

Present Status of Fish Biodiversity in Dekhar *Haor*, Bangladesh: a Case Study

¹Debasish Pandit, ¹Mrityunjoy Kunda, ¹Ahmed Harun-Al-Rashid,
¹Md. Abu Sufian and ^{1,2}Sabuj Kanti Mazumder

¹Department of Aquatic Resource Management,
Sylhet Agricultural University, Sylhet-3100, Bangladesh

²School of Environmental and Natural Resource Sciences,
Faculty of Science and Technology, University Kebangsaan Malaysia,
43600 UKM Bangi Selangor, D.E., Malaysia

Abstract: The study was conducted to identify the present status of fish biodiversity in Dekhar *Haor* of Sunamganj for a period of 11 months from June 2013 to April 2014. It was done by questionnaire interviews (QI) of fishers, focus group discussions (FGD), key informant interviews (KII) and secondary data collection. During the study period, a total of 84 fish species under 30 families were recorded where 65 species under 23 families were found available in the study area and 19 species disappeared by last 10-15 years. The species availability status was remarked in four categories and obtained as 26 commonly available, 18 moderately available, 21 rarely available and 19 not available species. Among the available species, 9 of carps, 16 of catfishes, 10 of barbs and minnows, 1 of clupeid, 4 of snakeheads, 4 of eels, 11 of perches, 1 of featherback, 3 of loaches and other miscellaneous 6 species including 3 species of prawns were found. The highest abundance of fishes was catfish (24.62%). Highest number of commonly available species (26) was found in October to December and lowest number of commonly available species (7) was observed in April. Among 54 threatened fish species listed by IUCN Bangladesh, about 37 species were found 10-15 years ago in the *Haor* but only 24 were found during the study period. It is revealed that there has been gradual reduction of fish diversity in the Dekhar *Haor* area that is from the earlier 84 species to present 65 species (22.62% declined). Average fish catch per fisherman per day was also reduced from 8.35 kg to 1.4 kg in the Dekhar *Haor* within 10-15 years. Community based fisheries management, fishing gears maintenance, sanctuary establishment and management, implementation of fish acts and regulations, stocking of fish fingerling in the open waters, dredging of beels and raising public awareness can play a great role in conserving fish biodiversity.

Key words: Biodiversity • Dekhar *Haor* • Fisherman • Questionnaire Interview and FGD

INTRODUCTION

Aquatic biodiversity has enormous economic and aesthetic value and is largely responsible for maintaining and supporting overall environmental health [1]. Bangladesh is enriched with its aquatic biodiversity containing 260 species of indigenous freshwater finfish belonging to 55 families (placing Bangladesh third in the world in terms of fish species per land area), 150 species

of water fowls, 50 species of reptiles, 24 species of mammals, 19 species of amphibians, 63 species of palaemonid and prawns [2, 3]. Moreover, 15 species of exotic fish, 25 species of edible tortoise and turtles and 17 species of crabs, freshwater mussels and snails have diversified total fishery resources of the country [4]. IUCN Bangladesh [5] revealed 54 threatened freshwater fish species in Bangladesh, of which 12 are critically endangered, 28 endangered and 14 are vulnerable. It is

Corresponding Author: S.K. Mazumder, Department of Aquatic Resource Management,
Faculty of Fisheries, Sylhet Agricultural University, Sylhet-3100, Bangladesh.
Tel: +88-01717386047 / +601111918136.

important to know the present status of fish biodiversity for efficient and rational management of this valuable resource.

Haors are defined as saucer or bowl shaped shallow depressions covering about 25% of the North-Eastern part of Bangladesh. *Haor* is a mosaic of aquatic habitats including rivers, streams and irrigation canals, large area of seasonally flooded cultivated plains and combination of hundreds of inter-connected *beels* [6]. There are altogether 411 *haors* comprising an area of about 8000 km² dispersed in the districts of Sunamganj, Sylhet, Moulvibazar, Hobiganj, Netrakona, Kishoreganj and Brahmanbaria [7]. In greater Sylhet, the most prominent *haors* are Saneer *Haor*, Hail *Haor*, Hakaluki *Haor*, Dekhar *Haor*, Maker *Haor*, Chayer *Haor*, Tanguar *Haor* and Kawadighi *Haor* [8].

Haor region of Bangladesh is blessed with huge potential of fisheries resources. There are vast floodplains along with some perennial waters in the deeper portion of the *haor* basin playing a vigorous role to supply huge amount of natural fish during pre-monsoon, monsoon, post-monsoon and dry periods. *Haors* provide spawning, nursing, feeding grounds for numerous fish species. The *haor* region comprises a wide variety of finfish including 143 indigenous and 12 exotic species along with several species of freshwater prawns [9].

Dekhar *Haor* is one of the most important *haors* in Bangladesh. It lies between latitude 24°34'N to 25°12'N and longitude 90°56'E to 91°49'E. The *Haor* covers four upazilas namely Sunamganj Sadar, Dakshin Sunamganj, Dowarabazar and Chhatak under the Sunamganj district. Total area of the *Haor* is about 11514.6 hectares. Dekhar *Haor* is made up of 36 small, medium and large interconnecting *beels*, canals, rivers and crop lands. In monsoon, the *Haor* is looked like an inland sea with full of water but in dry season it becomes almost dry except some deeper *beels* [10]. It is the home of many species of freshwater fishes and thousands of indigenous birds. This *Haor* is also a harbor of non-fish organisms like snails, mussels and different types of aquatic vegetation. Limited numbers of swamp trees are present in this area [10]. There is a great importance of this *Haor* in fish production, maintaining biodiversity, meeting local and regional demand and it also serve as the good source of fish seed supply for other adjacent water bodies. Now the *Haor* is gradually silted up due to flash floods and other manmade causes. Overfishing is a common practice in this area [10]. At this situation, research work is very

necessary to understand the core problems of the *Haor* and thereby keep the proper management steps. Before undertaking any fisheries management tools, the fish diversity in the water must be known [11], but there is a lack of published reports on its fish biodiversity and their ecological status. This is why the study was carried out to know the present status of fish biodiversity in the Dekhar *Haor*. Considering the above facts and situations the following the present study was carried out. Thus the objectives are to assess the present status of fish biodiversity and also to identify the changes in fish biodiversity in the Dekhar *Haor*, Bangladesh.

MATERIALS AND METHODS

Dekhar *Haor* was selected for the present study because it is one of the largest and most important *haors* in Bangladesh. As part of the research, a survey for a period of 11 months from June 2013 to April 2014 was conducted only a part of Dekhar *Haor* under Dakshin Sunamganj upazila (Fig. 1).

The study was based on field survey method where an appropriate questionnaire was prepared and used for collecting data from 7 villages namely Joykalash, Chandrapur, Islampur, Sultanpur, Enatnagar, Parbotipur and Noyagoan surrounding Dekhar *Haor* under Dakshin Sunamganj upazila. During collection of data, both primary and secondary sources were considered to interpret the results.

Primary data were collected from 80 randomly selected fishermen through questionnaire interviews (QI) and focus group discussions (FGD) where Upazila Fisheries Officer (UFO), union parishad chairman & members, leaders of the fisher community, fish market leaders, fish traders, fry traders and community people were also present. The secondary information were collected from Dakshin Sunamganj upazila fisheries office, district fisheries office of Sunamganj, projects of World Fish in Sunamganj, books, journals and theses. After collecting data, it was cross-checked through key informant interviews (KII) with Upazila Fisheries Officer (UFO), District Fisheries Officer (DFO), school teachers, local leaders and NGO workers in the study area. Finally data were analyzed by using Microsoft office excels 2010 and SPSS statistical software (20 version). Tables, pie-charts, cylinder diagram etc. were used for presentation of results.

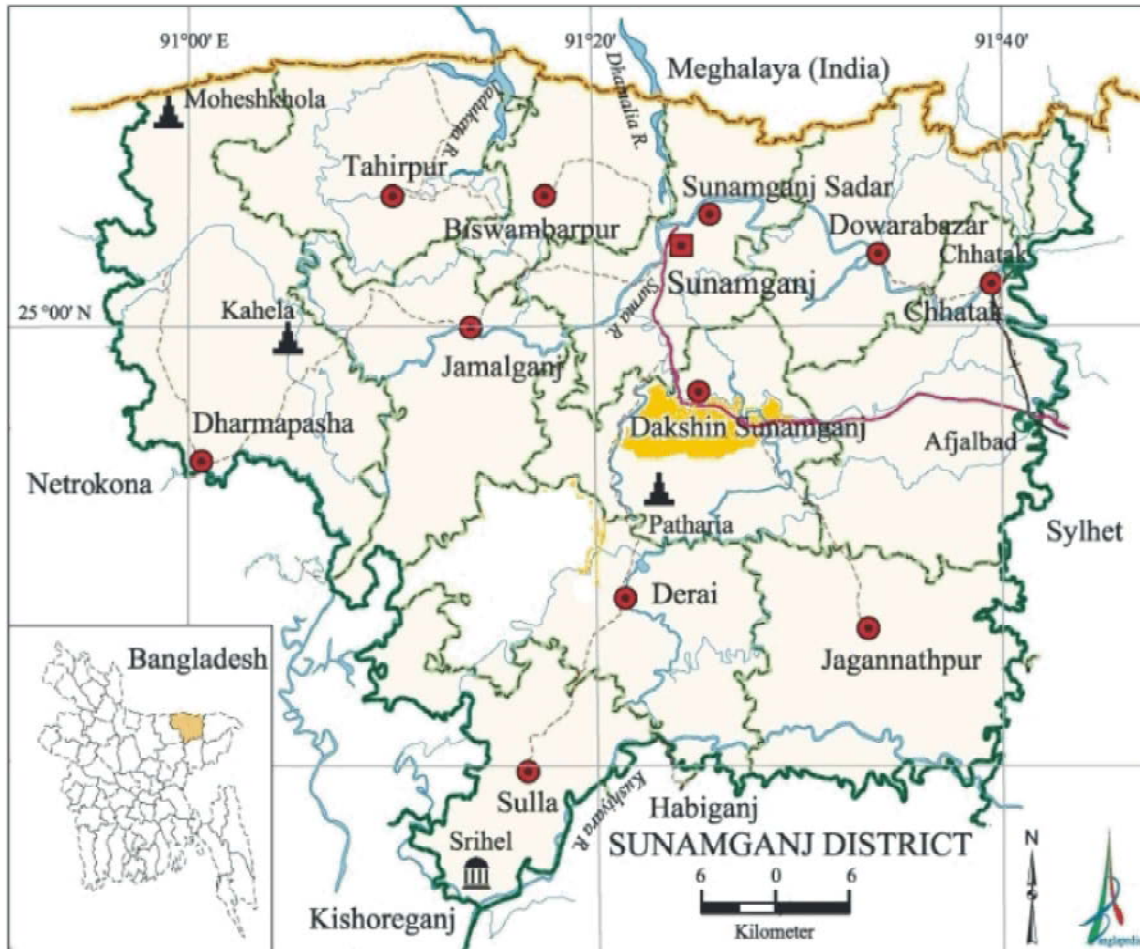


Fig. 1: Location of the study area marked with the gold color in the Sunamganj district map

RESULTS AND DISCUSSION

Present Status of Biodiversity of Fishes in the Dekhar Haor:

According to the availability of fish species, fish biodiversity were categorized into 4 groups like commonly available (CA), moderately available (MA), rarely available (RA) and not available (NA) species. The IUCN categories of the fishes were critically endangered (CR), endangered (EN), vulnerable (VU), not threatened (NO), data deficient (DD) and exotic (EX) species. According to the statement of local fishermen, a total of 84 fish species under 30 families were recorded, where 65 species under 23 families were found available during the period of investigation and 19 species were not available in the study area. These were included carps, catfishes, barbs and minnows, clupeids, snakeheads, perches, eels and other miscellaneous fish species which are discussed below:

Carps: During the period of present investigation, 12 species of carps were recorded where 3 species were inexistent in recent years (Table 1). Among them Rohu, Carpio & Kalibaush were commonly available and Catla, Mrigal, Grass Carp & Silver Carp were moderately available species. On the other hand, Goniya and Bata were rarely available species and Lachu, Nanid, Mohashol were not found during the study period, but according to the statement of the respondents, these species were commonly available 20 years back.

Catfishes: Twenty four species of catfishes were documented from the perception fishermen in the Dekhar Haor area whereas 8 species were not available during the study period (Table 2). Among different types of catfishes Bujuri, Tengra, Boal, Modhu Pabda, Pabda, Magur & Shing were commonly available species whereas Golsha & Kani Pabda were moderately available species.

Table 1: A list of carp species as recorded during the period of present study

Sl. No.	Family	Local Name	Common Name	Scientific Name	Remarks	IUCN Status
1	Cyprinidae	Catla	Indian Major Carp	<i>Catla catla</i>	MA	NO
2	Cyprinidae	Rohu	Indian Major Carp	<i>Labeo rohita</i>	CA	NO
3	Cyprinidae	Mrigal	Indian Major Carp	<i>Cirrhinus cirrhosus</i>	MA	NO
4	Cyprinidae	Carpio	Common Carp	<i>Cyprinus carpio</i>	CA	EX
5	Cyprinidae	Goniya	Kuria Labeo	<i>Labeo gonius</i>	RA	EN
6	Cyprinidae	Grass Carp	Grass Carp	<i>Ctenopharyngodon idella</i>	MA	EX
7	Cyprinidae	Kalibaush	Black Rohu	<i>Labeo calbasu</i>	CA	EN
8	Cyprinidae	Silver Carp	Silver Carp	<i>Hypophthalmichthys molitrix</i>	MA	EX
9	Cyprinidae	Bata	Minor Carp	<i>Labeo bata</i>	RA	EN
10	Cyprinidae	Lachu	Reba Carp	<i>Cirrhinus reba</i>	NA	VU
11	Cyprinidae	Nanid	Nandi Labeo	<i>Labeo nandina</i>	NA	CR
12	Cyprinidae	Mohashol	Tor Mahseer	<i>Tor tor</i>	NA	CR

Table 2: A list of catfishes as recorded during the present study.

Sl. No.	Family	Local Name	Common Name	Scientific Name	Remarks	IUCN Status
1	Bagridae	Golsha	Long Whiskered Catfish	<i>Mystus cavasius</i>	MA	VU
2	Bagridae	Bujuri	Long Bled Catfish	<i>Mystus tengra</i>	CA	NO
3	Bagridae	Rita	Rita	<i>Rita rita</i>	RA	CR
4	Bagridae	Tengra	Striped Dwarf Catfish	<i>Mystus vittatus</i>	CA	NO
5	Bagridae	Ayre	Long Whiskered Catfish	<i>Mystus aor</i>	RA	VU
6	Bagridae	Gagla	Menoda Catfish	<i>Hemibagrus menoda</i>	RA	NO
7	Schilbeidae	Gharua	Gharua Bacha	<i>Clupisoma garua</i>	RA	CR
8	Schilbeidae	Batashi	Indian Potasi	<i>Pseudeutropius atherinoides</i>	RA	NO
9	Schilbeidae	Bacha	Batchwa Bacha	<i>Eutropiichthys vacha</i>	NA	CR
10	Schilbeidae	Kajoli	Gangetic Ailia	<i>Ailia coilia</i>	RA	NO
11	Schilbeidae	Shilon	Silond Catfish	<i>Silonia silondia</i>	NA	EN
12	Siluridae	Boal	Freshwater Shark	<i>Wallago attu</i>	CA	NO
13	Siluridae	Modhu Pabda	Butter Catfish	<i>Ompok pabda</i>	CA	EN
14	Siluridae	KaniPabda	Indian Butter Catfish	<i>Ompok bimaculatus</i>	MA	EN
15	Siluridae	Pabda	Pabo Catfish	<i>Ompok pabo</i>	CA	EN
16	Pangasidae	Pangus	Indigenous Pungus	<i>Pangasius pangasius</i>	NA	CR
17	Pangasidae	Thai Pangus	Sutchi Catfish	<i>Pangasius hypophthalmus</i>	RA	EX
18	Chacidae	Chaka	Indian Chaca	<i>Chaca chaca</i>	NA	EN
19	Sisoridae	Gang Tengra	Clown Catfish	<i>Gagata chenia</i>	NA	NO
20	Sisoridae	Baghair	Gangetic Goonch	<i>Bagarius yarrellii</i>	NA	CR
21	Plotosidae	Gang Magur	Canine Catfish	<i>Plotosus canius</i>	NA	VU
22	Clariidae	Magur	Walking Catfish	<i>Clarius batrachus</i>	CA	NO
23	Heteropneustidae	Shing	Stinging Catfish	<i>Heteropneustes fossilis</i>	CA	NO
24	Olyridae	Bot Shingi	Himalayan Olyra	<i>Olyralongicaudata</i>	NA	DD

Table 3: A list of barbs and minnows as recorded during the period of study.

Sl. No.	Family	Local Name	Common Name	Scientific Name	Remarks	IUCN Status
1	Cyprinidae	Chela	Finescale Razorbelly Minnow	<i>Chela phulo</i>	RA	NO
2	Cyprinidae	Mola	Carplet	<i>Amblypharyngodon mola</i>	MA	NO
3	Cyprinidae	Dhela	Cotio	<i>Osteobrama cotio</i>	RA	EN
4	Cyprinidae	Darkina	Flaying Barb	<i>Esomus danricus</i>	MA	DD
5	Cyprinidae	Tit Punti	Ticto Barb	<i>Puntius ticto</i>	CA	VU
6	Cyprinidae	Teri Punti	One Spot Barb	<i>Puntius terio</i>	CA	NO
7	Cyprinidae	Jat Punti	Spot Fin Swamp Barb	<i>Puntius sophore</i>	CA	NO
8	Cyprinidae	Shar Punti	Olive Barb	<i>Puntius sarana</i>	RA	CR
9	Cyprinidae	Raj Punti	Java Barb	<i>Puntius gonionotus</i>	MA	EX
10	Cyprinidae	Kosa Punti	Cosuat Barb	<i>Puntius cosuatis</i>	NA	NO
11	Cyprinodontidae	Pach Chokha	Top Minnow	<i>Aplocheilichthys panchax</i>	CA	NO

Similarly Rita, Ayre, Gagla, Gharua, Batasi, Thai Pangus & Kajoli were rarely available species and Bacha, Shilon, Deshi Pangus, Chaka, Gang Tengra, Baghair, Gang Magur & Bot Shingi were not found during the study period.

Barbs and Minnows: In the present investigation, 11 barbs and minnows were listed in the study area, where one species (Kosa Punti) was not available but Tit Punti, Teri Punti, Jat Punti & Pach Chokha were commonly available species (Table 3). Three species such as Mola, Darkina & Raj Punti were moderately available species but Chela, Dhela, & Shar Punti were rarely available in the study area.

Clupeids: In case of clupeids, 3 species such as Chapila, Kachki & Ilish were available in recent years but only Chapila were found during the study (Table 4).

Snakeheads: Different species of snakeheads were present in the study area, where 2 species such as Taki & Shol were commonly available. Cheng & Gozar were moderately available and rest one species Pipla Shol disappeared many years ago (Table 5).

Eels: During the study period, 5 species of eels were identified by the fishermen where Bamosh was not available species (Table 6). Guchi Baim & Tara Baim were frequently available during catching fishes whereas Baro Baim & Cuchia were moderate in availability.

Perches: There were 13 species of perches recorded from the study area, where 2 species became inexistent in recent years. There were 5 commonly available, 2 moderately available and 4 rarely available species (Table 7).

Featherbacks: During the present investigation, 2 featherback species were recorded (Table 8). Among them, Foli was moderately available species and Chital was not available during the study period.

Loaches: Three species of loaches were recorded from the Dekhar Haor during study period, where Gutum was commonly available. On the other hand, Bou Rani was moderately available and Maitta Rani was rarely available species (Table 9).

Miscellaneous Fish Fauna: During study period, 3 miscellaneous fish species and 3 species of prawn were recorded from the Dekhar Haor (Table 10). Among them, Kakila & Ekthute were rarely available species and Potka was moderately available species. Among prawn species, Kalo Icha and Sada Icha were commonly available and Golda was rarely available species.

From the present survey, it was found that 26 species were commonly available, 18 species were moderately available, 21 species were rarely available and 19 species were not available. In percentage, there were 31% commonly available, 21% moderately available, 25% rarely available species of fishes whereas 23% fish species were

Table 4: A list of clupeids as recorded during the period of study

Sl. No.	Family	Local Name	Common Name	Scientific Name	Remarks	IUCN Status
1	Clupeidae	Chapila	Indian River Shad	<i>Gadusia chapra</i>	RA	NO
2	Clupeidae	Kachki	Ganga River Sprat	<i>Corica soborna</i>	NA	NO
3	Clupeidae	Ilish	Indian River Shad	<i>Tenualosa ilisha</i>	NA	NO

Table 5: A list of snakeheads as recorded during the period of study

Sl. No.	Family	Local Name	Common Name	Scientific Name	Remarks	IUCN Status
1	Channidae	Taki	Spotted Snakehead	<i>Channa punctatus</i>	CA	NO
2	Channidae	Cheng	Asiatic Snakehead	<i>Channa orientalis</i>	MA	VU
3	Channidae	Shol	Snakehead Murrel	<i>Channa striatus</i>	CA	NO
4	Channidae	Gozar	Giant Snakehead	<i>Channa marulius</i>	MA	EN
5	Channidae	Pipla Shol	Barca	<i>Channa barca</i>	NA	CR

Table 6: A list of eels as recorded during the period of study

Sl. No.	Family	Local Name	Common Name	Scientific Name	Remarks	IUCN Status
1	Mastacembelidae	Guchi Baim	Striped Spiny Eel	<i>Macragnathus pancalus</i>	CA	NO
2	Mastacembelidae	Tara Baim	One Striped Spiny Eel	<i>Macragnathus aculeatus</i>	CA	VU
3	Mastacembelidae	Baro Baim	Two-track Spiny Eel	<i>Mastacembelus armatus</i>	MA	EN
4	Anguillidae	Bamosh	Indian Longfin Eel	<i>Anguilla bengalensis</i>	NA	VU
5	Sybranchidae	Cuchia	Gangetic Mud Eel	<i>Monopterusuchia</i>	MA	VU

Table 7: A list of perches as recorded during the period of study.

Sl. No.	Family	Local Name	Common Name	Scientific Name	Remarks	IUCN Status
1	Anabantidae	Baro Khalisha	Striped Gourami	<i>Colisa fasciatus</i>	CA	NO
2	Anabantidae	Lal Khalisha	Dwarf Gourami	<i>Colisa lalia</i>	RA	NO
3	Anabantidae	Chota Khalisha	Honey Gourami	<i>Colisa chuno</i>	CA	NO
4	Anabantidae	Koi	Climbing Perch	<i>Anabas testudineus</i>	CA	NO
5	Ambassidae	Lamba Chanda	Elongated Glass Perchlet	<i>Chanda nama</i>	MA	VU
6	Ambassidae	Lal Chanda	Indian Glass Perchlet	<i>Parambassis lala</i>	RA	EN
7	Ambassidae	Gol Chanda	Indian Glass Fish	<i>Parambassis ranga</i>	CA	VU
8	Cichlidae	Tilapia	Mozambique Tilapia	<i>Oreochromis mossambicus</i>	RA	EX
9	Gobiidae	Bele	Bar Eyed Goby	<i>Glossogobius giuris</i>	MA	NO
10	Gobiidae	Nuna Bele	Bumblebee Goby	<i>Brachygobius nusus</i>	NA	NO
11	Pristolepidae	Napit Koi	Blue Perch	<i>Badis badis</i>	NA	EN
12	Nandidae	Meni	Mud Perch	<i>Nandus nandus</i>	CA	VU
13	Mugilidae	Khorsula	Corsula Mullet	<i>Rhinomugil corsula</i>	RA	NO

Table 8: Featherbacks as recorded during the period of study

Sl. No.	Family	Local Name	Common Name	Scientific Name	Remarks	IUCN Status
1	Notopteridae	Chital	Humped Featherback	<i>Notopterus chitala</i>	NA	EN
2	Notopteridae	Foli	Bronze Featherback	<i>Notopterus notopterus</i>	MA	VU

Table 9: A list of loaches as recorded during the period of study

Sl. No.	Family	Local Name	Common Name	Scientific Name	Remarks	IUCN Status
1	Cobitidae	Gutum	Guntea Loach	<i>Lepidocephalichthys guntea</i>	CA	NO
2	Cobitidae	Bou Rani	Bengal Loach	<i>Botio dario</i>	MA	EN
3	Cobitidae	Maitta Rani	Hora Loach	<i>Botia dayi</i>	RA	DD

Table 10: A list of miscellaneous fish species as recorded during the period of study

Sl. No.	Family	Local Name	Common Name	Scientific Name	Remarks	IUCN Status
1	Tetraodontidae	Potka	Ocellated Puffer fish	<i>Tetraodon cutcutia</i>	MA	NO
2	Belontiidae	Kakila	Fresh Water Gar Fish	<i>Xenentodon cancila</i>	RA	NO
3	Hemiramphidae	Ekthute	Congaturi Halhbeak	<i>Hyporhamphus limbatus</i>	RA	NO
4	Palaemonidae	Kalo Icha	Monsoon River Prawn	<i>Macrobrachium malcolmsonii</i>	CA	NO
5	Palaemonidae	Sada Icha	Prawn	<i>Macrobrachium</i> sp.	CA	NO
6	Palaemonidae	Golda	Prawn	<i>Macrobrachium rosenbergii</i>	RA	NO

not available during the study period explained by the respondents (Fig. 2). During the study, one quarter part of the fishes was rarely available that fishes were found only one or two times in the *Haor*. The local fishermen described them as they would be disappeared very soon.

During the period of study, total 65 species of fish fauna under 23 families including prawn species were available in the study area. Among them, 9 species of carps, 16 species catfishes, 10 species of barbs and minnows, 1 species of clupeid, 4 species of snakeheads, 4 species of eels, 11 species of perches, 1 species of featherback, 3 species of loaches and other miscellaneous 6 species were found including 3 species of prawns with varying level of availability. The *haor* region comprises a wide variety of finfish including 143 indigenous and 12 exotic species along with several species of freshwater prawns [9]. Nuruzzaman [12] recorded 141 species of fish from the Tanguar *Haor* in Sunamganj district. Mahalder

and Mustafa [13] recorded 126 fish species from 39 families in the Sunamganj *haor* area during 2008 to 2010 that clearly indicate higher fish diversity than the present study.

Among 65 available fish species, the highest percentage of fishes was catfishes (24.62%) and the lowest were clupeids (1.54%) and featherbacks (1.54%). Among other groups, there were 16.92% perches, 15.38% barbs and minnows, 13.85% carps, 6.15% snakeheads as well as eels, 4.62% loaches and 9.23% other miscellaneous fish species (Fig. 3).

Haroon *et al.* [14] identified a total of 92 species of fish and prawn from Sylhet-Mymensingh sub-basin. They found the dominance of barbs, catfishes and major carps in the Sylhet sub-basin. Catfishes are dominant in many water bodies because they can survive in low water depth and adverse environmental conditions. It is similar with the findings of the present study.

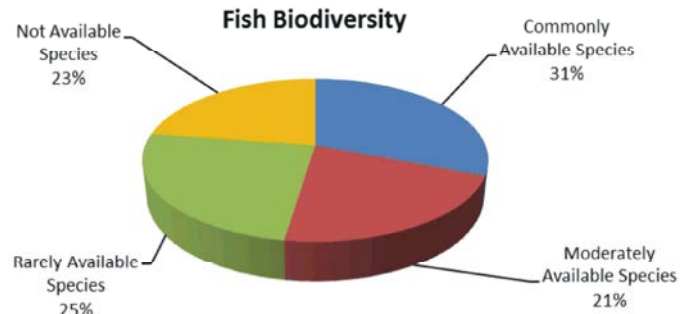


Fig. 2: Present status of fish biodiversity in the Dekhar Haor

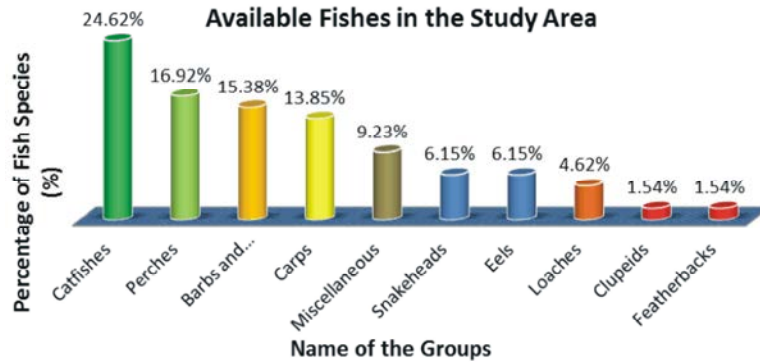


Fig. 3: Different types of fish groups recorded during the period of study

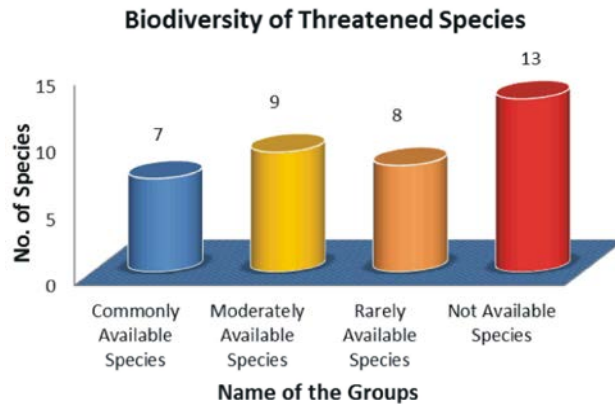


Fig. 4: Present status of threatened fish species in the study area

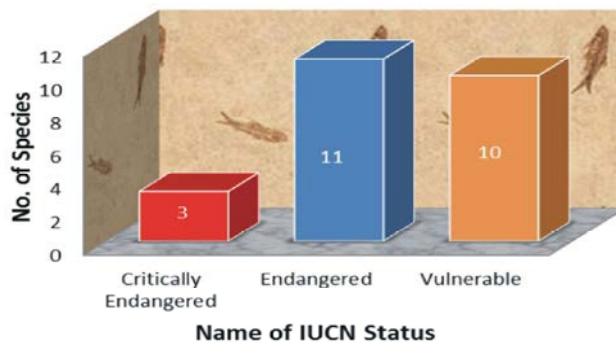


Fig. 5: IUCN status of threatened fish species found during study

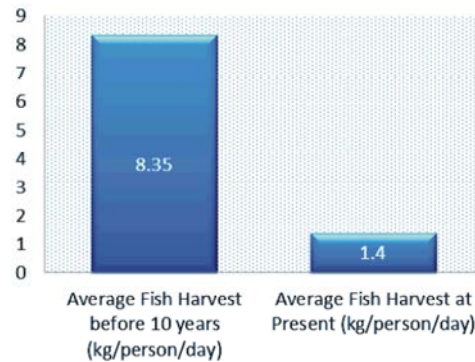


Fig. 6: Changes in the harvesting of fish per fisherman per day in the study area

Table 11: Changes in fish availability in Dekhar Haor

Name of the Groups	No. of Available Fish Species before 10-15 Years	No. of Available Fish Species at Present
Carps	12	9
Catfishes	24	16
Barbs and Minnows	11	10
Clupeids	3	1
Snakeheads	5	4
Eels	5	4
Perches	13	11
Feather backs	2	1
Loaches	3	3
Miscellaneous	6	6
Total	84	65 (22.62% loss)

Biodiversity Status of Threatened Fish Species: Among 54 threatened fish species listed by IUCN Bangladesh [5], about 37 species were found 10-15 years ago in the study area but only 24 species were found during the study period. Out of 24 species, 7 species were found commonly available, 9 species were moderately available and 8 species were rarely available (Fig. 4). The IUCN status of these threatened species were 3 critically endangered, 11 endangered and 10 vulnerable (Fig. 5).

More than 100 fish species were available in the Hakaluki Haor where one third of which was listed as threatened [17]. A total of 107 fish species were found in the Hakaluki Haor area [18]; among them 32 species were threatened, of which 12 were vulnerable, 16 were endangered and 4 were critically endangered [5]. All of these studies support present study.

Changes in Fish Availability in the Dekhar Haor:

According to the statement of local fishermen, 10-15 years ago Dekhar Haor was rich with about 84 species of fishes which included carps (12), catfishes (24), barbs and minnows (11), clupeids (3), snakeheads (5), eels (5), perches (13), featherbacks (2), loaches (3) and other miscellaneous (6) (Table 12). Fishermen were then

satisfied about their everyday catch from the Haor. During the present study period, it was found only 65 species of fishes in the Haor.

It is revealed that there has been gradual reduction in the fish diversity in the Haor that is from the earlier recorded 84 species to present 65 species in the Dekhar Haor (22.62% declined) (Table 11). A survey conducted during 1993 in the Hakaluki Haor counted 107 fish species whereas the number decreased to 75 species in 2009 [19]. This situation reflects the current scenario of fishes in haors of Bangladesh that fish biodiversity is rapidly decreasing.

Average fish catch per fisherman per day has been reduced from 8.35 kg to 1.4 kg from the Dekhar Haor within 10-15 years (Fig. 6). It was clearly indicated that not only numbers of fish species were reduced but also harvest was declined in the study area.

CONCLUSION

Haor region is generally considered as a highly diversified zone of Bangladesh mainly for its rich aquatic biodiversity. According to the statement of the respondent fishermen, the diversity of fishes in the

Dekhar *Haor* was very rich before 10-15 years. It was observed that total fish biodiversity was reducing drastically where about 19 available fish species became unavailable in the study area within 10-15 years. It was reported by the respondent fishers that the availability of fish has been declining due to various manmade and natural reasons. Main reasons for declining fish diversity were siltation, fishing by complete dewatering, indiscriminate fishing, use of illegal fishing gears, use of katha fishing method, use of chemical fertilizers, use of insecticides and pesticides in agriculture, drought in summer, making obstacle in natural movement of fishes through infrastructures etc. However, a total of 65 fish species belonged to 23 families have remained left in Dekhar *Haor* that need to be conserved. Community based fisheries management, fishing gears maintenance, sanctuary establishment and management, implementation of fish acts and regulations, stocking of fish fingerling and raising public awareness can play a great role in conserving fish biodiversity in the *Haor*. The government, NGO, national and international donors should come forward for a wider study on the fish biodiversity of the *Haor*. Besides, counter and random survey are suggested to assess the fish diversity status for proper management and conservation of this potential natural resource of Bangladesh.

ACKNOWLEDGEMENT

Authors are deeply thankful to Bangladesh Fisheries Research Forum (BFRF) for funding to carry out the study.

REFERENCES

- Hossain, M., 2012. Biodiversity of Threatened Fish Species of Choto Jamuna River in Badalgachhi Area under Naogaon District. MS Thesis, Department of Fisheries Management, Bangladesh Agricultural University, Mymensingh, pp: 30-53.
- Ali, M.Y., 1991. Towards Sustainable Development of Fisheries Resources of Bangladesh. IUCN and BRAC, Dhaka.
- World Bank, 1991. Bangladesh Environmental Strategy Review. World Bank, Washington DC. USA.
- Rahman, A.K.A., 1989. Freshwater Fishes of Bangladesh. Zool. Soc. Bangladesh, Dhaka.
- IUCN Bangladesh, 2000. Red Book of Threatened Fishes of Bangladesh. IUCN-The World Conservation Union, International Union for Conservation of Nature (IUCN) Bangladesh.
- Hussain, M.G. and Salam, 2007. Basic Service Delivery Advocacy: Review Report, Development Wheel (Dew), Dhaka.
- BHWDB (Bangladesh Haor and Wetland Development Board), 2011. Ministry of Water Resources, Government of the People's Republic of Bangladesh, Dhaka.
- Hossain, M.A.R., 2014. An Overview of Fisheries Sector of Bangladesh. Res. Agric., Livest. Fish., 1(1): 109-126.
- BHWDB (Bangladesh Haor and Wetland Development Board), 2012. Master Plan of Haor Area: Volume 1, Summary Report. Ministry of Water Resources, Government of the People's Republic of Bangladesh, pp: 18.
- CNRS (Center for Natural Resource Studies), 2004. Management of Aquatic Ecosystems through Community Husbandry. Feasibility Report on MACH (Management Of Aquatic Ecosystems through Community Husbandry) Outreach Program, pp: 10.
- Huda, A.T.M.N., M.S. Shah, A.F.M. Hasanuzzaman and M.R. Azam, 2009. An investigation on the ichthyofauna of the Gorai-Modhumati River system. Bangladesh J. Zool., 37(1): 11-24.
- Nuruzzaman, A.K.M., 1997. Inland Fisheries Resources of Bangladesh: Its Management and Development Strategies. Paper Presented at the Seminar on Fisheries Resources of Bangladesh at the Department of Zoology, University of Dhaka, pp: 30.
- Mahalder, B. and M.G. Mustafa, 2013. Introduction to Fish Species Diversity: Sunamganj Haor Region within CBRMP's Working Area. Community Based Resource Management Project-LGED, World fish, Dhaka, Bangladesh.
- Haroon, A.K.Y., G.C. Halder, S. Rahman, M.A. Razzaquee, M. Alam and S.M.N. Amin, 2002. Sylhet-Mymensingh Basin Fish Stock Assessment. Final Report, Bangladesh Fisheries Research Institute (BFRI), Riverine Station, Chandpur, Bangladesh, pp: 81.
- Ahmed, N., 1997. Marketing of Fish from Selected Floodplains in Bangladesh. In: Open Water Fisheries of Bangladesh. The University Press Limited, Dhaka-1000, pp: 72.

16. Thilsted, S.H., N. Roos and N. Hasan, 1997. The Role of Small Indigenous Fish Species in Food and Nutrition Security in Bangladesh. Naga News Letter, July-Dec., pp: 13.
17. Choudhury, J.K. and A.M. Faisal, 2005. Plant Resources of Haors and Floodplains; an Overview. IUCN-The World Conservation Union. Bangladesh Country Office, Dhaka.
18. ICNRS (Center for Natural Resource Studies), 2002. Bio-physical and Socio-economic Characterization of Hakaluki Haor: Steps towards Building Community Consensus on Sustainable Wetland Resource Management. IUCN-Netherlands Small Grants for Wetlands Program, Dhaka, Bangladesh.
19. IPAC (Integrated Protected Area Co-management), 2009. RRA/PRA Findings of Hakaluki Haor, Bangladesh.