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FISH DIVERSITY OF CHALAN *BEEL* IN RELATION TO FISH SANCTUARY

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Abstract

The impact of a fish sanctuary on fisheries diversity was studied for two years in Chalan Beel, Tarash Upazila, Sirajganj district, where the sanctuary was established at the end of the first year. Seine net (Berjal) was used to collect data on a monthly basis. There were 42 species recorded from 8 orders and 18 families, including two exotic species, *Cyprinus carpiro* and *Oreochromis mossambicus*. *Puntius puntio* was the most common species (18.38%), followed by *Colisa fasciata* (9.73%) and *Chanda nama* (9.28%). The order Cypriniformes (16 species) was discovered to be the dominant order, accounting for 47.78% of the total order, followed by Perciformes (22.85%) and Siluriformes (21.40%). The Shannon-Weaver diversity index (H) ranged between 2.26 and 2.66. The average value was higher (2.53) after the sanctuary was established than before (2.39). The impact of the fish sanctuary may have resulted in an increase in the biodiversity index and total catch. As a result, sanctuary establishment can be expanded to address the gradual improvement of fisheries diversity.

Key words: Chalan *beel*, Fish diversity, Percent composition, Sanctuary, Shannon- Weaver diversity

Introduction

Chalan *beel* is the largest wetland situated in northern region of Bangladesh comprising three districts Sirajganj, Natore and Pabna. The *beel* consists of some 93 smaller internal *beel*s, covering a total area of 9164 ha during the rainy season, and 2227 ha in the dry season. Some 25 of the large *beel*s (>10ha) cover 69% of the total *beel* area, while 76% (±1.97%) is seasonal. This seasonal *beel* is mostly dried out during the dry season. Hossain et al. (2009) reported gradual habitat degradation and overexploitation resulting in a loss of biodiversity and a decreased trend of aquatic production in Chalan *beel*. Azher et al. (2007) also mentioned overfishing, indiscriminate use of chemicals, and destruction of natural feeding and breeding ground of fishes as vital cause for biodiversity loss. To improve this situation several suggestions were made, and setting up of sanctuary was one of them which was recommended by Akhtaruzzaman and Alam (2014); Hossain et al. (2009); Galib et al. (2009); and Joadder et al. (2016); Sultana et al. (2019). Fish sanctuaries have been shown to be good way to protect the variety of fish in a water body and in some cases, to keep the habitat from being destroyed (Siddique et al. 2020). In view of this, a total of 40 fish sanctuaries were established in different parts of Chalan *Beel* by the department of fisheries (DoF) from 2006-2007 to 2016-2017 fiscal years. Biodiversity of different *beel* including Chalan *beel* have been reported by Galib et al (2009); Hossain et al. (2009); Kamrujjaman and Halder (2022); Joadder et al. (2016) and many others. Studies regarding impact of sanctuary are relatively less. Joadder et al. (2016) stated effect of sanctuary on biodiversity in *beel* Kumari, and Siddique et al. (2020) in Halti *beel*. So, the present study was undertaken to assess the biodiversity status by comparing species composition, biodiversity index and total catch before and after the establishment of the sanctuary at Tarash upazila of Sirajganj district.

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Methodology

The present study was conducted in Chalan *Beel* at Tarash upazila of Sirajganj district for periods of two years (January - October 2020 to January - October 2021) (Fig. 1). After the first year a fish sanctuary of 0.8 ha was set up at Makorson in Soguna union. Monthly data of one haul were collected throughout the study period using seine net (local name: berjal). The hauling time was 30min and catch of one haul was considered for analysis.

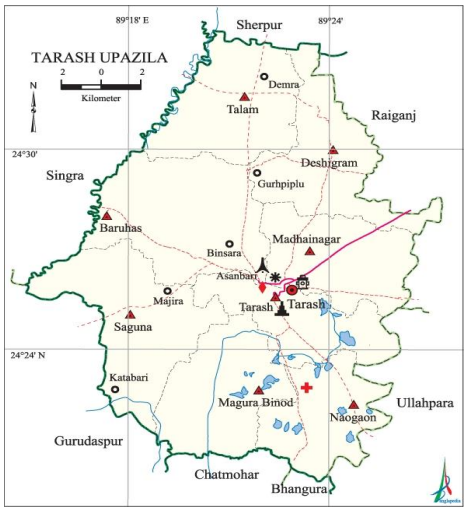

Fig. 1: Map of Tarash upazila showing the study area ( ), Source: Banglapedia.

Captured fish specimens were identified following Talwar and Jhingran (1991); and Rahman (2005), Fish diversity index and species composition were estimated to compare the impact of sanctuary.

Percent composition of species (A)

A = (Total number of individuals of species A/total individuals)*100

Shannon- Weaver diversity index (H)

H= -∑Pi LnPi (Shannon and Weaver, 1949)

Here, H is the diversity index and Pi is the relative abundance (s/N).

All the data were analyzed with the help of computer program Microsoft Excel.

Result and Discussion

Fisheries diversity in the study area

A total of 42 species, comprising 7 order and 18 families (Table 1), including two exotic species, were recorded during the study period. Khanom et al. (2018) found a total of 28 fish species including 2 exotic species from Uthrail *beel* of Naogaon district; and Kamrujjaman and Halder (2022) reported 34 species form Bahadurpur *beel* of Madaripur district which were lower than the present study. On the other hand, more or less similar findings were reported by Karim et al. (2020) as 38 fish species in Saldu *beel* of Tangail; Rahman

et al. (2019) as 38 fish species including 3 exotics from Basuakhali *beel* of Khulna; and Saha and Hossain (2002) as 40 in Chalan *Beel* from Pabna district of Bangladesh. However, 52 fish species were recorded by Ahmed et al. (2004) in Shakla *beel* of Brahmanbaria district. Galib et al. (2009) noted 81 fish species including 9 exotic species from Chalan *Beel*. Sixty three fish species including 8 exotic were reported from Halti *Beel* in the Natore district by Imteazzaman and Galib (2013). Siddiq et al. (2013) observed 58 species from Dogger *beel* of Chandpur. Akhtaruzzaman and Alam (2014) identified 62 fish species from Ichanoi *beel* of Gaibandha district. Siddique et al. (2016) identified 78 fish species including 9 exotic from four sampling sites of Chalan *beel*. Joadder et al. (2016) found 52 fish species from Kumari *beel* of Rajshahi. Sultana et al. (2019) reported 56 fish species from Bhawal *beel* of Mymensingh. Majumdar et al. (2020) reported 51 fish species from Chinadi *beel* in Narsingdi District each of which was much higher than the present outcomes. This may be due to alternate land use for agricultural purposes leading to increasing use of pesticides and inorganic fertilizers, shrinkage of water area in the dry season and fishing by complete dry out of the water body. Gradual fish habitat destruction resulting in lower diversity has also been reported in by Kamrujjaman and Halder (2022).

Puntius puntio was the most abundant (18.38%) species; followed by *Colisa fasciatus* (9.73%), *Chanda nama* (9.28%) and *Amblypharyngodon mola* (8.59%); and 10 species contributed 76.45% of the total catch in the present study. *Mystus tengera* was reported as most abundant species as well as 10 species constituted 62.8% of the total catch in *Beel* Kumari (Joadder et al. 2016); *Puntius sophore* and *Puntius ticto* followed by *Chanda nama* were the abundant in Chalan *Beel* (Mostafa et al. 2009).

Table 1: Fish diversity of study area along with percentage of total catch

Order	Family	Scientific name	% Com. of species		% Com. of order	
			1st Year	2nd Year	1st Year	2nd Year
Cypriniformes	Cyprinidae	*Labeo rohita*	0.49	0.93	46.51	49.04
		Catla Catla	0.26	0.39		
		Cirrhinus cirrhosis	0.91	1.23		
		Cyprinus carpio	0.52	0.49		
		H. molitrix	0.18	0.64		
		H. nobilis	0.16	0.20		
		Labeo calbasu	0.26	0.29		
		Labeo bata	3.17	2.75		
		Esomus danricus	4.91	4.44		
		Amblypharyngodon mola	7.88	9.30		
		Puntius puntio	17.11	19.65		
		Salmostoma bacilla	4.76	4.15		
		Cirrhinus reba	5.90	4.34		
		Tor tor	0.00	0.05		
	Cobitidae	*Lepocephalus guntea*	0.08	0.07		
		Botia dario	0.08	0.12		

Contd. (Table 1)

Siluriformes	Bagridae	*Mystus cavasius*	4.86	4.59	21.98	20.81
		Mystus tengra	8.01	7.56		
	Sisoridae	*Gagata cenia*	2.52	2.38		
		Bagarius bagarius	0.03	0.02		
	Schilbeidae	*Pangasius pangasius*	0.03	0.02		
		P. atherinoides	3.82	3.61		
		Eutropiichthys vacha	0.21	0.20		
	Siluridae	*Wallaga attu*	0.03	0.02		
		Ompok pabda	2.39	2.26		
	Heteropneustidae	*Heteropneustes fossilis*	0.08	0.15		
Perciformes	Cichlidae	*O. mossambicus*	1.33	1.25	23.61	22.08
	Anabantidae	*Colisa fasciatus*	9.88	9.57		
		Anabas testudineus	0.05	0.25		
	Ambassidae	*Chanda nama*	10.19	8.37		
	Mastacembelidae	*Mastacembelus armatus*	00	0.02		
		Mastacembelus pancalus	0.13	0.15		
	Gobidae	*Awaous grammepomus*	2.03	2.40		
	Nandidae	*Nandus nandus*	00	0.07		
Clupeiformes	Clupeidae	*Corica soborna*	3.15	2.65	4.79	4.17
		Gudusia chapra	1.64	1.52		
Channiformes	Channidae	*Channa punctatus*	0.36	1.13	0.54	1.3
		Channa striatas	0.18	0.17		
Beloniformes	Belonidae	*Xenentodon cancila*	0.08	0.07	0.08	0.07
Synbranchiformes	Synbranchidae	*Monopterus cuchia*	0.03	0.03	0.03	0.03
Decapoda	Palaemonidae	*Macrobrachium malcomsonii*	2.31	2.21	2.42	2.6

Diversity of order

During the study, Cypriniformes was revealed as dominant order comprising 47.78% of the total order followed by Perciformes (22.85%), Siluriformes (21.40%), Clupeiformes (4.48%), and rest of the four orders shared 3.54%. Cypriniformes was the most diversified order having 16 species followed by Siluriformes (10) and Clupeiformes (8) as presented in Fig. 2. A similar trend of most abundant first three order has been reported in Bahadurpur *beel* (Kamrujjaman and Haldar, 2022); Basukhali *beel* (Rahman et al. 2019); and Chalan *beel* (Siddique et al. 2016).

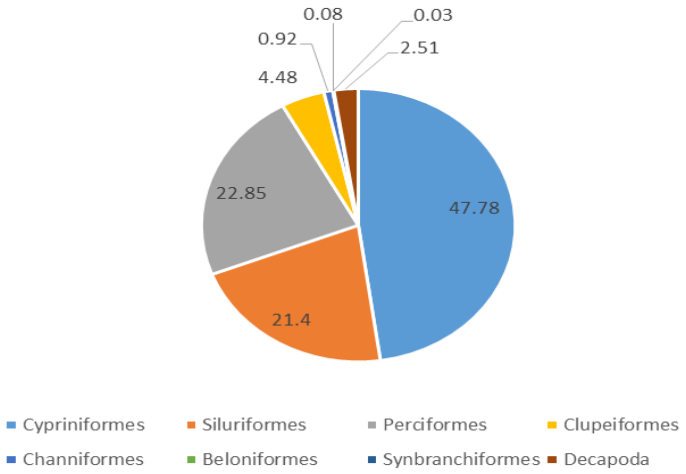

Fig. 2: Order wise percentage distribution of fish species in the study area.

Diversity of family

A total of 18 families were observed in the study area. The highest 14 species belonged to the family Cyprinidae followed by Schilbeidae with 3 species. Each of the nine family Cobitidae, Bagridae, Sisoridae, Siluridae, Anabantidae, Mastacembelidae, Clupeidae, Channidae, and Palaemonidae represented 2 species. And the rest seven families composed of one species each which is shown in Fig. 3. More or less similar findings were reported by Kamrujjaman and Halder (2020); Karim et al. (2020); Majumdar et al. (2020) and Khanom et al. (2018). However, Siddique et al. (2020); Rahman et al. (2019); Sultana et al. (2019); Siddique et al. (2016); Akhtaruzzaman and Alam (2014); and Siddiq et al. (2013) all reported a higher number of family (>20) in different *Beel*s of Bangladesh. But, all the researchers agreed on Cyprinidae as the dominant family which was supported by the present study.

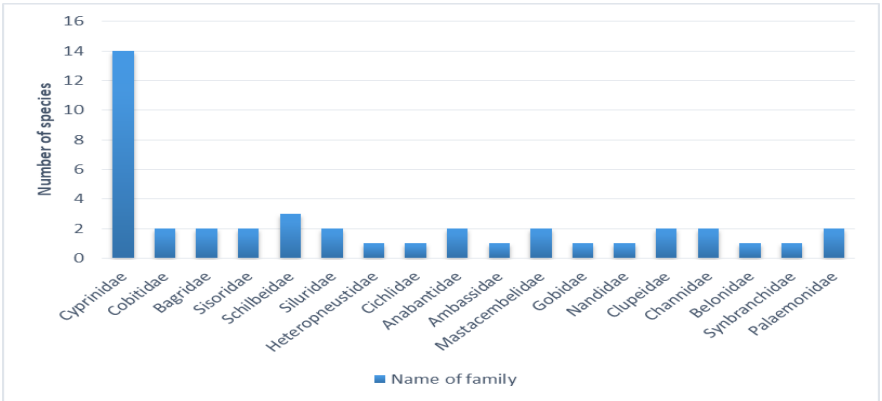

Fig. 3: Number of fish species under different family.

Exotic fish species in the study area

Two exotic fish species *Cyprinus carpiro*, and *Oreochromis mossambicus* were found in the study area while 9 exotic fishes were recorded from Chalan *beel* (Siddique et al. 2016); 6 from Dogger *beel* (Siddiq et al. 2013); 4 from Basuakhali *beel* (Rahman et al. 2019) and one from Bahadurpur *beel* (Kamrujjaman and Halder, 2022) These two species were common in all the cases except Bahadurpur *beel*.

Biodiversity indices: Shannon- Weaver diversity index

During the study period, the Shannon-Weaver diversity index (H) ranged from 2.26 to 2.66. An average value was recorded higher (2.53) after the establishment of the sanctuary than before (2.39). This index value typically ranges from 1.5 to 3.5 and can hardly exceed 4.0 (Hanif et al. 2015; Rahman et al. 2019). The value of H was reported at 0.95 to 2.62 in the Bakkhali river estuary (Nabi et al. 2011); and 1.40 to 2.38 in Basukhali *beel* (Rahman et al. 2019) which were lower than in the present study. On the other hand, H was found to be 2.54 to 3.15 in four sampling sites of Chalan *Beel* (Siddique et al. 2016) which was higher than present findings. This diversity index of a community describes the number of species and their relative abundances. A higher value of H represents a diverse and equally distributed community whereas a lower value denotes a less diverse community. So, an increase which was noticed in the 2nd year may be due to the impact of the fish sanctuary.

Effects of fish sanctuary

Before establishment of fish sanctuary, a total of 39 species (Table 1) were recorded; while an additional three species *Tor tor, Macrobrachium lamarrei* and *Nandus nandus* were found thereafter. The percent composition of each species was more or less same for the two years, but total catch showed a 6% increase. Retrieval rate was very poor compared to that of Halti *beel* tank fish sanctuary where 35 species were newly added (Siddique et al. 2020); Matshyarani fish sanctuary where 32 species were retrieved (Hasan et al. 2012); and Kumari *beel* sanctuary where 16 species were retrieved (Joadder et al. 2016). This may be due to the age and management of the sanctuary. Sanctuary of Halti *beel* and Kumari *beel* are permanent (Siddique et al. 2020) and managed by CBFM under DoF, but sanctuary under present study was newly established and temporary. The sanctuary provides shelter, breeding condition and food availability all the year, whereas a newly established sanctuary has yet to support this environment. It reveals that a year-round and permanent sanctuary contributes more than a temporary sanctuary to conserving biodiversity.

Conclusion

The goal of the study was to find out how the fish population changed after the fish sanctuary was set up. Because the study area was a seasonal beel covering only a small portion of the large beel, the study results may not represent the true scenario of fish diversity in Chalan beel as a whole. A slight increase in total catch and biodiversity index revealed gradual restoration of habitat and retrieval of species, but to a lesser extent. To get the actual benefit of sanctuary it is important to make the setup sustainable year after year. In this context, it is also important to know about the fishermen and how the sanctuary is run.

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Conflict of interest: The authors hereby declare no conflict of interest regarding the publication of this article.

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