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Fish Biodiversity of Chapai Beel in Faridpur, Bangladesh: Present Status, Threats I dentification and Recommendations for Conservation through Sustainable Management

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Abstract

The present study was undertaken on Chapai Beel in Faridpur Sadar Upazila, Bangladesh to determine the fish biodiversity and to find out the problem related to fisheries biodiversity and also will make an important contribution to the development of an appropriate Beel fisheries management policy in order to conserve fisheries biodiversity. A field investigation was conducted on the existing status of fishery for a period of 1 year from January to December 2020. The Chapai Beel is semi-closed and has an arc-shaped water body of 84.86 ha spreading over the seven villages with covering the two unions and two Upazilas of Faridpur district. A total of 47 species (including 6 exotic species) were identified during the study. Of the 47 species, 41 were indigenous species belonging to 17 fish families, 12 different common groups and 32 fish genera; of which 25 were SIS and the remaining 16 were large fish. Cyprinidae constitutes highest number of fish population representing 15 species and shares the highest percentage (37%) among the recorded family. Barbs & Minnows was found to be the biggest group (22%) among the recorded 12 common groups. From the Chapai Beel 6 fish species were recorded as threatened which is 9% of total threatened fishes of Bangladesh. Within 41 species, 36.58% fish species were ranked as abundant followed by moderate (24.40%), low (19.51%), and rare (19.51%). The present study suggests that prudent planning, management and regulatory practices, as well as active community engagement, can positively impact fish biodiversity.

Keywords: Beel fishery; Fish biodiversity; Conservation; Sustainable management; Chapai beel

Introduction

Bangladesh prides itself on being very rich in fish diversity. Its numerous and diverse inland water bodies-Beels (floodplain depressions and lakes), ponds, rivers, canals, ditches, and paddy fields are home to over 267 freshwater fish species [1]. The total area of Beel in Bangladesh is estimated to be 114161 ha covering about 27% of the inland freshwater resources [2]. Among 265 freshwater fishes [3] 143 species are considered Small Indigenous Species (SIS) in Bangladesh. All of these species were found availably in Beel water bodies a few years back whereas, 64 of them are now threatened, 9 are critically endangered, 30 are endangered, and 25 are vulnerable [4]. Beel fishery of Bangladesh is declining day by day due to overfishing, indiscriminate use of chemical fertilizers and insecticides, destruction of natural breeding and feeding grounds, harvesting of wild brood fishes, and many other causes [5]. Therefore, the present study aimed to discover the fish biodiversity status in the Chapai Beel; which is one of the largest and most important Beel in the Faridpur district of Bangladesh.

Research Methodology

Study period

The study period was conducted for a period of 1 year from January, 2020 to December 2020.

Data collection and research framework

A semi-structured questionnaire was used for data collection. Additionally, the following methods were used:

Direct Observation: The status of Chapai Beel, as well as species diversity, was assessed through personal field observation.

- Morphometric and hydrographic details of Chapai Beel
- Hydrological condition of the Chapai Beel

Fish Specimen Identification: Firstly, fish specimens were collected from the market and fisherman's catch. Then, Images of different fish specimens were taken by a digital camera. Finally, collected fish samples were identified by analyzing their morphometric and meristic characteristic [6]. By checking the Catalogue of Fishes [7], valid scientific names of the identified species were ensured. Fishes were grouped into four categories

based on their abundance *viz.*, abundant, moderate, low and rare.

Fish Biodiversity of Chapai Beel: Availability of fish species were determined based on their abundance through direct sampling from fishermen catch and fish bazar, interviewing of fishermen, fish retailers and fish traders following the questionnaire pattern.

Determination of Conservation Status (IUCN Conservation Status-BD): Conservation status was also determined by following the database of IUCN Bangladesh (IUCN, 2015).

Perceptions of community (FGD) on fish Biodiversity: FGD was conducted in fish bazar (Chungirmor and Kanaipur Bazar) and fishers' village adjacent to the studied Beel.

Key Informant Interviews: Key informants such as oldest and experienced persons related to fisheries sectors adjacent to studied Beel (fishermen, venerable local community leaders, fish retailers, fish traders etc.) local DoF (Department of Fisheries) and NGO personnel were interviewed face to face.

Overall Threat Identification of Chapai Beel: Threats on biodiversity and its conservation were collected through the survey on the fishermen and local community leaders, fish retailers, fish traders, local DoF & NGO personnel and available literature.

Data processing and analysis

Descriptive analysis and graphical presentation of data were carried out using Microsoft Excel (Version 2016).

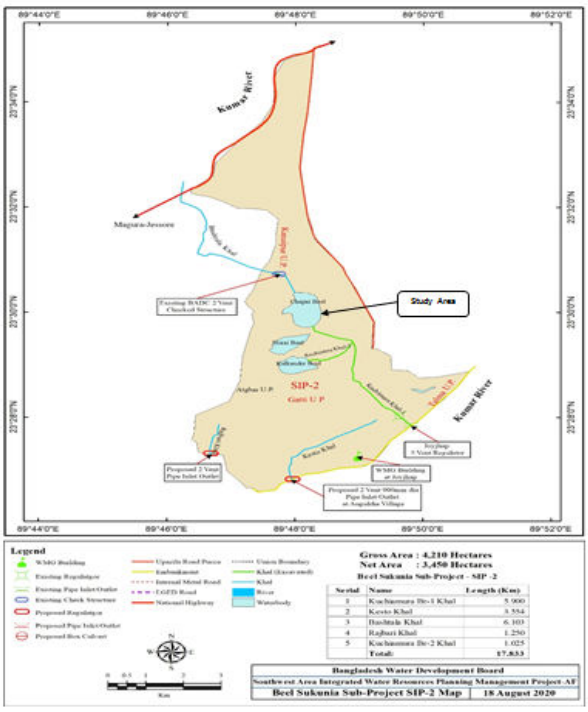

Figure 1: Map showing the study area.

Source: Hydrological boundary and unit water body demarcation were completed in the 2012-13 period under the feasibility study of the Southwest Area Integrated Water Resources Planning and Management Project, implemented by the Bangladesh Water Development Board.

Result

Direct observation

Morphometric and Hydrographic details of Chapai Beel: Chapai Beel is located about 12 km away from Faridpur town and is rich in biodiversity. As per the hydrological survey of the Beel area (Figure 01), the Chapai Beel is connected to the Kumar river which in turn is connected to the Padma river through two major canals, Bashtola canal (6.103 km) on the northwest, and Kuchiamara-1 canal (5.9 km) on the southeast. The demarcated area for the Beel 84.86 ha spreading over the seven villages with covering the two unions and two Upazilas of Faridpur district. It is semi-closed and has an arc-shaped water body. There are two adjacent Beel nearby (Horai Beel-40.8867 Ha & Kalkander Beel-40.4323 Ha). Kalkander Beel lost its' natural water retention capacity and is mostly encroached by the land grabbers. Horai Beel still has year-round water in places to retain the biodiversity but encroached partially as well. Though these three Beels are consistently being different but they are connected through small canals among them, from Chapai to Horai to Kalkander Beel. During the monsoon, the Chapai Beel is merged with the other two and spread out to several hundred hectares and turns out to be a vast inland water body under the Faridpur district. This study was conducted in this hydrological boundary considering a major source of diversity is from Chapai Beel. As the Chapai Beel is large, the water depth varies in different areas and fluctuates in different months ranges from 4 to 15 ft. The highest water depth was recorded in August. In the dry season, most of the Beel is drained naturally, and with the support of the water retention and drainage structure, two vent regulators by Bangladesh Agriculture Development Corporation (BADC) in Bashtola canal (Inactive now), and by Joyjhap six vent regulator by Bangladesh Water Development Board (BWDB). The current flood control and drainage facilitate by the Joyjhap six vent regulators for the hydrological unit. The most depressing part of the Beel retains water throughout the year and supports biodiversity retention. The fish catch was different with different habitats over the year. Some variation may have related to the fish migration facilities, flooding & inundation regime, type of habitats, and its linkages. The peak catches were observed in October and November each year when water is receding. The decline of biodiversity in different catch may be related to the seasonal fluctuation of water depth in the Beel. In the rainy season, species diversity is generally high through the Beel because of frequent movement of fishes. In the winter season, the water level of the Beel decreases and fishes enter into the deepest part of the Beel. The gradual decrease of fish species in catch composition may be related to this phenomenon. Due to structural development in Beel surrounding area, a lot of real fishermen living around the Chapai Beel who are directly reliant on Beel fisheries for their subsistence are shifting to other trades nowadays.

Hydrological Condition of the Chapai Beel: With over half of t he country comprised of floodplains, in the past, agriculture and capture fisheries complemented one another in a natural cycle of wet and dry season and monsoon rains. During the dry season (approx. May-December), most of the land was cultivated and fish were restricted to Beels, rivers and canals. In the monsoon and post-monsoon periods (June-November), the floodplains were inundated and cultivation of deep water rice was practiced. This vast area provided an ideal habitat for the many freshwater fish species and people had access to fish [8]. The hydrological condition of the Beel strongly influences the Beel fisheries. Early flooding is particularly important for fisheries as it stimulates the early spawning of many floodplain resident species of fish. In addition, seasonal changes are very important for the biology and life cycle of fish residing in floodplains. Various authors [9-11] categorized the hydrological conditions of the Beels into different parameters (Table 01).

Table 1: Hydrological condition of the river-floodplain-Beel.

Parameters	Aspects
Sources of water	Rivers and Rainfall
Pre-monsoon river flood surge and recession	March-April
Early-monsoon river flood surge	Early May
Sustained monsoon Beel flooding	June-October
Late-monsoon Beel drainage	Early September
Dry season fish refuge habitat area contraction	Late October January
Unseasonable Beel inundation from local rainfall during dry season	December-February

Fish specimen identification

A total of 47 species (including 6 exotic species) were identified during the study. Of the 47 species, 41 were indigenous species, of which 25 were SIS (which grow to a size of 25 cm or 9 inches at mature or adult stage in their life cycle [12] and the remaining 16 were large fish (Table 3).

Fish biodiversity

From the collected information as per the questionnaire through different methods (described in the data collection framework) conducted in the field, the present status and the loss of fish biodiversity of Chapai Beel has been identified and analyzed accordingly. In conducting the analysis, only indigenous species that currently exist in the studied Beel are taken into consideration. Exotic species are excluded from the analysis and presented separately (Table 04).

A total of 41 indigenous fish species were recorded during the study period under 17 fish families belonging to 12 different common groups and 32 fish genera and are listed together with details of their present abundance status and local IUCN conservation status as well (Table 02).

Table 2: Fishes of Chapai Beel and their status.

S. No	Common Group	Family	Local Name	Scientific Name	Status	IUCN-BD, 2015
1	Biodiversity of Carps	Cyprinidae	Rui	*Labeo rohita*	Low	LC
2			Catla	*Gibelion catla*	Low	LC
3			Mrigal	*Cirrhinus cirrhosus*	Low	NT
4			Kalibaus	*Labeo calbasu*	Rare	LC
5			Bata	*Labeo bata*	Rare	LC
6			Raek/ Tatkini	*Cirrhinus reba*	Low	NT

7	Biodiversity of Barbs and Minnows		Mola	*Amblypharyngodon mola*	Abundant	LC
8			chela	*salmostoma bacaila*	Low	LC
9			Phul chela	*salmostoma phulo*	Low	NT
10			Phutani punti	*Puntius phutunio*	Moderate	LC
11			Jatputi	*Puntius sophore*	Abundant	LC
12			Titputi	*Puntius ticto*	Abundant	VU
13			Mola puti	*Pethia guganio*	Abundant	LC
14			Sharpunti	*Systomus sarana*	Rare	NT
15			Darkina	*Esomus danrica*	Abundant	LC
16	Biodiversity of Catfishes	Bagridae	Tengra	*Mystus vittatus*	Moderate	LC
17			Bujuri tengra	*Mystus tengara*	Moderate	LC
18			Gura tengra	*Chandramara chandramara*	Moderate	LC
19		Siluridae	Boal	*Wallago attu*	Rare	VU
20		Clariidae	Magur	*Clarias batrachus*	Low	LC
21		Heteropneustidae	Shing	*Heteropneustes fossilis*	Abundant	LC
22	Biodiversity of Snakeheads	Channidae	Taki	*Channa punctata*	Abundant	LC
23			Cheng	*Channa orientalis*	Moderate	LC
24			Shol	*Channa striata*	Abundant	LC
25			Gojar	*Channa marulius*	Moderate	EN
26	Biodiversity of Eels	Mastacembelidae	Tara baim	*Macrognathus aculeatus*	Moderate	NT
27			Guchi baim	*Macrognathus pancalus*	Abundant	LC
28		Synbranchidae	Kuchia	*Monopterus cuchia*	Abundant	VU
29	Biodiversity of Perches	Anabantidae	Koi	*Anabas testudineus*	Abundant	LC
30			khalisha	*Trichogaster fasciata*	Abundant	LC
31			Lal khalisha	*Trichogaster lalius*	Moderate	LC

32			Nama chanda	*Chanda nama*	Low	LC
33		Badidae	Napit koi	*Badis badis*	Abundant	NT
34		Nandidae	Veda	*Nandus nandus*	Moderate	NT
35	Biodiversity of Loaches	Cobitidae	Gutum	*Lepidocephalichthys guntea*	Moderate	LC
36			Rani	*Botia dario*	Rare	EN
37	Feather backs	Notopteridae	Foli	*Notopterus notopterus*	Rare	VU
38	Prawn	Palaemonidae	Ichha	*Macrobrachium lumarre*	Abundant	LC
39	Tank Goby	Gobiidae	Bailla	*Glossogobius giuris*	Rare	LC
40	Freshwater garfish	Belondiae	Kakila	*Xenentodon cancila*	Rare	LC
41	Blue Panchax	Aplocheilidae	Khanpona	*Aplocheilus panchax*	Abundant	LC

LC- Least Concern, NT- Near Threatened, EN- Endangered, VU- Vulnerable

Species availability compared to national study

The identified fish species (41) of the Chapai Beel is 13 % of the total fresh water fish species (265) recorded by Rahman, 2005 (Figure 02).

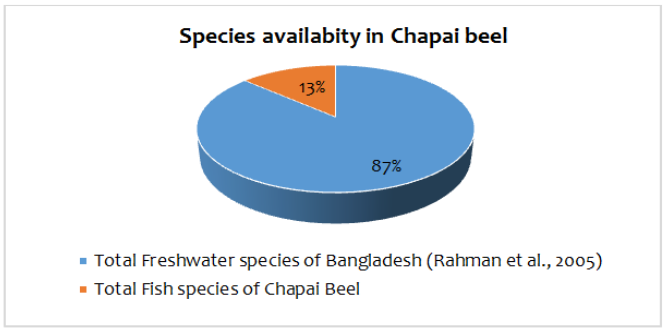

Figure 2: Species availability in Chapai Beel compared to national status.

Family diversity in the study area

According to the pie chart it is clear that among 41 species, Cyprinidae found to be the richest family represented the maximum 15 ish species (37%) followed by two families (Anabantidae and Channidae) represented 4 species (10%) each and the Bagridae represented 3 fish species (7%). Another 2 families (Mastacembelidae and Cobitidae) represented 2 species (5%) each and the rest 11 families (Siluridae, Clariidae, Heteropneustidae, Synbranchida e, Badidae, Nandidae, Notopteridae, Palaemonidae, Gobiidae, Belondiae, and Aplocheilidae) represented 1 species (2%) each. Below pie chart represent the percent composition (Figure 03).

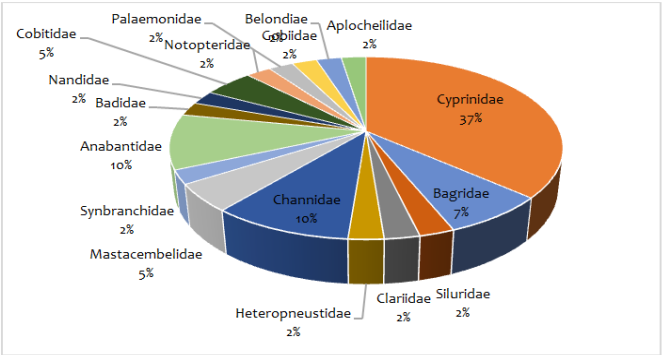

Figure 3: Family diversity percentage of Chapai Beel fish species.

Common group diversity of the species

It is clearly evident that Twelve (12) common groups were recorded in the present study.

Barbs & Minnows contributes the highest percentage (22%) followed by Carps, Catfishes and Perches (15%), Snakeheads (10%), Eels (7%), Loaches (5%).

Another and the rest 5 common group (Feather backs, Freshwater garfish, Tank Goby, Blue Panchax and Prawn) represent only 2% each (Figure 04).

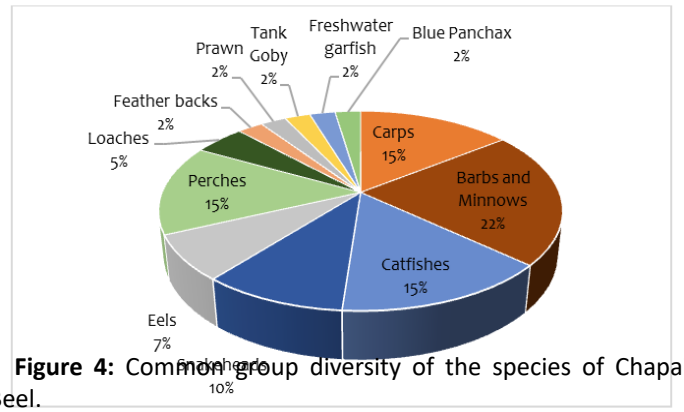

Figure 4: Common group diversity of the species of Chapai Beel.

IUCN conservation status (BD) o f C hapai B eel fish species

IUCN Conservation Status (BD) of Chapai Beel fish species showed that the highest percentage was recorded as Least Concern (66%) followed by Near Threatened (19%), Vulnerable (10%), and Endangered (5%) [Figure 05: (a)]. Among the threatened fish species, Vulnerable (67%) was found to be most abundant category followed by Endangered (33%) category [Figure 05: (b)]. 64 native freshwater fish species of Bangladesh have been declared as threatened species (IUCN-2015). Among them 6 fish species were recorded from the Chapai Beel, which is 9% of total threatened fishes of Bangladesh [Figure 05: (c)]. The threatened species of Chapai Beel was 13% of the total identified species [Figure 05: (d)]. Out of the 6 fish species, 4 species (10%) were found as Vulnerable (VU), 2 species (5%) as Endangered (EN). During the study period Critically Endangered (CR) were not recorded.

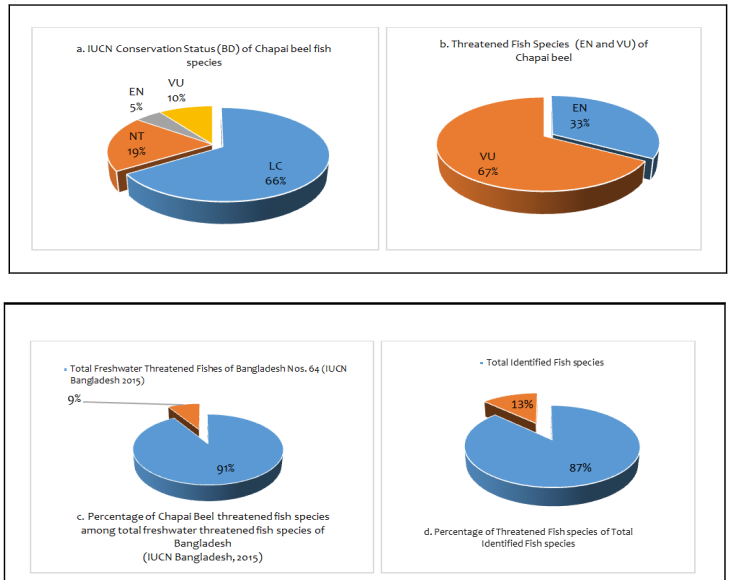

Figure 5: (a) IUCN conservation status in the found species; (b) Threatened Fish Species (EN and VU) of Chapai Beel; (c) Percentage of Chapai Beel threatened fish species among total freshwater threatened fish species of Bangladesh (IUCN Bangladesh, 2015); (d) Percentage of Threatened Fish species of Total Identified Fish species

Abundance Status of the Study Area

It is clearly evident that within 41 species, 36.58% fish species were ranked as abundant followed by moderate (24.40%), low (19.51%), and rare (19.51%) (Table 03).

Table 3: Abundance status of fishes in Chapai Beel during the study period.

SL	Abundance Status	No. of species	%	Small Indigenous Species (SIS)	Large fish
1	Abundant	15	36.58	Mola, Jatputi, Titputi, Mola puti, Darkina, Taki, Koi, Lal khalisha, Napit koi, Ichha, Khanpona	Shing, Shol, Guchi baim, Kuchia
2	Moderate	10	24.40	Phutani punti, Tengra, Bujuri tengra, Gura tengra, Cheng, Tara baim, Chuna khalisha, Veda, Gutum	Gojar
3	Low	8	19.51	Raek/ Tatkini, Lamba chela, Phul chela, Nama chanda	Rui, Catla, Mrigal, Magur
4	Rare	8	19.51	Rani	Kalibaus, Bata, Sharpunti, Boal, Foli, Bailla, Kakila
Total		41	100	25 species	16 species

Occurrence of Exotic Fish Species

There were 6 exotic species were recorded in the Beel during the study (Table 04).

Over the last six decades, 23 fish species have been introduced in Bangladesh, mainly for cultivation in closed pond systems. Because of low price and high nutritional value few species are very popular culture species in Bangladesh.

It is reported that the escape of these species to rivers and floodplains during the monsoon and floods is a threat to the biodiversity of Small Indigenous Fish Species (SIS), as some are highly carnivorous and predatory. Recorded species were cultured in ponds of the study area and apparently, they found their way to the open Beel after being washed down the different culture ponds by floods water during the monsoon season. In addition, if these alien species once get established, it will be difficult to eliminate them.

They will compete with the native species for food and space. Furthermore, they will carry different types of diseases.

Currently, no information exists whether these exotic species have established breeding populations in the wild, and such studies need to be carried out in the future along with the development of management plans for their control and eradication.

Table 4: List of Exotic species recorded in Chapai Beel during the study period.

SL	Common Group	Family	Local Name	Scientific Name
1	Carps	Cyprinidae	Silver carp	*Hypophthalmichthys molitrix*
2			Bighead carp	*Aristichthys nobilis*
3			Common carp	*Cyprinus carpio var. communis*
4			Mirror carp	*Cyorinus carpio var. specularis*
5			Grass carp	*Ctenopharyngodon idella*
6	Nile Tilapia	Cichlidae	Tilapia Nilotica	*Oreochromis niloticus*

Perceptions o f C ommunity (FGD) o n Fish Biodiversity

In focus group discussion (2 FGD; n=60), most fishermen reported that fish production and diversity were declining day by day. Out of the 60 respondents, thirty-four respondents (56.67%) indicated that both decreasing fish production and fish biodiversity. Fourteen respondents (23.34%) responded that decreasing fish production and only twelve responds (20%) noted that decreasing fish biodiversity (Table 05).

Table 5: Perceptions comparison of local community towards fish biodiversity now days and during the last decade.

Perceptions (Out of the 60 respondents)	Respond	Number of respondents
Increased/ Decreased fish biodiversity	Decreased	12 (20%)
Increased/ Decreased fish production	Decreased	14 (23.34%)
Increased/ Decreased both fish production and fish biodiversity	Decreased	34 (56.67%)

During FGD, two agendas were similarly discussed with the participants including the major threats and its impact on the fish biodiversity of Chapai Beel. Participants in consensus pointed out some probable solutions with management strategies to enhance fisheries biodiversity and fish catch. (Table 06)

Key informant interviews

According to the statement of Key Informants, it was revealed that Chapai beel is an important habitat for most of all kinds of indigenous fishes; therefore, sanctuaries need to be set up to provide a safe refuge for the species, in particular during the breeding season. However, the biodiversity of resident species in studied Beel is gradually declining and different species of fish

that were abundant in Chapai Beel are now under great threat. Some of them are already extinct, some are threatened, and some are vulnerable. Study revealed that some native species are already extinct and it was found that Dhela (*Rohtee cotio*), Joiya (*Barilius bendelisis*), Piali (*Aspidoparia morar*), Chapila (*Gadusia chapra*), Gulsha (*Mystus cavasius*), Air (*Mystus aor*), Modho pabda (*Ompok pabda*), Kani pabda (*Ompok bimaculatus*), Borobaim (*Mastacembelus armatus*), Chitol (*Chitala chitala*), Golda (*Macrobrachium rosenbergii*), and Potka (*Tetraodon cutcutia*) etc. are not found nowadays in Chapai Beel. The study also indicated that while 41 native fish species have been identified, not all species are found to be of equal quantity. A major concern is the loss of biodiversity as water abstraction for agriculture, however, are threatening the ecosystem. Therefore, there is a need for a trade-off between managing Beel for biodiversity conservation and agricultural production.

Overall threat identification

Freshwater fish biodiversity in Bangladesh is under threat due to various anthropogenic and natural causes [13]. Major threats to the fisheries resources of Chapai Beel were subsequently identified and verified the impacts, to develop consequential conservation recommendations using the sustainable management approach presented in table 06. Therefore, this study provides a scientific basis of fish biodiversity status which would be useful for policy-makers to set priorities for Beel management in Bangladesh.

Table 6: Threats, Impacts and Recommendations.

SL	Threat	Impact	Recommendation
1	Sluice gates were commissioned in the river connected canal	Disrupts the water flow that may interrupt the migratory routes of fishes. It may have a detrimental effect on physical attributes and destruction of feeding & spawning ground.	•Maintain environmental flow in the Beel considering the aquatic biodiversity through adaptive management engaging the multi-stakeholder. •Sluice gate should be kept open during the monsoon especially the breeding season each year (April- mid July) to allow the water flow by which entering the natural riverine seedlings into the Beel.
2	Siltation in the connected canal (river to Beel)	Reduces the water depth & flow, which may affect the overall fish diversity to a large extent.	•Renovation/ re-excavation of river connecting canal under different developmental programs after a certain period of interval. Continuous water flows facilitate fish migration. •Fish habitat restoration is primarily on re-excitation with an appropriate slope & ensuring management of excavated soil.
3	Encroachment to water spread area due to new establishments and demand for agricultural land	Loss of water area which not only decreases the fish density but also greatly effects on the reproductive strategies of the fishes and their habit & habitats; eventually hazardous to the abundance and distribution of fish.	•Redefining Beel boundary based on ecosystem and in accordance with the ecological boundary is required to revert encroachment trends. •Government authorities should take necessary action as well as National strategies should be formulated for policy making, monitoring and implementation. •It is necessary to make a trade-off between Beel management for biodiversity conservation & agricultural production with the establishment of a Beel management committee.

			•Maintenance of minimum water depth (at least 1 m) during water extraction in dry season.
4	Unsafe agricultural activities practices (use of excessive chemical fertilizers, insecticides and pesticides) and pollution from the transboundary sources	Water pollution cause harm not only to the fish biodiversity but also the entire community of the ecosystem. Besides, increased turbidity of the water, creation of algal blooms, which effect many species. It could also negatively affect the spawning and feeding behavior of fishes.	•Rational use of chemical fertilizers, insecticides and pesticides. At the same time, encourage the introduction of integrated pest management by farmers (IPM). •Strong implementation of conservation laws and acts to make free from pollution. •Creating mass awareness among local people and their participation is must in controlling the water pollution.
5	Fishermen intension significant increase in fishing effort owing to not implementation of the legislations on fishing regarding the use of fishing gear, regulation of mesh size of nets, time of fishing and size of the catch	Overfishing leads to highly depletion of fish biodiversity and production, as well as recruitment failure by indiscriminate killing of gravid female & Juvenile fish.	•Fishing gears maintenance. •Enforcement of Govt. laws to stop destructive fishing. •Implementation of fishing ban period for 3-4 months during breeding season of resident fish species. •Special drive to conserve and multiply IUCN listed endangered fishes as well as introduce new SIS which are already extinct from the Beel. •Establishment of fish sanctuary in certain part of the Beel based on a community approach. Also introduce guarding system engaging the community. •Functional and need-based training related to the importance of fisheries diversity should be provided in order to increase awareness of protecting their own resource. •Arrangement of alternate livelihood options during lean/ban period, which can be done only by the help of eco-tourism. •Ecofriendly modern fishing technology should be implemented through local fisherman. •Breeding technologies of commercially important native species should be developed. •Stocking juvenile of indigenous species every year through Beel nursery management.
6	Absent of Fisherman Cooperative Societies	Destructive fishing due to no management which results in biodiversity degradation.	•Formation & Strengthening Fisherman Cooperative Societies. •Community based fisheries management policy should be

			taken up for effective and sustainable management.
7	Lack of financing for fishermen	Not developing as organized sector	•Easy Finance Schemes from Govt. credit agencies •Commercial Banks and other financial institution should come forward with collateral free special supervisory credit-program.
8	Climate change and associated effects	Loss of habitats due to water quality degradation, change in salinity, flood, drought etc.	•Mass awareness should be built to save the environment. •Sufficient forest trees should be planted around the border of the Beel and along the dike of the canal.
9	Priority to given cultures of fast growing non-resident species	Many native SIS are on the verge of extinction.	•Govt. should take the initiative for developing the breeding technologies of selective native SIS and bring them under production commercially. •Zero tolerance to new exotic fish introduction in the Beel.

Discussion

Bangladesh has rich in aquatic fish biodiversity with 265 freshwater fish species where minnows, catfish, eels, perch, gobies, clupeids and prawns constituted the major portion [14]. A rich diversity of fish fauna is contributing significantly to the ecology and sustainable productivity of the floodplains. During the monsoon, the floodplains of Bangladesh become integrated into a single biological productive system [15]. Total inland water bodies cover an area of about 4.6 million ha. Of the various resources in the domestic fishery, Beel has played an important role in fish production from time immemorial. The area of the Chapai Beel is about 84.86 ha which is very little compared to the total area of inland water bodies in Bangladesh but large in comparison to the other Beels. The area of the Beel spread out to several hectares during the monsoon. Carried out a study on the ecological aspect of Beel Kumari, Rajshahi with an average area of is about 500 ha [16]. A total of 76 fish species belonging to 26 families and 1 species of prawn were identified so far from the Beel. Conducted estimation of the abundance and diversity of Small Indigenous Species (SIS) of fish in the Chalan Beel [17]. A total of 82 SIS fish belonging to 10 orders, 22 families and 46 genera were recorded. Found 52 fish species in Shakla Beel (Brahmanbaria) belonging to 36 genera, 20 families and observed that thirty-three fish species were present in Rajdhala Beel [18-19]. Recorded a total of 40 fish species from Saldu Beel of Tangail [20]. Availability of exotic fishes in open or semi-open water bodies was also reported from the Kaptai Lake (the largest man-made lake of Bangladesh) and Saldu Beel of Tangail district respectively [20-21]. Found a total of sixty-three fish species including 55 indigenous and 8 exotic species inhabiting in the Halti Beel [22]. Three critically endangered, eleven endangered and eight vulnerable fish species of Bangladesh were also recorded in this water body. The total area of the water body is about 1012.5 ha (during monsoon) and 15.95 ha (during dry season). In the present study, a total of 47 species (including 6 exotic species) were identified. Of the 47 species, 41 were indigenous species belonging to 17 fish families, 12 different common groups and 32 fish genera; of which 25 were SIS and the remaining 16 were large fish. The highest number of fish species was under the Cyprinidae family representing 15 species. In the studied Beel, 6 threatened fish species were identified, of which 4 species were found as Vulnerable (VU), 2 species as Endangered (EN), however, Critically Endangered (CR) were not recorded. From the study, it was found that presently Dhela, Joiya, Piali, Chapila, Gulsha, Air, Modho pabda, Kani pabda, Borobaim, Chitol, Golda and Potka etc. are not found in Chapai Beel. The study also indicated that while 41 native fish species have been identified, not all species are found to be of equal quantity. Albeit Chapai Beel is an important habitat for most of all kinds of indigenous fishes but the biodiversity of resident species in studied Beel are gradually declining due to environmental degradation, siltation, irrigation, a significant increase in fishing effort, encroachment of water spread area due to the demand of land, priority to given non-resident fast-growing culture species, and many other causes. Reported similar threats to the fish diversity of inland waters of Bangladesh [23]. Identified the similar causes for the reduction of species in the inland waters of Bangladesh [24-30]. Likewise, indiscriminate catching of gravid female & juvenile fish, water flow reduction, modification and loss of fish habitat, are also reflected as major threats for declining freshwater species diversity [31-33].

Conclusion

The study indicates that there is noticeable decline of fish species during the last decade. It can be concluded that the

biodiversity of Beel fisheries of Bangladesh has become ultimate threat in recent years and undergoing critical stage than earlier time. Due to diversified reasons, many species of fishes are disappearing from our water bodies and the day is not far where many native species will be a picture on the pages of the book, but will not really be the national fishery of Bangladesh. This is the high time to address the biodiversity of native fish – Bangladesh's pride, heritage and livelihoods before they are lost forever. Each of the Beel has their own biological, environmental and social characteristics. Local management approach should be developed because biodiversity of an area closely related with the local people livelihood. Hence, there is a great need for scientific management to utilize the Beel fisheries to its potential and sustainable level. The data generated in the present study would help to evolve appropriate strategies for sustainable development of fisheries resources in Chapai Beel. In Chapai Beel there is no Governmental and non-governmental survey conducted before. Long term studies on biodiversity, fishing gears and socio-economic condition are much essential to know the changes in the biodiversity and socio-economic development of the fisher community for better and sustainable Beel fishery management.

Conflict of Interest

None to declare.

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