Rahman *et al.* 1999 Rahman 2015 *et al.*) [22, 8]. Impacts of fishing from gears also reported by other studied from different part of the world (Sainsbury 1997, Auster and Langton 1998; Jennings and Kaiser 1998; Kaiser 1998; Mugetti *et al.* 2004) [23-27] which was similar of present findings.

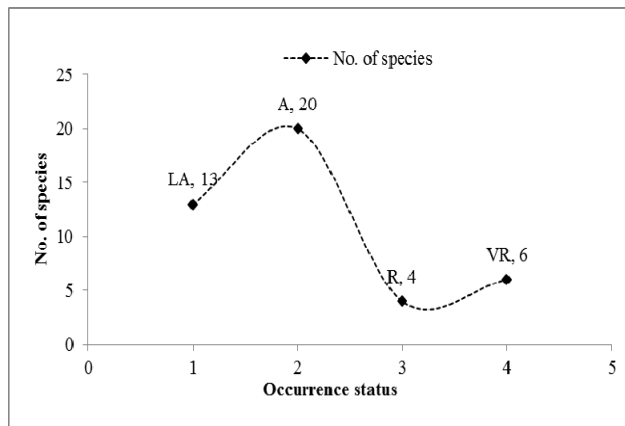


Fig 3: Occurrence status of recorded ichthyospecies from Kajal River

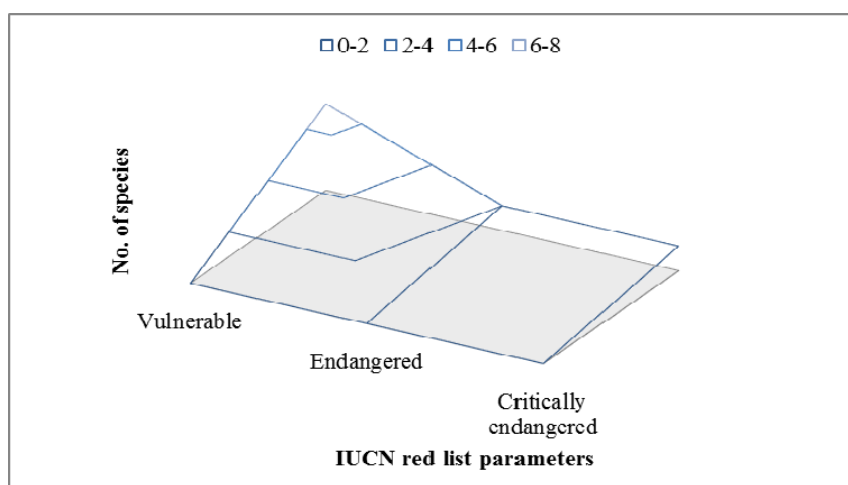


Fig 4: Threatened fish species according to IUCN (2000) obtained from Kajal River

Table 2: Systematic position of finfish species with their common name, occurrence status and breeding seasons recorded from Kajal River

Family	Common name	Scientific name	Status	Breeding seasons
Order 1: Beloniformes (1 species)				
Belontiidae	Freshwater garfish	Xenentodon cancila	LA	April-July
Order 2: Clupeiformes (3 species)				
Clupeidae	Hilsa shad	Tenulosa ilisha	A	Sep-Oct
	Ganges river sprat	Corica soborna	A	March-Oct
	Indian river shad	Gudusia chapra	A	May-Aug
Order 3: Cypriniformes (8 species)				
Cobitidae	Guntea loach	Lepidocephalichthys guntea	LA	April-July
Cyprinidae	Spot fin swamp barb	Puntius sophore	A	April-Nov
	Ticto barb	Puntius ticto*	LA	April-Aug
	Olive barb	Puntius sarana***	R	April-July
	Flying barb	Esomus danricus	A	NK
	Aspidoparia	Aspidoparia morar	LA	NK
	Cunma osteobrama	Osteobrama cotio	LA	April- July
	Mola carplet	Amblypharyngodon mola	LA	April-Nov
Order 4: Myliobatiformes (1 species)				
Dasyatidae	Bleeker's whipray	Himantura bleekeri	VR	NK
Order 5: Osteoglossiformes (2 species)				
Notopteridae	Humped featherback	Notopterus chitala**	VR	April-July
	Grey featherback	Notopterus notopterus*	R	May-July
Order 6: Perciformes (13 species)				
Ambassidae	Elongate glassy perchlet	Chanda nama*	VR	March-Oct
Anabantidae	Climbing perch	Anabas testudineus	LA	April-July
Channidae	Spotted snakehead	Channa punctatus	A	April-July
	Snakehead murrel	Channa striatus	LA	April-July

Gobiidae	Tank goby	Glossogobius giuris	A	June – July
	Gobi	Apocryptes bato	A	NK
	Eel goby	Odontamblyopus rubicundus	A	NK
Latidae	Sea bass	Lates Lalarifer	LA	Feb-June
Nandidae	Mottled Nandus	Nandus nandus*	VR	March-Oct
Osphronemidae	Banded gourami	Colisa fasciatus	A	June- Oct
Polynemidae	Paradise threadfin	Polynemus paradiseus	R	NK
Sciaenidae	Croakers pama	Otolithoides pama	A	NK
	Panna croaker	Panna microdon	LA	NK
Order 7: Pleuronectiformes (1 species)				
Cynoglossidae	Bengal tongue sole	Cynoglossus cynoglossus	A	NK
Order 8: Siluriformes (7 species)				
Bagridae	Striped River Catfish	Mystus vittatus	LA	April-July
	Long- catfish	Mystus aor*	LA	Monsoon
	Tengra catfish	Mystus tengara	A	April-July
Pangasiidae	Yellowtail catfish	Pangasius pangasius***	VR	NK
Schilbeidae	Jamuna ailia	Ailia punctata*	A	May-July
Siluridae	Freshwater Shark	Wallago attu	LA	May- Aug
	Pabdha catfish	Ompok pabda**	VR	April- Aug
Order 9: Synbranchiformes (1 species)				
Synbranchidae	Swamp eel	Monopterus cuchia*	R	Mar- June
Order 10: Tetraodontiformes (1 species)				
Tetraodontidae	Green puffer fish	Tetraodon fluviatilis	A	Monsoon

As per IUCN Bangladesh (2000) conservation status: ***Critically Endangered, **Endangered, *Vulnerable; A= Available, LA= Less Available, R= Rare, VR= Very Rare; NK= Not Known; Sep-September, Oct-October, Aug- August, Feb- February

Table 3: Systematic position of shellfish species with their common name and occurrence status recorded from Kajal River

Family	Common name	Scientific name	Status
Order 11: Decapoda (5 species)			
Palaemonidae	Fresh water prawn	Macrobrachium rosenbergii	A
	Monsoon river prawn	Macrobrachium malcolmsonii	A
	River prawn	Macrobrachium rude	A
	Riceland prawn	Macrobrachium lanchesteri	A
Portunidae	Mud crab	Scylla serrata	A

A= Available

4. Conclusion

A lack of understanding about the ecological consequences of the effects of removals of fish, and the direct effects of fishing and fishing gear on community and ecosystem functions has produced questions about the sustainability of current levels of fishing. The fish of Kajal River are under threat due to excessive fishing pressure exerted from overfishing activities by the subsistence and artisanal fishermen causes destruction of habitat, feeding, spawning grounds and nursing grounds. This study is a preliminary attempt to know about different fishing gears, ichthyospecies and causes of reduction of aquatic fauna of Kajal River. Therefore, fishing should be banned during breeding seasons by local authority and government as well as fisheries research institution. Gears should be constructed depending on target fish species and by-catch should be avoided. Overall public awareness should be increased through training program to conserve the ecosystem of these valuable fish species from near extinction.

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