J. Sylhet Agril. Univ. 4(1):111-120, 2017 ISSN: 2308-1597

FISHING GEARS AND THEIR EFFECTS ON FISH DIVERSITY OF DEKAR *HAOR* IN SUNAMGONJ DISTRICT

M Mia, M S Islam*, N Begum, I N Suravi and S Ali

Department of Coastal and Marine Fisheries, Sylhet Agricultural University, Sylhet-3100, Bangladesh

(Available online at: www.jsau.com.bd)

Abstract

The study was carried out to assess the fishing gears used, their catch composition and their effect on fish diversity in Dekar *haor* of Sunamganj district from September 2015 to August 2016. A total of 20 types of fishing gears under nets, traps, hooks and lines, wounding gear and fish aggregating devices were recorded during study period. Considering fishing nets the highest and the lowest CPUE (kg gear^{-1}day^{-1}) were 4.67 (*ber jal*) and 1.56 (*thela jal*), respectively. Of the traps, the highest and the lowest catch per unit effort (CPUE) were 2.3 (*borshi*) and 0.09 (*plastic chai*), respectively. It was observed that huge amount of fishes were caught by seine net (*ber jal*) and gill net (*current jal*), and the rare species are damaged through this bulk catches. Seine net and gill nets are the most detrimental gears compared to others. A total of 51 fish species belonging to 8 orders under 20 families and 32 genera were recorded. Twenty one (21) species out of 51 were found threatened. Among the threatened fishes, 8 species were vulnerable (VU), 10 endangered (EN) and 3 critically endangered (CR). Abundant fish species were *Puntius ticto* (titputi), *Mystus tengara* (tengra), *Amblypharyngodon mola* (mola), *Mastacembelus armatus* (baim), *Macrognathus pancalus* (guchi baim), *Nandus nandus* (bheda), *Glossogobius giuris* (baila), *Macrobrachium malcolmsonii* (ichha), etc. Order-wise catch composition shows that Cypriniformes (33%) was the most dominant order followed by Perciformes (25%), Siluriformes (22%) and others. It is observed that availability of fishes in the *haor* is gradually reducing every year due to different causes. If it continues in this way, *haor* will be devoid of fishes and other organisms very soon. Therefore, the government should immediately take appropriate initiatives to protect the biodiversity and ecosystem of the *haor* for the greater interest of the nation.

Keywords*:* Fishing gears, fish species, catch composition, fish diversity, *haor*.

Introduction

Bangladesh has extensive and vast natural waterbodies in the form of rivers, *haor*s, *baor*s, *beel*s, lakes, canals, ponds and estuaries. There are about 4.05 million ha inland open water, 0.53 million ha closed water and 16.6 million ha marine water (Mazid, 2002). Vast waterbodies are enriched with aquatic diversity containing 260 species of freshwater fish, 12 species of exotic fish, 475 species of marine water fish, 24 species of freshwater prawn and 36 species of marine water shrimp (DoF, 2016). Inland waterbodies have been supporting rich and diversified fisheries and these are critically important to the people of Bangladesh for their food security and livelihood (Hasan, 2012). The inland fisheries contributed 83.79% to the total catch (inland capture 27.79% and inland culture 56%) and remaining 16.21% comes from the marine fisheries. Fisheries sector contributed about 3.69% to the GDP and 1.92% of export earnings. Bangladesh earned 4,660.60 million BDT by exporting 83,524 MT fish and fishery products in 2014-2015. It also provided 23.12% of total income of agricultural sector (DoF, 2016).

There are altogether 411 *haors* (aquatic habitats including rivers, streams, canals, large area of seasonally flooded cultivated plains and combination of hundreds of inter-connected *beels*) in northeastern part of Bangladesh. *Haors* cover an area of 51,797 km^2, which are situated in the district of Sunamganj, Sylhet, Moulvibazar, Hobiganj, Netrakona, Kishoreganj and Brahmanbaria of Bangladesh (Rahman and Akhter, 2015). The most important *haor*s in respect of biodiversity and natural fish production are Shaneer *haor*, Hail *haor*, Hakaluki *haor*, Dekar *haor*, Maker

**Corresponding author: M S Islam, Department of Coastal & Marine Fisheries, Faculty of Fisheries, Sylhet Agricultural University, Sylhet-3100, Bangladesh, Email: islamms 2011@yahoo.com*

haor, Chayer *haor*, Tanguar *haor* and Kawadighi *haor* in greater Sylhet. Of these, Dekar *haor* is one of the most important and largest *haor* in Bangladesh. The *haor* is a natural depression and contains a number of permanent and temporary *beel*s (naturally depressed seasonal/perennial open waterbody and small in size) and connected with canals and rivers (Rahman and Akhter, 2015). It is the integral part of floodplain and its fisheries are regarded as an important source of food, income and livelihood for poor farmers and fishermen. In monsoon, *haor* looks like an inland freshwater sea with full of water but in dry season it dries up quickly except some deeper *beel*s. It is the home of many freshwater fish species and thousands of indigenous birds. The *haor* is also a harbor of non-fish organisms like snails, mussels and different types of aquatic vegetations. Limited numbers of swamp trees are present in this *haor*. A large number of fishing gears are operated in Dekar *haor* for commercial exploitation of the fisheries resources. These fishing gears are fishing nets, traps, hooks and lines, gillnet, seine net, lift net, wounding gears and fish aggregating device, etc. Destructive gears are used indiscriminately by the fishermen in Dekar *haor*. Harmful gears have negative impact on fish diversity and other aquatic resources of the *haor*.

There is a great importance of *haors* in fish production, maintaining biodiversity, meeting local and regional demand and serving as a good source of fish seed supply for other adjacent waterbodies. *Haors* are now gradually silted up due to flash floods, upstream runoff and other manmade as well as natural causes. Water carrying capacity of *haors* is simultaneously reducing. Overfishing, under sized fishing, unplanned fishing, fishing in breeding period, fishing by dewatering and hand picking are common fishing practices in *haors*. Their combined effect has created an intolerable condition for *haor* resident fishes. On the other hand, fishing pressure is increasing owing to ever increase the number of fishermen, lack of employment opportunity and easy access to fishing, construction of flood protection embankments and roads, etc. The future of fisheries is very much dependent on fishing gear selection, mode of operation, fishermen's number, intensity of fishing and level of exploitation. Some sporadic works have been done in the past on fish production and constraints, and fish diversity in Dekar *haor*. Considering the above facts, the present work was undertaken to assess the types of fishing gear used, their catch composition and catch per unit effort, and to determine the effect of gears on fish diversity of Dekar *haor*.

Materials and Methods

Study area and study period

The study was performed in four *haor* villages namely Noagaon, Sultanpur, Robbaninogor and Sadarpur under Dakshin Sunamganj upazila. Dekar *haor* (naturally depressed seasonal-perennial open waterbody) is bounded by four upazilas like Dakshin Sunamganj, Sunamganj sadar, Dowarabazar and Chhatak upazilas of Sunamganj district (Fig. 1). It is situated by the side of Sylhet-Sunamganj high way. It acts as an internal drainage basin. The *haor* is supplied with water mainly from the river Mashing (branch of the river Surma) and other rivers (Dhanu, Khashiamara, Dhumkhali, etc). It is located 60 km west away from Sylhet divisional town but is closed to Sunamganj district town. The study was conducted for a period of 12 months from September 2015 to August 2016.

Data collection

Data were collected from both primary and secondary sources. Primary data were collected directly from the fishermen through structured questionnaire and focus group discussion (FGD) with different stakeholders (union parishad chairman & members, leaders of the fishermen community, school teacher, fish market leaders, fish traders and community people). Secondary data were collected from Upazila Fisheries Office, District Fisheries Office, Non-government organizations, Universities, different books, journals and reports.

Fish samples collection

Fish samples were collected from the catches of fishermen for determination of the species composition. Collection of fish samples was done at the middle of each month and about 0.5 to 1.0 kg of fishes was collected from the catches of each type of gear at each time. After collection, fishes were preserved in 7% formalin and then brought to the laboratory for subsequent studies. In laboratory, fishes were counted, weighted separately and identified upto genus/species level following DoF (2014); Rahman (2005); Shafi and Quddus (2001); Talwar and Jhingran (1991).

There were several types of gear operated by fishermen in study areas. The gear survey was made using survey form during study period to calculate the catch per unit effort (CPUE) and the species composition for each type of gear. Catch per unit effort (CPUE) was calculated using the following formula:

$$CPUE = \frac{\text{Total fish catch in a particular sample gear (wt. in kg)}}{\text{No. of sampled gear}} \times \text{fishing hours}$$

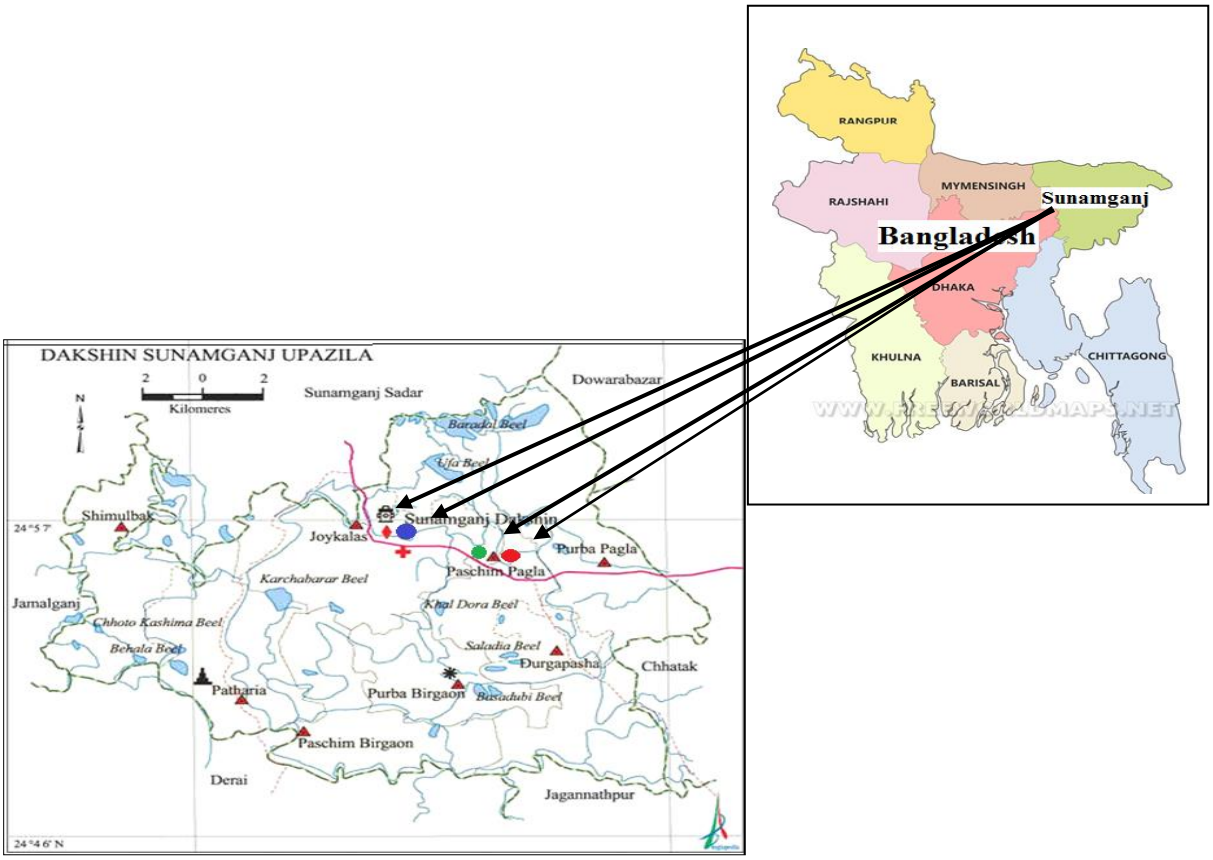

Fig. 1. Map of Dakshin Sunamganj upazila showing the study areas

Data analysis

Collected data were checked for accuracy and clarity after each visit in the study areas. After collection of all relevant data, these were compiled, processed and analyzed. MS Excel and MS Word were used for processing and analyses the data.

Results and Discussion

Fishing gears

Various types of fishing gears were found to operate in the *haor*. Most of them were traditional and some were unique for the locality. A total of 20 types of gear under five categories were observed to be used by fishermen for catching fish in Dekar *haor* (Table 1). Sayeed *et al*. (2015) reported that 15 types of fishing gears of five major groups were operated for fishing by fishermen in Hakaluki *haor*, Moulvibazar. Major groups of fishing gears were

nets, traps, hooks and line, wounding gears and fish aggregating devices. Rahman and Akhter (2015) stated that a total of 34 different types of fishing gears were in use to catch fish from *haors*. Of these seine net, gill net, lift net, push net, cast net, fish trap and hooks and lines were 12 (34%), 4 (12%), 2 (6%), 4 (12%), 1 (3%), 7 (21%) and 4 (12%), respectively. Sayeed (2010) noted that thirty four different gears in six categories were recorded in Chalan *beel* in greater Pabna and Natore districts. He also stated that capture fishery in Chalan *beel* is decreasing day by day. One of the major causes was the indiscriminate killing of small fishes in the early stages by various illegal fishing gears. Holder (2002) reported 9 types of gear used in two *beel*s (Doba and Chara) of Mymensingh sadar upazila, Mymensingh. These gears were classified into three groups as nets, traps and wounding gears. Besides these, dewatering and handpicking were also done by fishermen. BCAS (1991) found about 30 different types of gears used by fishermen in Halti *beel* in Natore and Rajshahi districts. Gears were classified into nets, traps and hooks and line. Besides these gears, fishermen were also found to catch fish by dewatering through pump machine and handpicking.

Table 1. Different types of fishing gears recorded in Dekar *haor* during study period

Category	Types of gear	Name of gears	Mesh size (mm)	Target species	Fish harvesting period
Fish nets	Seine net	*Ber jal*	5-30 mm	All	May-Oct.
	Lift net	*Dharma jal*	5-150 mm	All	June-Oct.
		Khora jal	10-15 mm	All	June-Nov.
	Cast net	*Jhaki jal*	50-120 mm	All	Year round
	Big cast net	*Uttar jal*	150-300 mm	All	Sept.-May
	Push net	*Thela jal*	3-30 mm	All	May-Dec.
	Gill net	*Current jal* or *Chela jal*	50-360 mm	All	May-Nov.
		Koi jal	200-210 mm	Koi	May-Nov.
		Bata jal or Cotor jal	200-600 mm	Big fish	May-Nov.
Fish traps		*Dori*	-	SIS*	May-Dec.
		Chai	-	SIS	May-Dec.
		Plastic chai	-	SIS	May-Dec.
		Gui	-	SIS	May-Dec.
		Ronga	-	SIS	May-Dec.
		Polo	-	Big fish	Dec.-Feb.
		Ucha	-	SIS	May-Dec.
Hook and line		*Borshi*	-	Carnivore	May-Nov.
		Hat borshi	-	Carnivore	May-Nov.
Wounding gear		*Koach*	-	All	June-Feb.
Fish aggregating devices (FADs)		*Dhol*	-	All	Nov.-April
Others	Hand picking and dewatering		-	SIS and all	Nov.-April

*SIS-Small indigenous species of fishes

Comparison of catch per unit effort (CPUE) of fishes

Catch per unit effort (kg gear^{-1}day^{-1}) was compared among different fishing gears as nets, traps and wounding gears used in Dekar *haor* (Figs. 2 and 3). The highest CPUE (4.67 kg gear^{-1}day^{-1}) was recorded in seine net (*ber jal*) followed by *current jal* (4.5), *khora jal* (3.83), *dharma jal* (3.8), *uttar jal* (2.75) and *bata jal* (2.26), respectively. The lowest CPUE (1.56 kg gear^{-1}day^{-1}) was found in *thela jal* at study areas. Among the 20 types of fishing gears *ber jal* (seine net) and *current jal* (gill net) were the most destructive gear as large amount of fishes were caught per tow by these gears and there is every possibilities to extinct the rare species if these gears are used in the early breeding season. Rahman and Akhter (2015) also reported that seine and gill nets were the main gears used in *haors*,

which supports the findings of the present study. Sayeed *et al*. (2015) mentioned that average CPUE for all fishing gears was varied widely ranging between 0.24±0.07 and 15.62±9.10 kg person^{-1} day^{-1} in Hakaluki *haor*. The mean CPUE of *ber jal, veshal jal, current jal, jhaki jal, thela jal, charo, foria, bana, tenta*/*teora* and *hat borshi* were 5.62±9.10, 1.04±0.33, 1.82±1.06, 2.51±1.04, 0.65±0.27, 0.25±0.07, 0.24±0.07, 0.76±0.38, 1.10±0.44 and 0.67±0.27 kg person^{-1} day^{-1}, respectively. Significant differences were observed among the fish catches over the fishing months using different gears. Miah (2012) demonstrated that the seine net had the highest CPUE followed by gill net (*current jal*) in Hakaluki *haor* floodplain. Ahmed (2008) found that the seine net had the highest catch per unit effort (15. 41 kg gear^{-1} day^{-1}) in Titas floodplain. It is cleared from the above discussions that seine net and gill net are widely used in *haor* and floodplains compared to other fishing gears. A plenty of different sizes of fishes were indiscriminately caught by these nets round the year. Consequently, many fish species are being disappeared from the open waterbodies, which are in agreement with the findings of the present study.

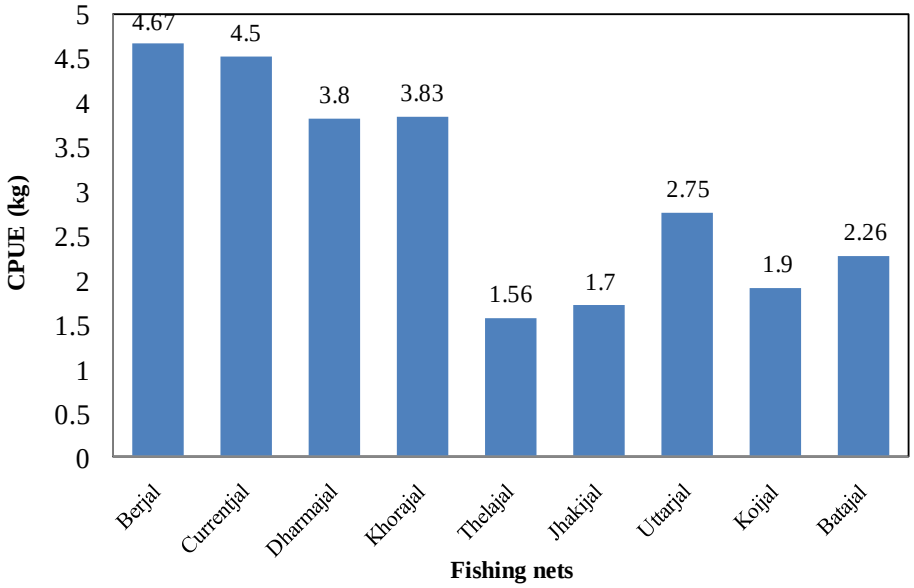

Fig. 2. Efficiency of different types of fishing net in Dekar *haor*

Various types of fish traps were found for catching fishes by fishermen in Dekar *haor* like as *bhair, dori, chai, plastic chai, gui, ucha, polo, ronga,* etc. Among traps, hooks and line and wounding gear, the highest CPUE (2.3 kg gear^{-1} day^{-1}) was recorded in *borshi* followed by *polo* (1.75 kg), *ucha* (1.62 kg), *hat borshi* (0.6 kg), *koach* (0.36 kg), *dori* (0.2 kg), *bhair* (0.17 kg) and *ronga* (0.12 kg). The lowest CPUE (0.09 kg gear^{-1}day^{-1}) was found in *plastic chai* in the *haor* during the study period. Sayeed *et al*. (2015) also mentioned that lower CPUE was recorded in different traps and wounding gears *viz. charo* (0.25±0.07), *foria* (0.24±0.07), *bana* (0.76±0.38), *tenta*/*teora* (1.10±0.44) and *hat borshi* (0.67±0.27) in Hakaluki *haor*. Himu (2014) cited that lower CPUE of fishes was recorded in traps and wounding gears compared to fishing nets. In traps the catch per unit effort was 0.11 kg, 0.10 kg and 0.12 kg gear^{-1} hour^{-1} but in hooks and line the catch per unit effort was 0.21 kg, 0.20 kg and 0.26 kg gear^{-1} hour^{-1}, respectively in Baralekha, Fenchuganj and Kulaura area of Hakaluki *haor*. Ahmed (2008) found that the lowest CPUE values were recorded in hooks and lines (0.21 kg gear^{-1} hour^{-1}) and traditional traps (0.12 kg gear^{-1} hour^{-1}) in Titas floodplain. The findings of the above mentioned authors support the finding of the present study.

Number of fish species and catch composition

The number of fish species and order-wise catch composition of fishes in Dekar *haor* caught by different types of gears were recorded. It reveals that a total of 51 fish species were recorded and these were divided into eight orders (Table 2). Among the orders, Cypriniformes was the most dominant order followed by Perciformes, Siluriformes, Synbranchiformes, Beloniformes, Osteoglossiformes, Tetraodontiformes and Decapoda. Cypriniformes, Perciformes, Siluriformes, Synbranchiformes, Beloniformes, Osteoglossiformes, Tetraodontiformes and Decapoda

were represented by 17, 13, 11, 4, 2, 2, 1 and 1 species, which belongs to 11, 5, 8, 3, 2, 1, 1 and 1 genera/genus under two, five, six, two, two, one, one and one families/family, respectively. The finding of the present study was much lower than the finding of FAP-17 (1994), who recorded a total of 107 species of fish from Dekar *haor* during 1994, which indicates that fish diversity and fish abundance of Dekar *haor* are in alarming situation.

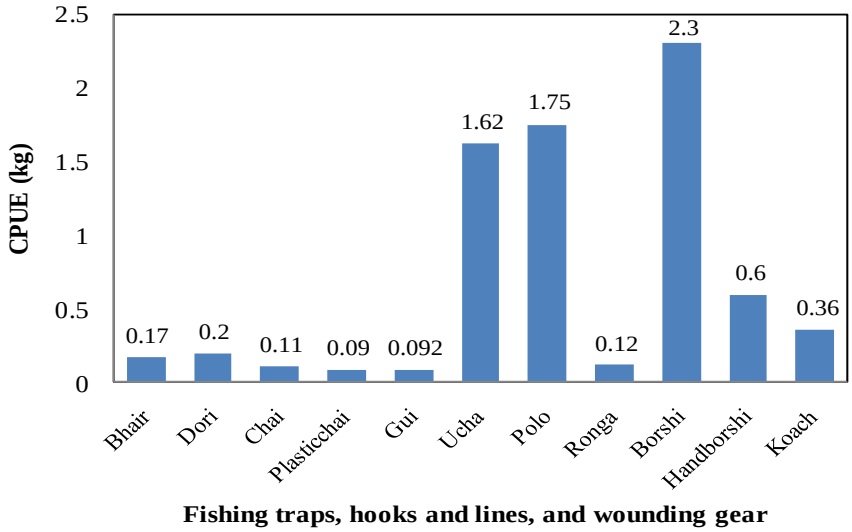

Fig. 3. Catch per unit effort of different types of fishing trap, hooks and lines, and wounding gear

Cypriniformes was secured the highest percentage (33%) in order-wise catch composition by number followed by Perciformes (25%), Siluriformes (22%), Synbranchiformes (8%), Beloniformes (4%), Osteoglossiformes (4%), Tetraodontiformes (2%) and Decapoda (2%) (Fig. 4). Himu (2014) reported that Cypriniformes (36%) was the most dominant order followed by Siluriformes (23%), Perciformes (20%), Synbranchiformes (5%), Osteoglossiformes (4%), Clupeiformes (3%), Beloniformes (3%) Tetraodontiformes (2%) and Decapoda (4%) in order-wise catch composition of fishes in Hakaluki *haor*. Miah (2012) stated that catch compositions in order-wise of Hakaluki *haor* floodplain fishes were 54% Cypriniformes, 13% Perciformes, 11% Clupeiformes, 8% Channiformes, 8% Chingri and 6% other orders. These findings reveal that Cypriniformes, Perciformes and Siluriformes were most dominant and important fish order than other orders in *haors*, which are consistent with the findings of the present study.

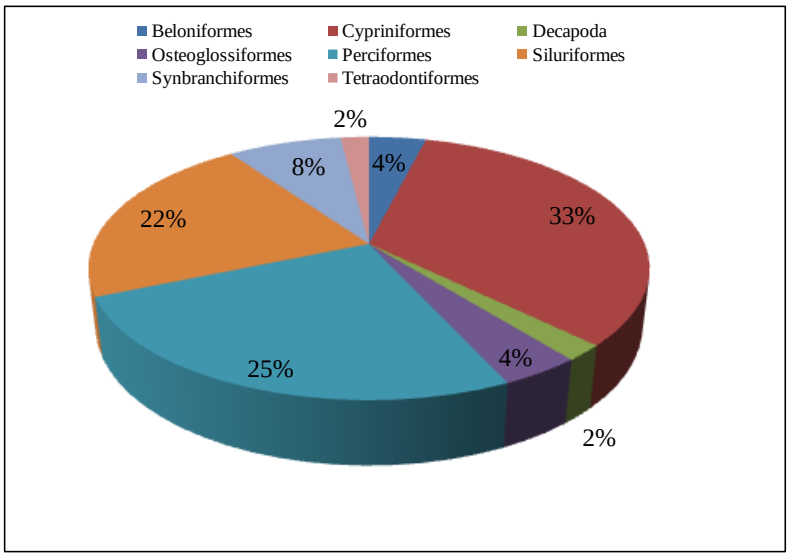

Fig. 4. Contribution of different orders of fishes in catch composition of Dekar *haor*

Table 2. List of fish species recorded in Dekar *haor* during study period

Order	Family	Bengali name	English name	Scientific name	% catch composition	Status in Dekar *haor*	IUCN status Bangladesh (IUCN 2015)
Beloniformes	Hemiramphidae	Kakila	Fresh water gar fish	*Xenentodon cancila*	4%	Common	LC
Beloniformes	Belonidae	Ek thuita	Fresh water gar fish	*Hyporhamphus limbatus*		Common	LC
Cypriniformes	Cyprinidae	Rui	Indian major carp	*Labeo rohita*	33%	Abundant	LC
Cypriniformes	Cyprinidae	Catla	Indian major carp	*Catla catla*		Abundant	LC
Cypriniformes	Cyprinidae	Kalibaus	Black rohu	*Labeo calbasu*		Abundant	LC
Cypriniformes	Cyprinidae	Carpio	Common carp	*Cyprinus carpio*		Available	NE
Cypriniformes	Cyprinidae	Bata	Bata	*Labeo bata*		Rare	LC
Cypriniformes	Cyprinidae	Lamba chela	Barb	*Chela bacaila*		Common	LC
Cypriniformes	Cyprinidae	Grass carp	Grass carp	*Ctenopharyngodon idella*		Less common	LC
Cypriniformes	Cyprinidae	Dhela	Barb	*Rohtee cotio*		Common	NT
Cypriniformes	Cyprinidae	Mola	Barb	*Amblypharyngodon mola*		Available	LC
Cypriniformes	Cyprinidae	Jatputi	Spot fin swamp barb	*Puntius sophore*		Abundant	LC
Cypriniformes	Cyprinidae	Chola punti	Swamp barb	*Puntius chola*		Abundant	LC
Cypriniformes	Cyprinidae	Taka punti	Red barb	*Puntius conchonius*		Abundant	LC
Cypriniformes	Cyprinidae	Titputi	Fire fin barb	*Puntius ticto*		Abundant	VU
Cypriniformes	Cyprinidae	Teri puti	One spot barb	*Puntius terio*		Abundant	LC
Cypriniformes	Cyprinidae	Darkina	Top minnow	*Esomus danricus*		Abundant	LC
Cypriniformes	Cobitidae	Rani	Bengal loach	*Botia dario*		Rare	EN
Cypriniformes	Cobitidae	Gutum	Guntea loach	*Lepidocephalus guntea*		Available	LC
Decapoda	Crustaceaceae	Gura chingri	Monsoon river prawn	*Macrobrachium malcolmsonii*	2%	Abundant	LC
Osteoglossiformes	Notopteridae	Chitol	Humped feather back	*Notopterus chitala*	4%	Common	EN
Osteoglossiformes	Notopteridae	Foli	Feather back	*Notopterus notopterus*		Common	VU
Perciformes	Ambassidae	Mola punti	Lal chanda	*Chanda lala*	25%	Available	LC
Perciformes	Ambassidae	Gol chanda	Indian glass perch	*Chanda ranga*		Available	LC
Perciformes	Ambassidae	Lomba chanda	Elongated glass perchlet	*Chanda nama*		Common	LC
Perciformes	Ambassidae	Napit koi	Badis	*Badis badis*		Common	NT
Perciformes	Pristolepidae	Kata chanda	Round glass perchlet	*Chanda baculis*		Common	NT

Table 2. Cont'd…..

Order	Family	Bengali name	English name	Scientific name	% catch composition	Status in Dekar *haor*	IUCN status Bangladesh (IUCN 2015)
Perciformes	Nandidae	Veda	Mud perch	*Nandus nandus*		Common	NT
Perciformes	Channidae	Shol	Snakehead murrel	*Channa striatus*		Available	LC
Perciformes	Channidae	Taki	Spotted snakehead	*Channa punctatus*		Abundant	LC
Perciformes	Channidae	Pipla shol	Barca snakehead	*Channa darca*		Rare	CR
Perciformes	Channidae	Raga	Asiatic snakehead	*Channa orientalis*		Common	LC
Perciformes	Channidae	Gajar	Giant snakehead	*Channa marulius*		Common	EN
Perciformes	Channidae	Chang	Dwarf snakehead	*Channa gachua*		Less common	LC
Perciformes	Gobiidae	Baila	Bar-eyed goby	*Glossogobious giuris*		Rare	VU
Siluriformes	Bagridae	Tengra	Striped dwarf catfish	*Mystus vittatus*	22%	Common	VU
Siluriformes	Bagridae	Gulsha	Long whiskered catfish	*Mystus gulio*		Common	LC
Siluriformes	Clariidae	Magur	Walking catfish	*Clarius batrachus*		Available	LC
Siluriformes	Schilbeidae	Bashpata	Gangetic ailia	*Ailia coila*		Rare	LC
Siluriformes	Siluridae	Boal	Fresh water shark	*Wallago attu*		Common	VU
Siluriformes	Siluridae	Pabda	Butter catfish	*Ompok bimaculatus*		Less common	EN
Siluriformes	Siluridae	Pabda	Pabo catfish	*Ompok pabo*		Rare	CR
Siluriformes	Siluridae	Pabda	Pabda catfish	*Ompok pabda*		Less common	EN
Siluriformes	Bagridae	Baghair	Genetic goonch	*Bagarius bagarius*		Rare	CR
Siluriformes	Heteropneustidae	Shing	Stinging catfish	*Heteropneustes fossilis*		Available	LC
Siluriformes	Chacidae	Kaua fish	Squarehead catfish	*Chaca chaca*		Less common	EN
Synbranchiformes	Mastacembelidae	Guchi baim	Striped spiny eel	*Mastacembelus pancalus*	8%	Available	LC
Synbranchiformes	Mastacembelidae	Tara baim	One striped spiny eel	*Macrognathus aculeatus*		Available	NT
Synbranchiformes	Mastacembelidae	Boro baim	Tire-track spiny eel	*Mastacembelus armatus*		Available	EN
Synbranchiformes	Synbranchidae	Kuchia	Kuchia	*Monopterus cuchia*		Rare	VU
Tetraodontiformes	Tetraodontidae	Choto tepa	Ocellated puffer fish	*Tetraodon cutcutia*	2%	Common	LC

EX-Extinct, EW- Extinct in the Wild, RE- Regionally Extinct, CR- Critically Endangered, EN- Endangered, VU- Vulnerable, NT-Near Threatened, LC-Least Concern, DD: Data Deficient, NE: Not Evaluated

Declining of fishes

During study period 21 fish species were found to be threatened in Dekar *haor*. Among these, vulnerable (VU), endangered (EN) and critically endangered (CR) were 8, 10 and 3 species, respectively (Table 2). Himu (2014) mentioned that among 32 threatened fishes 11 were vulnerable, 11 endangered and 10 critically endangered in Hakaluki *haor*. Sayeed (2010) reported that among 36 threatened fishes 10 were vulnerable, 20 endangered and 6 critically endangered in Chalan *beel*. According to IUCN Red List (2015), among 64 threatened freshwater fish species in Bangladesh, 25 were vulnerable (VU), 30 were endangered (EN) and 9 were critically endangered (CR).

IUCN Bangladesh (2003) stated that 32 nationally threatened fish species among the 107 fish species found in Hakaluki *haor*. A total of 32 fish species have already disappeared from Hakaluki *haor* due to indiscriminate fishing, habitats degradation, use of chemical fertilizers and pesticides, high fishing pressure and unscientific management (Rahman and Akhter, 2015).

Several causes are responsible for declining the fishes in Dekar *haor*. Some causes identified by respondents for declining the fishes in study area were rainfall variation, drought, temperature fluctuation, rapid depletion of DO due to decomposition of submerged semi-ripen *boro* rice during early flood, sudden raise of toxic substances (NH_3, H_2S, CH_4, etc) at high level, turbidity, erosion, progressive siltation, shortage of water in winter and early summer, blockade river and canals, cyclone, habitats destruction, overfishing, underfishing, operation of harmful gears, indiscriminate use of fertilizers, insecticides and pesticides, fishing by dewatering, destruction of breeding, nursery, grazing and feeding fields, elimination of green trees, etc. On the other hand, the respondents strongly believe that re-excavation of *beel*s of *haor*, establishment of fish sanctuary, making high embankments by the side of the *haor*, transplanting of trees (*hizol*, *koroch*, *zao*, etc.) in different parts of the *haor*, train up stakeholders, financial support for alternative income generating activities, changing leasing system and policy, fishing without dewatering, implementing of existing fishing laws with special emphasis, taking awareness programs on the protection of *haor* resources are the imperative measures for restoration, conservation and acceleration of fish diversity and abundance.

The results of the study imply that *ber jal* (seine net) and *current jal* (gill net) are the most harmful gears among the recorded fishing gears in Dekar *haor*. Fifty one (51) fish species were found in the *haor* of which 21 species were threatened (8 vulnerable, 10 endangered and 3 critically endangered). Production potential of fishes in the *haor* is now in danger condition and gradually reducing day by day owing to different manmade and natural causes. Proper mitigating measures should be taken by Government and non-government organizations for the conservation of fish diversity, fish habitats and aquatic vegetation, which will enhance the restoration and protection of fisheries habitats, aquatic plants and fish availability in the *haor*, and will improve the livelihood of fishermen living around the *haor*.

Acknowledgements

The authors highly acknowledge to Krishi Gobeshona Foundation (KGF), Bangladesh Agricultural Research Council (BARC), Farmgate, Dhaka for providing fund to conduct this research under the project entitled “Farm Productivity Improvement in *Haor* Areas through Integrated Farming Systems Approach”.

References

Ahmed M S. 2008. Assessment of fishing practices on the exploitation of the Titas Flood Plain in Brahmanbaria, Bangladesh. Turk. J. Fish. Aqua. Sci. 8(1):329-334.

BCAS (Bangladesh Centre for Advanced Studies). 1991. The Floodplain Production Monitoring. Initial Study Report. BCAS, Dhaka, Bangladesh. 99p.

DoF (Department of Fisheries). 2016. National Fish Week Compendium (In Bengali). Department of Fisheries, Ministry of Fisheries and Livestock, Dhaka, Bangladesh. 148p.

DoF (Department of Fisheries). 2014. Freshwater fishes of Bangladesh. Department of Fisheries, Dhaka, Bangladesh. 213p.

FAP-17 (Flood Action Plan-17). 1994. Fisheries Studies and Pilot Project: Shanghair *haor* project and Dekker *haor*. Final Report (Draft). Supporting Vol. No. 9. Overseas Development Administration (ODA), UK. 119p.

Hasan M R. 2012. Study on the fish diversity in the *haor* area of Karimgonj upazila, Kishoregonj. M.S. Thesis, Department of Aquaculture, Bangladesh Agricultural University Mymensingh. 65p.

Himu M H. 2014. Impact of fish biodiversity on fishers livelihood of Hakaluki *haor* in Bangladesh. M.S. Thesis, Department of Fisheries Technology and Quality Control, Sylhet Agricultural University, Sylhet. 60p.

Holder D K. 2002. Studies on the availability of small indigenous species (SIS) of fishes and socioeconomic condition of fishers in two *beels*of rice fields. M.S. Thesis, Department of Fisheries Management, Bangladesh Agricultural University, Mymensingh. 136p.

IUCN (International Union for Conservation of Nature). Bangladesh. 2003. Bangladesher Bipanno Bonno Prani, IUCN-The World Conservation Union. xiv + 294p.

IUCN (International Union for Conservation of Nature) Bangladesh. 2015. Red List of Bangladesh, Vol. 5: Freshwater Fishes, Bangladesh Country Office, Dhaka, Bangladesh. pp. xvi+360p.

Mazid M A. 2002. Development of fisheries in Bangladesh: Plans and strategies for income generation and poverty alleviation. 176p.

Miah M M A. 2012. Fish and Ecosystem Diversity of Hakaluki *Haor* - A Major Fishery in Northeast Bangladesh. PhD Dissertation. Department of Fisheries Biology and Genetics, Bangladesh Agricultural University, Mymensingh. 224p.

Rahman A K M. 2005. Freshwater Fishes of Bangladesh. 2nd ed. Zoo. Soc. of Bangladesh, Dhaka, Bangladesh. 394p.

Rahman M K and Akhter J N. 2015. Ecology and management of inland water and fisheries resources of Bangladesh. Ayub Ali Publication, 38/2 ka Banglabazar, Dhaka. 417p.

Sayeed M A. 2010. Fish biodiversity in the Chalan *beel*, a natural depression in north west Bangladesh. PhD Dissertation, Department of Fisheries Biology and Genetics, BAU, Mymensingh, Bangladesh. 195p.

Sayeed M A, Deb R C, Bhattarcharjee D, Himu and M H and Alam M T. 2015. Fish biodiversity of Hakaluki *haor* in north-east region of Bangladesh. *In*: Research Progress Report-2, Sylhet Agricultural University, Sylhet, Bangladesh. pp. 71-78.

Shafi M and Quddus M M A. 2001. Bangladesher Matshaw Sampad (Bangla). Kabir Publications, Dhaka, Bangladesh. 485p.

Talwar P K and Jhingran A G. 1991. Inland fishes of India and adjacent countries. Volume 1 and 2. Oxford and IBH Publishing Co. Pvt. Ltd. New Delhi, Calcutta, India. 1158p.