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Present status of fish diversity in the Beel Kumari in relation to fish sanctuary and fishing gears

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Abstract

The study was conducted on Beel Kumari *beel* (wetland) in Rajshahi, Bangladesh from October 2013 to September 2014. A total of 52 species of fish were recorded and the dominant species was *Mystus tengara (Tanagra* (9.75%). Exotic species like bighead carp (*Aristichthys nobilis*), silver carp (*Hypophthalmichthys molitrix)* and common carp (*Cyprinus carpio*) were also commonly found. Of the indigenous species, *Ompok bimaculatus, Puntius sarana, Pseudeutropius atherinoides, Botia dario, Mystus aor* and *Chitala chitala* were abundant, though these species were rare before the establishment of the fish sanctuary. Four groups of fishing gears i.e. net, trap, spear and harpoons and line fishing were found to use, among them 8 types of net, 7 types of trap, 4 types of spear and harpoon and 4 types of line fishing were recorded. Among these gill net contributed to the highest catch (32%) and push net was the lowest (6%). Most of the respondents (80%) were found to believe that their fish catch had increased considerably due to impact of fish sanctuary establishment and effective community based fisheries management approach employed in this *beel*.

Keywords: Beel Kumari; fish sanctuary; fish diversity; fishing gears; protection and restoration; conservation

INTRODUCTION

The *beel* is a Bengali term used for relatively large surface, static water body that accumulates surface run-off water through an internal drainage channel (Banglapedia 2006). The total area of *beel* in Bangladesh was estimated to be 114,161 ha, occupying 27.0% of the inland freshwater (Ahmed *et al.* 2007). Approximately 260 species of freshwater fishes, 24 species of prawns, 50 species of reptiles, 24 species of mammals are found in Bangladesh (Rahman 1989). According to IUCN Bangladesh (2000) 12 species are Critically Endangered, 28 are Endangered and 14 are Vulnerable. Fisheries is the second largest export earning sector which contributes to GDP about 3.69% and to foreign exchange earning about 2.01% and this sector provides the country with about 60% of animal protein intake (DoF 2015). Bangladesh has been able to secure fourth position in inland open water capture fisheries and fifth position in culture fisheries respectively (FAO 2014). Most inland fisheries in the developing world are heavily exploited. As a result, freshwater fisheries resources has declined during the past 30 years. This decline has had significant negative impacts on fish biodiversity and the fishing community (Jenkins 2003). The *beel* fishery of Bangladesh is being deteriorated day by day due to over fishing, indiscriminate use of chemical fertilizer and insecticides, destruction of natural breeding and feeding grounds, harvesting of wild brood fishes and for many other reasons (Azher *et al.* 2007). Thus poor fishers' livelihoods have been adversely affected due to

the gradual reduction of fish production from open water bodies. In order to prevent the declining trend and ensure sustainability of fish biodiversity and production from inland open water, various measures for protection, conservation and management of fisheries resources have been adopted time to time. The Beel Kumari, which is largely connected with the Shib River, is the most important *beel* in Tanore Upazila of Rajshahi district. However, this water body is facing severe water scarcity during dry season which led to reduction of fish production. To overcome these problems some interventions like Community Based Fisheries Management (CBFM) approach, construction of 200 feet long cause-away at the downstream in order to maintain optimal water depth and establishment of two permanent fish sanctuaries under the supervision of Department of Fisheries (DoF) were taken. The present study was undertaken with a view to determining the fish availability in relation to fish sanctuary established in the *beel*.

METHODOLOGY

Study area: The study was conducted from October, 2013 to September, 2014. Sample were collected from three locations of the Beel Kumari namely Gollapar Ghat (24°35N 88°34'E), Gokul Ghat (24°37'N 88°35'E) and Shitalipara Ghat (24°35'N 88°34'E) (Figure 1).

Figure 1: Location of the Beel Kumari

Sampling framework: Monthly data were collected from three selected sampling sites using seine net (mesh size 0.5 cm) , cast net (mesh size 1cm) and lift net (mesh size 0.5cm). Sampling was carried out between 7 AM and 8 AM. Species wise weight was taken to estimate the weight basis percentage contribution in the daily total catch. Both qualitative and quantitative data were collected from 100 respondents (80 fishermen or beneficiaries and 20 local people; selected through random sampling). For this study, questionnaire interview and Focus Group Discussion (FGD) were employed. Collected data were validated through discussion with concern Upazila Fisheries Office (UFO) of Tanore Upazila.

Fish species collection and identification: Specimens of collected fish were identified based on the morphometric and meristics characters following Rahman (1989 and 2005) and Talwar and Jhingran (1991). Identified fish species were classified based on classification system of Nelson (2006). Conservation status and population trend of fish species were determined using update list of IUCN (2015) and IUCN Bangladesh (2000).

Analysis of data: Simple descriptive analysis and graphical presentation of data were carried out using Microsoft Excel (version 2007).

RESULTS AND DISCUSSION

Fish biodiversity: A total of 52 (43 native fish species and 9 exotic fish species) specie were identified in the Beel Kumari (Table 1). Among 52 fish species, 20 were belonging to the family Cyprinidae followed by Channidae (4 species) and Ambassidae, Cobitidae, Bagridae and Mastacembelidae (each with 3 species). However, Haque *et al.* (2010) recorded a total of 37 fish species including small prawn in the catches of different gears from the Beel Kumari. In the studied beel, the availability some alien species like Bighead carp (*Aristichthys nobilis*) and Common carp (*Cyprinus carpio*) was on the rising trend because of yearly fry release and implementation of Beel nursery project by DoF. Some native species (*Ompok bimaculatus, Puntius sarana, Chitala chitala, Pseudeutropius atherinoides, Botia dario, Mystus aor* etc.) had declined noticeably and appeared to be rare due to lack of sufficient water in dry season and over fishing. However, these species have been found to be revived (Table 2) because of establishing two fish sanctuaries at the deepest portion of the *beel* which have positively impacted on the restoration of these species through providing suitable breeding environment. In addition, the cause-way built at downstream contributed to maintaining optimal depth for prolonged period around the sanctuary which also served as supporting factor for fish diversity. The study revealed that community based management approach of sanctuary under Beel Kumari Fishermen Cooperative Society appeared to be effective for fish diversity enhancement which led to increase in number and amount of various fish species. MACH (2006), reported almost similar outcomes in Hail Haor of Moulovibazar district where some conservation measures such as excavation, seasonal ban on fishing, restricting fishing by dewatering, and control of destructive fishing.

Status and catch composition of fish fauna

The number of recorded fish species from Kumari Beel was similar to various *beels* (MACH 2006; Mustafa *et al.* 2014) and slightly lower than the Chalan Beel (Galib *et al.* 2009a), Dahia Beel (Flowra *et al.* 2009), Halti Beel (Imteazzaman and Galib 2013), Brahmaputra River (Galib 2015) and Mahananda River (Galib *et al.* 2016).

Table 1: Percentage of weight basis catch composition (%) of different fish species in the Beel Kumari

SL No.	Local Name	Scientific Name	Conservation status		Population trend		Contribution percentage (%)
			Global*	Local**	Global*	Local**	
Native fish Species							
Beloniformes							
Belonidae (Needle fishes)							
1	Kakila	*Xenentodon cancila*	LC	NO	UN	DE	1.78
Clupeiformes							
Clupeidae							
2	Kaski	*Corica soborna*	NE	NO	ST	DE	0.25
Cypriniformes							
Cobitidae							
3	Poia	*Somileptus gongota*	NE	NO	NE	DE	0.07
4	Puiya	*Lepidocephalus guntea*	LC	NO	UN	DE	0.05
5	Rani	*Botia dario*	LC	EN	UN	DE	0.45
Cyprinidae							
6	Punti	*Puntius sophore*	LC	NO	UN	ST	1.24
7	Raikor	*Cirrhinus reba*	LC	VU	ST	ST	1.60
8	Kalibaus	*Labeo calbasu*	LC	EN	UN	DE	0.87
9	Catla	*Catla catla*	LC	NO	UN	DE	0.95
10	Chela	*Salmostoma phula*	LC	NO	ST	DE	0.38
11	Rui	*Labeo rohita*	LC	NO	UN	DE	0.35
12	Sarpunti	*Puntius sarana*	LC	CR	UN	DE	6.00
13	Bata	*Labeo bata*	LC	EN	UN	DE	0.64
14	Mrigel	*Cirrhinus mrigala*	VU	NO	DE	ST	0.67
15	Dhela	*Rohtee cotio*	LC	EN	UN	DE	0.30
16	Mola	*Amblypharyngodon mola*	LC	NO	ST	ST	1.58
Rasborinae							
17	Darkina	*Esomus danricus*	NE	NO	ST	ST	1.86
Siluriformes							
Bagridae							
18	Ayre	*Mystus aor*	LC	VU	ST	ST	7.50
19	Gulsha	*Mystus cavasius*	LC	VU	DE	ST	1.28
20	Tengra	*Mystus tengara*	LC	NO	UN	IN	9.75
Claridae							
21	Magur	*Clarius batrachus*	LC	NO	UN	DE	1.25
Heteropneustidae							
22	Shing	*Heteropneustes fossilis*	LC	NO	ST	ST	1.74
Schilbeidae							
23	Baspata	*Ailia coil*	TH	NO	DE	DE	0.25
24	Batasi	*Pseudeutropius atherinoides*	LC	NO	UN	DE	0.30
Siluridae							
25	Pabda	*Ompok pabda*	NT	EN	DE	ST	3.25
26	Boal	*Wallago attu*	NT	NO	DE	ST	4.50
Osteoglossiformes							
Osteoglossidae							
27	Foli	*Notopterus notopterus*	LC	VU	UN	ST	0.60
28	Chital	*Notopterus chitala*	NT	EN	DE	DE	0.05

Table 1: Continued

SL No.	Local Name	Scientific Name	Conservation status		Population trend		Contribution percentage (%)
			Global*	Local**	Global*	Local**	
Perciformes							
Ambassidae							
29	Chanda	*Chanda nama*	LC	VU	DE	DE	5.50
30	Lal chanda	*Chanda ranga*	LC	VU	ST	DE	0.35
31	Chanda	*Chanda lala*	NT	NE	DE	DE	1.15
Anabantidae							
32	Koi	*Anabas testudineus*	DD	NO	UN	ST	1.70
Channidae							
33	Shol	*Channa striatus*	LC	NO	UN	ST	0.56
34	Taki	*Channa punctatus*	LC	NO	UN	IN	3.25
35	Chang	*Channa orientalies*	LC	VU	ST	ST	2.74
36	Gojar	*Channa marulius*	LC	EN	DE	ST	0.04
Gobidae							
37	Bele	*Glossogobius giuris*	LC	NO	UN	DE	1.25
Mastacembelidae							
38	Guchi	*Mastacembelus armatus*	LC	EN	UN	DE	8.50
39	Guchi, baim	*Mastacembelus pancalus*	LC	NO	UN	ST	3.24
40	Tara baim	*Macrognathus aculeatus*	NE	NE	NE	DE	3.75
Notopteridae							
41	Lal khalisha	*Colisa lalius*	LC	NO	UN	DE	0.14
42	Khalisha	*Colisa fasciatus*	LC	NO	UN	DE	0.75
Tetradontiformes							
Tetradontidae							
43	Potka	*Tetraodon cutcutio*	LC	NO	UN	DE	0.08
Exotic Fish Species							
44	Bighead carp	*Aristichthys nobilis*	-	-	-	-	7.25
45	Scale carp	*Cyprinus carpio communis*	-	-	-	-	6.75
46	Grass carp	*Ctenopharyngodon idella*	-	-	-	-	0.25
47	Mirror carp	*Cyprinus carpio specularis*	-	-	-	-	1.66
48	Nilotica	*Oreochromis niloticus*	-	-	-	-	0.43
49	Pangus	Pangasius sutchi	-	-	-	-	0.03
50	Thai Punti	*Puntius gonionotus*	-	-	-	-	0.34
51	Silver carp	*Hypophthalmichthys molitrix*	-	-	-	-	0.58
52	Tilapia	*Oreochromis mossambicus*	-	-	-	-	0.20

*Based on IUCN (2015); **Based on IUCN Bangladesh (2000)

Conservation Status: *NE, Not Evaluated; CR, Critically Endangered; EN, Endangered; LC, Least Concern; DD, Data Deficient; NO, Not Threatened; NT, Near Threatened; EN, Endangered; VU, Vulnerable.*

Population Trend: *DE, Decreasing; ST, Stable; UN, Unknown.*

Most of the respondent (82%) mentioned that the fish species was decreasing day by day before establishing the fish sanctuary. But during the study period, 33.33% of the observed fish species were in stable condition after the establishment of sanctuary. Fishermen also assumed that if government takes necessary measures to ensure effective management, Kumari Beel will get back its previous abundance of fish species within very short time.

The most abundant fish species in the Beel Kumari fish Sanctuary was Tengra (*Mystus tengara,* 9.75%; Table 1). Analysis also revealed that 10 species contributed 62.8% of the total catch. Haque *et al*. (2007) observed that 43 species with the highest availability of a loach-*Psilorhynchus sucatio* and a catfish, tengra- *M. vittatus* in the three fish sanctuaries established under CBFM-2 project in three rivers namely Updakhali, the Kalihar and the Kangsha in Netrokona district using bamboo and tree branches as sanctuary materials. Mostafa *et al.* (2009) found the most abundant fish species during the 2 year study period were punti (*Puntius sophore* and *P. ticto*), followed by chanda (*Chanda nama* and *Parambassis ranga*), chapila (*Gudusia garua*) and tengra (*M. vittatus*).

A number of endangered fishes of Bangladesh were found in the Beel Kumari fish sanctuary in 2014. The notable

were *Chitala chitala* (chital), *Ompok bimaculatus* (pabda), *Botia dario* (rani), *Labeo calbasu* (kalibaus) and critically endangered fish like *Pseudeutropius atherinoides* (batasi). The availability of these fish was high in the sanctuary due to the food abundance, favorable breeding shelter, rearing facility and hazardless environment. FFP (2005) reported that after establishment of sanctuaries, 23 fish and some prawn species including some endangered species have increased their population in the command area of the project.

Table 2: Fish species revived and their status after sanctuary establishment

Local name	*Scientific name*	*IUCN (2000) status*	*Current status **
Pabda	*Ompok bimaculatus*	Endangered	Common
Sarputi	*Puntius sarana*	Critically Endangered	Common
Chital	*Chitala chitala*	Endangered	Common
Batasi	*Pseudeutropius atherinoides*	Critically Endangered	Common
Rani	*Botia dario*	Endangered	Abundant
Ayre	*Mystus aor*	Endangered	Abundant

**Assessment based on local fishers' perceptions*

Fish production trend: The fish production data collected from Upazila Fisheries Office showed that in 2008 fish production was 120 metric ton which gradually increased to 138 metric ton in 2013 due to the positive impact of permanent fish sanctuary in augmenting fish production as well as in fish diversity restoration (Figure 2). During study period, 60 % of the respondents indicated that this sanctuary is very effective in regards to increasing fish biodiversity, 30% responded that it is effective in regards to increasing fish catch, and only 10% responded that the sanctuary was effective in regards to both increasing fish catch and improving fish biodiversity. No one responded that the sanctuary was ineffective in achieving these outcomes. Haque (2013) reported 47.5% responded to increasing fish biodiversity, 35% responded to increasing fish catch and 17.5% responded to increasing both fish catch and fish biodiversity due to establishment of fish sanctuary.

Fishing gears and traps used in the Beel Kumari

During the study, different gears were found to be used varying from season to season based on species selection. Various types of traps were also noticed in different areas of the studied *beel*.

Nets: In the study period, 8 different types of nets (Ber Jal, Puti jal, Phash jal, Khepla jal, Thela jal, Veshal jal, Tana jal and Path jal were found to be used in the beel Kumari. Among these nets Current jal (Puti jal and Phash jal), Vhesal jal, Khara jal, Ber jal, Moi jal, etc, are extensively noticeable. All types of nets were not being used for fishing in all season. Different mesh sizes of nets were common for the different size of fishes. The fresh water fishing gears and crafts of traditional types are being used for a long time without any modification (Haque *et al.* 2010). Rahman *et al.* (1999) reported that fishing gear operating in the three flood plains (Chanda, BSKB and Haiti Beel) comprised four groups such as fish net (7 types, 20 sub-types), fish trap (5 types, 14 sub-types) hook and line (5 types) and spear harpoon (4 types).

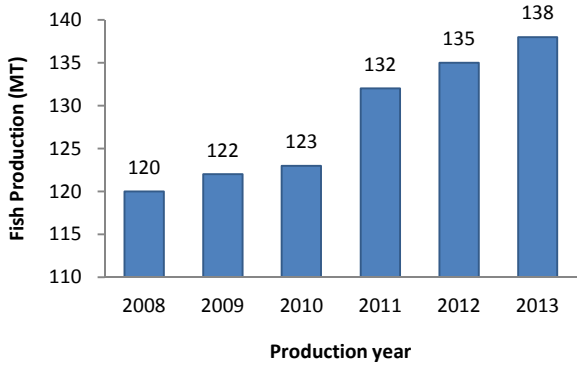

Figure 3: Annual fish production trend in the Beel Kumari

Traps: During the study, 7 types of traps (Khadum, Kholsun, Chaloon, Polo, Bitti, Bhair, and Bana) used in the study area of which Kholsun, Chaloon, Polo, Bitti, Bhair and Bana were commonly found. Bhair was used to catch large size of fishes and on the other hand, Bitti, Charo are used to catch small to medium size of fishes. Bana is used as the barricade. The big sized cat fishes *(Wallago attu)* were generally caught by hook and line. The smaller fishes were bagged by dip nets and cast nets. The gill dragnets were more efficient gears in low weed infested *beels* during the winter season. Traps, chiefly made of split bamboo, are extensively used for catching fish in *beels* (Jhingran 1991). Haque *et al.* (2010) identified 16 types of fishing gears where 4 types of traps were recorded in Beel Kumari. Using of fishing traps was found to increase due to availability of indigenous fish species because of positive impact of fish sanctuary establishment.

Line fishing: During the study period 4 types of hook and line (Bollah barshi, Chip barsi, Pata barsi and wheel barsi) were found to use by the fishermen in the Beel Kumari. Metallic hooks of various shape and size were found to use for this purpose. Chip barsi, Pata barsi, wheel barsi were extensively used. Bait (dead or live) was used for line fishing. Bait of earthworm, gura chingri was mostly used in the study area.

Spears and harpoons (wounding/ shooting gears): In capturing purpose of fishes, spears and harpoons were found to be used in the Beel Kumari. Usually large sizes of fishes like *Channa marulius*, *Channa striatus*, *Notopterus chitala*, *Notopterus notopterus*, *Wallago attu* etc. were caught by using spears and harpoons. There were 4 different types of spears and harpoon used for fishing purpose. Haque *et al.* (2010) recorded 3 types of hooks or line and 3 types of wounding gears were commonly used in Beel Kumari.

Other means of fishing

A. De-watering: In the month April to June the water level of the Beel Kumari was found to decrease sharply. People would make bundh (temporary barrier) with mud across the Shib River when it became narrow. After de-watering inside the bundh, all the fishes along with brood fish were found to harvest. The methods of de-watering were mainly of two types-

i) Manual de-watering: Manual de-watering is generally done in a small water area. In this purpose usually different pots tied with rope were found to use. Two men operated this tin pot. After de-watering fishes were collected by hand.

ii) Mechanical de-watering: Mechanical de-watering was done in a comparatively deep and large water area of the Beel Kumari. In this case a shallow water pump machine was used for dewatering. The water was shifted to other side of the bundh. After dewatering the remaining fishes were collected by hands. As no fishes were found to be left for next year breeding in complete dewatering, it makes tremendous adverse impact on fish diversity.

B. Katha fishing: 'Katha' fishing, though prohibited according to fisheries regulation, was also found in the Beel Kumari. In the area where water stands at least 5 to 6 ft. deepth with the area of 10 to 250 ft. long, branches of different trees are placed to protect the fish of that area as well as to provide them a habitable place. The branches of tress or split bamboo were used to prepare 'Katha' which remained surrounded by 'Badai jal' made of nylon fibre. Some feeds like mustard oil cake, rice, cooked rice, wheat bran etc. were found to apply in order that the fishes get attracted and take shelter in 'Khata' area. Fishing in 'Katha' was done after 40 to 60 days. Usually a group of poor fishermen were involved in the katha and they usually got half of the total catch. The other half of the catch was taken by the 'Mohajan' who lends money for establishing 'Katha'.

Gear efficiency: Use of different fishing gears and traps serves as a rough indicator of the availability of different fish species. Some gear is species-selective such as gill nets, traps, hook and lines, and long lines. After assessing the efficiency of each type of gear it was observed that gill nets (32%) resulted in the highest catch during the study period, while fish traps (23%) produced the second highest catch (Figure 4).

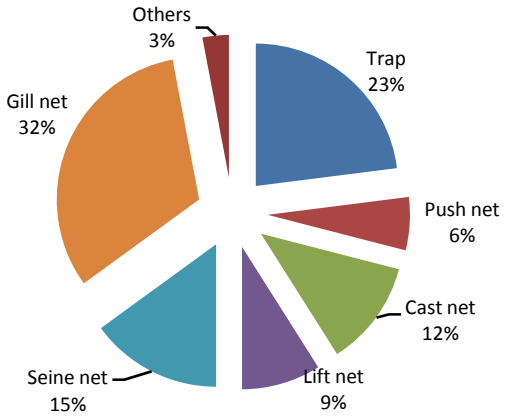

Figure 4: Proportion of catches by different gear types in Beel Kumari

The use of various types of gill nets and traps in the breeding season was excessive in Beel Kumari and was very harmful to both fish fry and small indigenous species. Similar findings are very common in Bangladesh (Galib *et al.* 2009b, Imteazzaman and Galib 2013). Haque (2013) reported highest catch by gill nets (36%) and second highest catch by fish traps (28%) in the Hail Haor area.

CONCLUSION

Beel Kumari having permanent fish sanctuary is an ideal example of fisheries resource management in effective manner, particularly Community Based Fisheries Management Approach, which contributes immensely in restoring fisheries diversity facilitating an increasing trend of fish production. As this resource management model has proved to be effective, the approach can be introduced in other potential *beel* of Bangladesh which may bring about positive changes in production trend as well as promotion of conservation of fisheries diversity.

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