

Research Article

Malays. j. med. biol. res.



Status and Decline Causes of Fish Diversity of Bhawal Beel, Bangladesh

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ABSTRACT

Beel is one of the ancient types and obviously a fascinating one due to its biodiversity and ecological importance in local and national perspective of Bangladesh. The Bhawal beel is one of important beels and excellent habitat for small indigenous species (SIS). The present status and decline causes of Bhawal beel was studied from March 2016 to February 2017. Data collection was carried out from four villages of Achim union under Fulbaria upazila. Questionnaire Interview (QI), Focus Group Discussion (FGD) and cross-check Interview were done to obtain data related to status and decline causes of fishes from the fishermen and resource person. A total of 56 species of fish including prawn under 10 orders and 23 families were recorded from thebeel. Cypriniformes (33.93%) was the most dominant order followed by Siluriformes (21.43%), Perciformes (19.65%), Channiformes (7.14%), Synbranchiformes (7.14%), Decapoda (3.58%), Cyprinodontiformes (1.78%), Osteoglossiformes (1.78%), Beloniformes (1.78%) and Tetraodontiformes (1.78%). Among the recorded families Cyprinidae was the most dominant family contributing 17 species. The availability status of observed species were remarked in four categories and obtained as available (44.64%), seasonal (19.64%), rare (16.08%) and very rare (19.64%). Decline causes like overfishing, use of illegal fishing gear, siltation, katha fishing, and abstraction of water for irrigation, catching of fry and brood fishes, lack of connection of beel with Banar river and absence of proper beel management policy were observed as major threats for fish diversity. About 13species were found threatened (1 critically endangered, 5 endangered and 7 vulnerable) which may extinct in near future due to proper management of the beel fishery. The present study recommends minimizing of all these impediments. Besides Community Based Fisheries Management (CBFM) and beel nurseryis essential to save the valuable fish diversity of Bhawal Beel on which local livelihood depends.

Key words: Fish, Diversity, Beel, Illegal gear, Conservation, Management

Manuscript Received: 23 May 2019

Revised: 12 July 2019

Accepted: 24 July 2019

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INTRODUCTION

Fisheries are important sub-sector of agriculture in Bangladesh and play a significant role in nutrition, employment, foreign exchange earnings and food supply (Dey et al., 2005; Roos et al., 2007). 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. Around 17.80 million people earn their livelihood directly or indirectly from activities related to fisheries (DoF, 2015).

Bangladesh is blessed with a vast area of inland open water bodies in the forms of rivers, haors, beels, floodplains among them beels are the best natural habitats for the indigenous fishes of different food habits. 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 which are small saucer-like depressions of a marshy character (Banglapedia, 2014). The total

area of beel in Bangladesh has estimated to be 114,161 ha, occupying 27.0% of the inland freshwater area (Ahmed *et al.*, 2007). Most of the aquatic species specially the fish and prawn enter in the inundated areas of the beel from the adjoining rivers and canals to feed and grow during the monsoon months (Akteruzzaman *et al.*, 1997). The beel ecosystem is extra-ordinarily complex with wide temporal and spatial variations of many key parameters. Among the various factors that influence the wetland ecosystem are depth, nature of catchments area or river basin and precipitation and duration of connection to river (Sugunan *et al.*, 2000).

Bhawal beel is one of the important fishery resources of Fulbaria upazila, Mymensingh, Bangladesh in terms of fish production and income generation of many fishermen. It is very important for abundance of fish fauna and fishing activities. A large number of poor fishers living around the beels harvest the fish almost round the year without any prior investment. Perhaps more than any other countries, the population of Bangladesh depend on wild fish for food and the generation of income. Large portions of rural households are engaged in part-time fish capture from the floodplain/beels (Hughes *et al.*, 1994). Several decades ago, beel was abundant with variety of fishes but in recent years like other water bodies of Bangladesh, aquatic resources from this water body is decreasing to a large extent due to uncontrolled fishing and highly destructive devices of fish capture in Beel deplete fisheries resources and are followed by great economic distress (Karim, 2003). 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).

At present time, reduction in the abundance and fish species from the inland waters of Bangladesh is a burning issue in Bangladesh (Galib *et al.*, 2009). Decrease in fish catch increasingly threatens the livelihoods of more than 12 million fishers in Bangladesh (Tsai and Ali, 1997). 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). Therefor area basis study is required to identify the present status and causes of destruction of fish fauna in different beels of Bangladesh. But the efforts are scanty to find out the present status of fish diversity of the country. So, the present study was conducted to identify the fish and shellfish species of Bhawal beel with their decline causes and to suggest proper recommendation measures.

MATERIALS AND METHODS

Study area

The study was conducted in Fulbaria upazila (Mymensingh district) with an area of 401.16 sq km, located in between 24°23' and 24°44' north latitudes and in between 90°08' and 90°28' east longitudes.



Figure 1: Map depicting study area with red circle (Banglapedia, 2015)

Main rivers are Khiru, Nageshwari, Banar, Bajna, Sirkhali, Bajua, Miabua, Katamadari and Deorai. Bhawal, Ratai, Katar, Sangayet, Shreefalata, Kalai, Radha, Bara beels are notable (Banglapedia, 2015). Bhawal beel has occupied an area of 44.53 ha in rainy season and 25.60 ha in winter season which spreading between two villages named Kutira and Puraghati of Achim union under Fulbaria upazila (Fig. 1). It is more or less rectangular shaped inland water body. Rainfall is the main source of water in this beel, whereas, during monsoon period the beelis connected to the river Banar. During rainy season the entire beel inundate with water average depth become 4.5-5 ft.

Collection of data

The study was conducted from March 2016 to February 2017 in Bhawal beel under Fulbaria upazila of Mymensingh district, Bangladesh (Fig. 1). The data were collected in respect of the fish fauna and decline causes of the beel. For this study a combination of questionnaire interview, Participatory Rural Appraisal (PRA) tool such as Focus Group Discussion (FGD) for fishermen and cross-check interviews with key informants were used. To collect data with questionnaire interviews, simple random sampling method was followed in 80 fishermen from four villages named Puraghati, Kutira, Ramnagar and Gopalpur surrounding the Bhawal beel. The interview of fishermen was made at home or beelsites during fishing. A total of five FGDs were conducted in the beelarea where each group size of FGD was 10 to 15 fishermen. Cross-check interviews were conducted with key person such as Upazila Fisheries Officer (UFO), school teachers, local leaders, NGO workers where information was contradictory or requested for further assessment. The natural and manmade decline causes of fish diversity were collected through direct observation and interview during data collection. Statuses of the collected species were assessed in four categories on the basis of present status and availability of fishes of the Bhawal beel as: available fish species (A): species available throughout the year, seasonal fish species (S): species only found in certain period of the year, rare fish species (R): species only found sporadically in the study area and very rare fish species (VR): species almost not found in the study area.

Data processing and analysis

The collected data were coded, summarized and processed for analysis. Tabular technique was applied for the analysis of data by using simple statistical tools like averages and percentages. Collected data has been analyzed by Microsoft Office Excel 2010.

RESULTS AND DISCUSSION

Bhawal beelis a source of many economically important fishes and breeding, nursing and feeding ground of many wild fish species. A total of 56 species of fish and prawn species comprising 10 orders and 23 families were recorded from the Bhawal beel (Table 1). Imteazzaman and Galib (2013) recorded a total of 63 fish species including 55 indigenous and 8 exotic species belonging to 8 orders, 20 families and 41 genera from the Halti Beel, a famous wetland of northwest Bangladesh. Akhtaruzzaman and Alam (2014) found a total of 62 fish species under 10 orders from Ichanoi Beel, Bangladesh. Flura et al., (2015) identified 74 fish species belonging to 21 families were from Balla beel ecosystem in Moulavibazar district of Bangladesh. Galib et al., (2009) recorded a total of 81 fish species including 72 indigenous and 9 exotic species were recorded under 12 fish orders, 27 families and 59 genera which were higher than the present findings from Chalan beel. Saha and Hossain (2002) recorded a total of 40 fish species from Saldu beel of Tangail which was lower than the present study. Ahmed et al., (2004) recorded a total of 52 fish species in Shakla beel (Brahmanbaria) of Bangladesh. Joadder et al., (2016) found a total of 52 species of fish from Kumari beel (wetland) in Rajshahi, Bangladesh. Siddiq et al., (2013) found 58 species belong to 21 family under 9 order which are almost similar with the findings of the present study.

Table 1: Present status of fish biodiversity in Bhawal beel

Order	Family	Local name	English name	Scientific name	Present status	IUCN status
Beloniformes	Belontiidae	Kakila	Fresh water gar fish	<i>Xenentodon cancila</i>	S	LC
Channiformes	Channidae	Taki	Spotted snakehead	<i>Channa punctatus</i>	A	LC
		Cheng	Asiatic snakehead	<i>Channa orientalis</i>	A	LC
		Shol	Snakehead murrel	<i>Channa striatus</i>	A	LC
		Gozar	Giant snakehead	<i>Channa marulius</i>	VR	EN
		Gutum	Guntea loach	<i>Lepidocephalichthys guntea</i>	A	LC
Cypriniformes	Cobitidae	Rani	Bengal loach	<i>Botio dario</i>	VR	EN
		Cyprinidae	Catla	Indian major carp	<i>Catla catla</i>	S
	Rohu		Indian major carp	<i>Labeo rohita</i>	S	LC
	Mrigal		Indian major carp	<i>Cirrhinus cirrhosus</i>	S	NT
	Common carp		Common carp	<i>Cyprinus carpio</i>	R	EX
	Gonia		Kuria labeo	<i>Labeo gonius</i>	VR	NT
	Grass carp		Grass carp	<i>Ctenopharyngodon</i>	S	EX

				<i>idella</i>		
		Kalibaush	Black rohu	<i>Labeo calbasu</i>	VR	LC
		Silver carp	Silver carp	<i>Hypophthalmichthys molitrix</i>	R	EX
		Vagna	Reba carp	<i>Cirrhinus reba</i>	VR	NT
		Chela	Fine scale razor belly minnow	<i>Chela cachius</i>	A	VU
		Mola	Mola Carplet	<i>Amblypharyngodon mola</i>	A	LC
		Darkina	Flaying barb	<i>Esomus danricus</i>	A	LC
		Dhela	Cotio	<i>Osteobrama cotio</i>	R	NT
		Tit punti	Ticto barb	<i>Puntius ticto</i>	A	VU
		Jat punti	Spot fin swamp barb	<i>Puntius sophore</i>	A	LC
		Shar punti	Olive barb	<i>Puntius sarana</i>	S	LC
		Raj punti	Java barb	<i>Puntius gonoiotus</i>	R	EX
Cyprinodontiformes	Aplocheilidae	Kanpona	Blue panchax	<i>Aplocheilus panchax</i>	A	LC
Osteoglossiformes	Notopteriidae	Foli	Bronze Featherback	<i>Notopterus notopterus</i>	S	VU
Perciformes	Ambassidae	Lamba chanda	Elongated glass perchlet	<i>Chanda nama</i>	A	LC
		Kata chanda	Round glass perchlet	<i>Chanda baculis</i>	A	LC
		Gol chanda	Indian glass fish	<i>Parambassis ranga</i>	R	LC
	Anabantidae	Koi	Climbing perch	<i>Anabas testudineus</i>	A	LC
	Pristolepidae	Napit koi	Climbing perch	<i>Badis badis</i>	VR	NT
	Cichlidae	Tilapia	Mozambique tilapia	<i>Oreochromis mossambicus</i>	A	EX
	Gobiidae	Bele	Tank goby	<i>Glossogobius giuris</i>	S	LC
	Nandidae	Meni	Gangetic leaffish	<i>Nandus nandus</i>	R	NT
	Osphronemidae	Boro khalisha	Striped gourami	<i>Colisa fasciatus</i>	A	NO
		Choto khalisha	Honey gourami	<i>Colisa chuno</i>	A	NO
		Lal khalisha	Dwarf gourami	<i>Colisa lalia</i>	VR	NO
	Bagridae	Gulsha	Long whiskered catfish	<i>Mystus cavasius</i>	S	NT
		Bujuri	Long bled catfish	<i>Mystus tengra</i>	VR	LC
		Tengra	Striped dwarf catfish	<i>Mystus vittatus</i>	A	LC
	Clariidae	Magur	Walking catfish	<i>Clarius batrachus</i>	A	LC
	Heteropneustidae	Shing	Stinging catfish	<i>Heteropneustes fossilis</i>	A	LC
	Pangasiidae	Pangus	Yellowtail catfish	<i>Pangasius pangasius</i>	VR	EN
	Schilbeidae	Batasi	Indian potasi	<i>Pseudeutropius atherinoides</i>	R	NT
		Garua	Garua Bachcha	<i>Clupisoma garua</i>	VR	EN
	Siluridae	Boal	Freshwater shark	<i>Wallago attu</i>	S	VU
		Pabda	Pabo catfish	<i>Ompok pabo</i>	A	CR
		Kani pabda	Butter catfish	<i>Ompok bimaculatus</i>	R	EN
		Madhu pabda	Pabdah catfish	<i>Ompok pabda</i>	VR	EN
Boro Baim		Zig-zag eel	<i>Mastacembelus armatus</i>	S	EN	
Synbranchiformes	Mastacembelidae	Guchi	Barred spiny eel	<i>Macrognathus pancalus</i>	A	LC
		Tara Baim	Lesser spiny eel	<i>Macrognathus aculeatus</i>	A	NT
	Synbranchidae	Kuchia	Mud eel	<i>Monopterusuchia</i>	A	VU
Tetraodontiformes	Tetraodontidae	Potka	Ocellated pufferfish	<i>Tetraodon cutcutia</i>	R	LC
Decapoda	Palaemonidae	Chatka icha	Monsoon river prawn	<i>Macrobrachium malcolmsonii</i>	A	NO
		Gura icha	Monsoon river prawn	<i>Macrobrachium lamarre</i>	A	NO

A: available, S: seasonal, R: rare, VR: very rare, CR: critically endangered, EN: endangered, VU: vulnerable, NT: near threatened, NO: not threatened, LC: least concern and EX: exotic species.

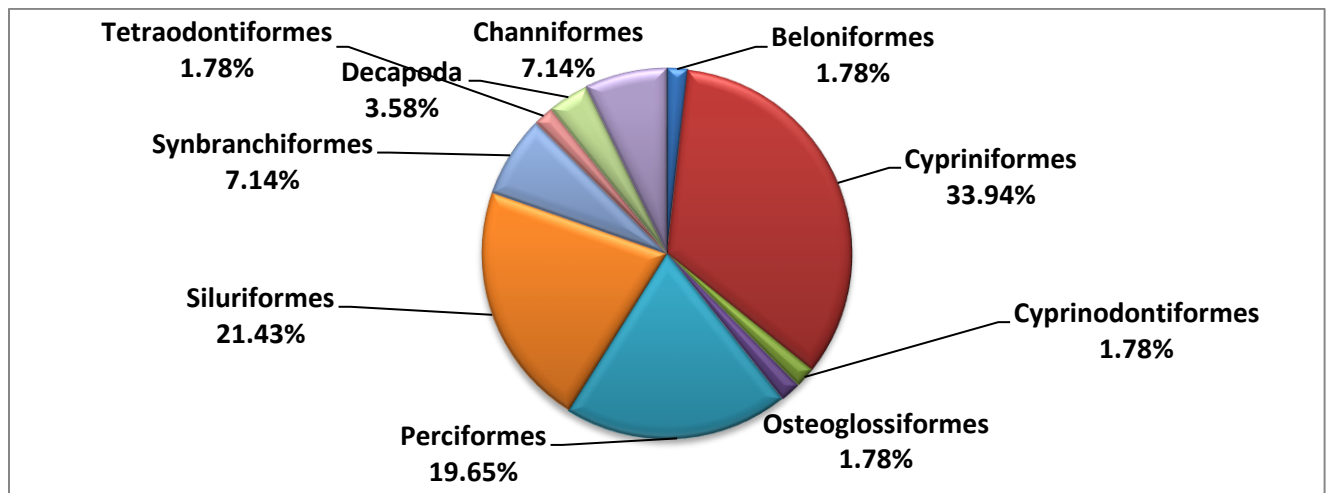


Figure 2: Percentage composition of total fish species under different orders in the study area

The order based percentage analysis of the existing species of fish and prawn showed highest occurrence under the order Cypriniformes (33.93%) followed by Siluriformes (21.43%), Perciformes (19.65%), Channiformes (7.14%), Synbranchiformes (7.14%) and Decapoda (3.58%). The percentage occurrence was found same (1.78%) for the orders viz. Cyprinodontiformes, Osteoglossiformes, Beloniformes and Tetraodontiformes on the basis of availability (Figure 2).

Imteazzaman and Galib (2013) found Cypriniformes (41.27%) as dominant order followed by Siluriformes (22.22%) and Perciformes (20.63%) from Haldi Beel, Bangladesh. Akhtaruzzaman and Alam (2014) identified 35.48% species from Cypriniformes, 25.81% from Siluriformes, 20.97% from Perciformes, 6.45% from Channiformes and 3.23% from Osteoglossiformes from Ichanoi Beel. These results are similar to the present results.

Among 23 families recorded during the present study Cyprinidae was the most dominant family contributing 17 species (Table 1). Cyprinidae represented a major contribution with large number of species in different open water bodies of Bangladesh (De et al., 2011) and south west Sunderbans, India (Giri et al., 2004; Mohan and Singh, 2004). Imteazzaman and Galib (2013), Siddiq et al., (2013), Joadder et al., (2016), Akhtaruzzaman and Alam (2014) also recorded Cyprinidae as the dominant family.

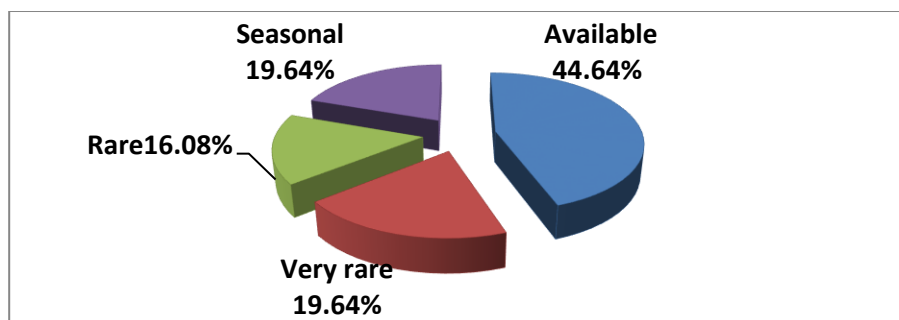


Figure 3: Availability status of fishes in the Bhawal beel

The observed species were categorized into four statuses based on their availability and obtained as available (44.64%), seasonal (19.64%), rare (16.08%) and very rare (19.64%) presented in (Fig. 3 and Table 1). Akhtaruzzaman and Alam (2014) found available (46.77%), seasonal (8.06%), rare (6.45%) and extremely rare (38.71%) from Ichanoi Beel, one of the floodplains of Bangladesh. Galib et al., (2009) found common (23%), abundant (17%), rare (9%) and very rare (5%) which supports the present findings.

Status of threatened species

According to the red list of IUCN (2016), a total of 64 species are threatened in Bangladesh of which 25 species were vulnerable, 30 species were endangered and 9 species were critically endangered. Among them only 13 species were found from the present study. Out of them, 4 species were found as available, 3 species as seasonal, 1 species as rare and 5 species as very rare in the Bhawal beel (Fig. 4) which may extinct in the near future due lack of proper conservation measures.

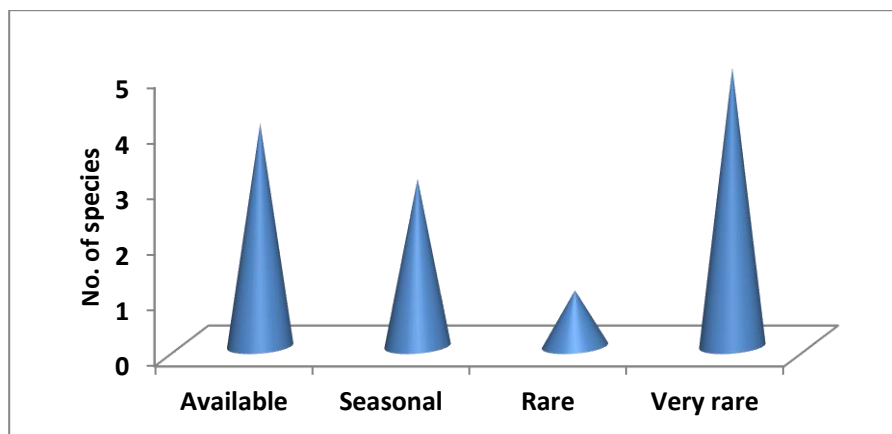


Figure 4: Present status of threatened fish species in the study area

The IUCN (2016) status of these threatened species was 1 (*Ompok pabo*) critically endangered (out of 9 species), 7 (*Channa marulius*, *Mastacembelus armatus*, *Ompok bimaculatus*, *Ompok pabda*, *Clupisoma garua*, *Pangasius pangasius* and *Channa marulius*) endangered (out of 30 species) and 5 (*Monopterus cuchia*, *Wallago attu*, *Notopterus notopterus*, *Puntius ticto* and *Chela cuchia*) vulnerable (out of 25 species) (Fig. 5).

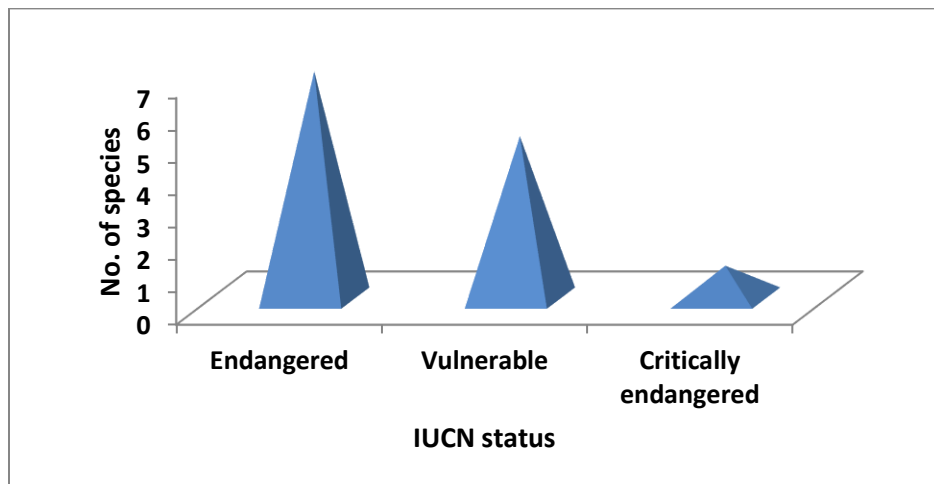


Figure 5: IUCN status of threatened fish species recorded from the study area

From the present investigation, 13 threatened species were recorded out of 56 species. Galib *et al.*, (2009) recorded 28 threatened species out of 81 species from Chalan beel. Chakraborty and Nur (2009) found 9 commercial important aquatic species as Critically Endangered, 39 species as Endangered, 19 species as Vulnerable from Medha beel in the Northern region of Bangladesh. Imteazzaman and Galib (2013) recorded 3 critically endangered, 11 endangered and 8 vulnerable fish species from Haldi beel out of 63 species which supports the present results.

Fisheries resources in Bangladesh like Bhawal beel are under severe threat due to over-exploitation and environmental degradation, which includes human interventions through conversion of inundated land to cropland thereby reducing water area and indiscriminate use of pesticides. Stock of the wildlife brood fishes and other species in the breeding ground was suffered significant damages, resulting in a reduction of biodiversity as well as a decline in the socio-economic importance of Bhawal beel. According to the respondents main threats to the fish diversity in the Bhawal beel were overfishing, use of illegal fishing gears (current jal), siltation, katha fishing, fishing by dewatering, low water depth in winter, abstraction of water for irrigation, catching of fry and brood fishes, lack of connection of beel with Banar river and absence of proper beel management policy. The findings clearly represent the declining trends of fish diversity in the study area which warning the gradual declination of fish diversity of open waters of Bangladesh. Stoddard *et al.*, (2006) observed similar decline causes of fish diversity of inland water bodies of Bangladesh. Chakraborty and Nur (2009), Siddiq *et al.*, (2013), Galib *et al.*, (2009), Nishat (1993), Chakraborty and Mirza (2007), Khan (1993), Ali (1991) and Zaman (1993) found more or less same decline causes of fish diversity which support the present findings.

CONCLUSION

Biodiversity loss especially loss of species diversity is a major threat in the country and abundance of indigenous fish species are decreasing each year in different inland water bodies. Over fishing, catching of juvenile and brood fishes by using illegal fishing gears, katha fishing were common in the Bhawal beel like other water bodies, which need to be stopped. This will lead to increase abundance and species diversity of fishes as well as other species. Adopt sustainable beel management policies e.g. Community Based Fisheries Management (CBFM). Besides establishment of permanent and temporary fish sanctuaries in the Bhawal beel and proper management of these sanctuaries need to be ensured. Stocking of quality fry of indigenous species and introduce beel nursery program may be an option for increasing abundance and diversity of fishes. Government should ensure food security for few months to the fishermen. Effort should be made to educate the local people and create awareness among them about the importance and the need for conservation and management of this valuable wetland. Alternative means of livelihood should be generated for the fishermen who depend upon this beel for their survival. This will reduce the exploitation and killing of fish fauna. Effort should be made to educate the fisherman and create awareness among them about the importance and the need for conservation and management of this valuable beel ecosystem. Government should take necessary steps to train up the fishermen on fish culture and management to reduce fishing pressure in the Bhawal beel. Finally biodiversity survey is recommended to investigate the fish diversity status for proper management and conservation of this potential natural resource and to ensure food security of the people of Bangladesh.

ACKNOWLEDGEMENT

Authors are cordially thankful to the fishermen of the Achim union and Upazila fisheries Officer, Fulbaria, Mymensingh for their help and cooperation during collection of data.

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