International Journal of Natural and Social Sciences
Print: 2617-6637 < ISSN > Online: 2313-4461

Fish biodiversity in the Khiru River of Bangladesh: Present status and threats

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ARTICLE INFO

Article history

Received: 03 November 2020
Accepted: 22 November 2020

Keywords

Fish fauna, Diversity, Fishing gears, Threats, Khiru River

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ABSTRACT

This study was conducted from December 2016 to November 2017 to assess the status of fish diversity in the Khiru River of Mymensingh district in Bangladesh. Primary data were collected through questionnaire interviews of 80 fishermen, 8 focus group discussions, and 5 key informant interviews. A total of 64 fish and prawn species under 22 families and 11 orders were recorded. Cyprinidae (31.25%) was the most diversified family. On the basis of their availability the recorded species were categorized into four groups: available (35.94%), less available (29.69%), rare (20.31%), and very rare (14.06%). A total of 10 fishing gears under 5 major categories *viz*., fish nets, fish traps, wounding gears, hooks and lines, and fish aggregating device were recorded. Overfishing, siltation, use of banned fishing gears, irrespective catching of juvenile and brood fishes, *katha* fishing, etc. were detected as major threats to the fish diversity and habitat degradation of the fishes in this river. Therefore, dredging, use of legally applicable fishing gears, establishment and management of fish sanctuary, community based fisheries management, stocking of economically and nutritionally important indigenous fish species, implementation of fish acts and laws, and increasing fishers' awareness should be undertaken to conserve the fish diversity in this river.

INTRODUCTION

Bangladesh is a riverine country and the inland waters of the country are naturally rich with fisheries diversity comprising 260 species of freshwater fishes (DoF, 2018). Inland open water fisheries resources play a substantial role in the culture, tradition, food habit, and economic development of the local people (Hossain, 2014). Fishes supply about 60% of the people's daily animal protein consumption (DoF, 2018). More than 17 million people of Bangladesh including around1.4 million ladiesare directly or indirectly dependent on fisheries resources for their livelihoods (BFTI, 2016).

Khiru is the main river in Bhaluka and Fulbaria upazilas (sub-districts) of Mymensingh district, Bangladesh which interconnects two major rivers, the Brahmaputra and the Shitalakshya which is naturally rich with aquatic biodiversity and supports the biodiversity of fish fauna, and thus contributing to the supply of animal protein and overall economy of the country. Bangladesh is a highly populated country and most of the country people prefer freshwater species than marine species. Therefore, the substantial demand is placed on freshwaters, and as a result many riverine fish species have been endangered (Rahman et al., 2012). Due to several manmade and natural factors most of the wild fish populations have extremely declined in the water bodies of Bangladesh (Pandit et al., 2015a; Arefin et al., 2018; Islam et al., 2019). The suspected major causes of this biodiversity declination are mainly over-exploitation and habitat degradation (Galib et al., 2009). Nowadays, ongoing reduction of aquatic biodiversity from natural waters is a vital problem in Bangladesh (Galib et al., 2009; Imteazzaman and Galib, 2013; Chaki et al., 2014). These findings clearly indicate the necessity of biodiversity study in rivers (Imteazzaman and

How to cite this article: Akter N, Kunda M, Rashid AHA, Mazumder S, Sultana MA and Pandit D (2020). Fish biodiversity in the Khiru River of Bangladesh: Present status and threats. International Journal of Natural and Social Sciences, 7(4): 30-39. DOI: 10.5281/zenodo.4305923

Galib, 2013). The Khiru is one of the significant rivers of Mymensingh district for fish production. However, there is no published article on the fish biodiversity of this river so far. Therefore, this study was conducted for identifying the present status and threats to the fish diversity of the Khiru River which would facilitate further studies on this aquatic fauna by interested researchers.

MATERIALS AND METHODS

Study area

The Khiru River is located at the Fulbaria and Bhaluka upazilas under Mymensingh district of Bangladesh. It comes from Brahmaputra River, then flows through Bhaluka and Fulbaria upazilas, and then meets the Shitalakshya River. The total area of this river is about 41 km. During the winter season the upstream almost dries up, and thus the lower part acts as a reservoir for aquatic biodiversity. However, it provides interconnecting open water ecosystems in monsoon. It was found that most of the fishermen community lives in the adjacent villages and out of those villages eight randomly selected villages *viz*., Shatenga, Borta and Kharwali of Bhaluka, and Ramnagar, Chatkapar, Dairarpar, Soberpar and Polashtoli of Fulbaria were selected for the study. The study was carried out for one year from December 2016 through November 2017.

Collection of data

A total of 80 fishermen, 10 fish traders, and 5 local leaders from the study sites were randomly selected for questionnaire interviews (QI). A total of 8 focus group discussions (FGDs) were made at different places of the selected villages. Each of the FGD was performed with 9 to 12 members of the fishing communities. The secondary data were collected from the Upazilla Fisheries Offices of Bhaluka and Fulbaria upazilas, district fisheries office of Mymensingh, books, internet, and journal articles. About 5 key informant interviews were accomplished with experienced fishers and other vital persons including Upazila Fisheries Officers, and District Fisheries Officer.

Identification of fish fauna

Fish and prawn samples were collected from the fishermen's catch during fishing in the selected sampling sites, nearby fish landing centers, and also from fish markets (Figure 1). Identification of the samples was performed up to the species level based on their external morphology (Rahman, 2005; IUCN Bangladesh, 2015) as well as criteria found in Fish base record (http://www.fishbase.org). Based on QI and catch records the collected species were categorized in four statutes: available (A) which were observed abundantly round the year, less available (LA) which were observed occasionally in the study area, rare (R) which were observed infrequently and less amount in the study area, and very rare (VR) species which were observed incidentally once or twice a year. The species list was also compared with the IUCN Red List of Threatened Species (IUCN Bangladesh, 2015).

Data processing and analysis

After collection, the data were documented in computer and finally analyzed by using Microsoft Office Excel, version 2010.

RESULTS AND DISCUSSION

Fish biodiversity status

A total of 64 fish and prawn species under 22 families and 11 orders were recorded during the study (Figure 2). As there is no recent biodiversity study on the fish species of this river, the findings of this study were thus compared with similar studies in some other rivers of Bangladesh. Similar findings were recorded by Arefin et al. (2018) where 62 species of finfish and shellfish species of 23 families were recorded from the Rupsa River.

Similarly, Galib et al. (2013) recorded a total of 63 species of fish from the *Choto* Jamuna River. Rahman et al. (2012) recorded a total of 80 species of fish from the Padma distributary of the Ganges River in the north-western Bangladesh. Azadi and Alam (2013) found total 93 species of ichthyofauna from the Halda River.

Figure 1: Collection of fishes from Khiru River for identification

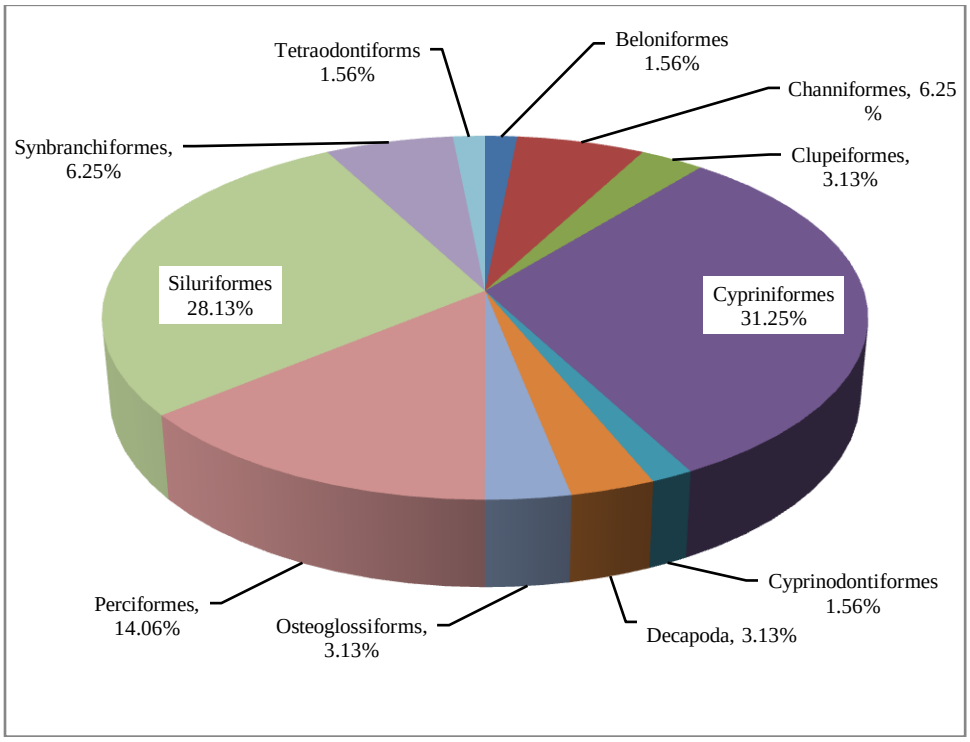

Figure 2: Percentage composition of total fish species under different orders in the Khiru River

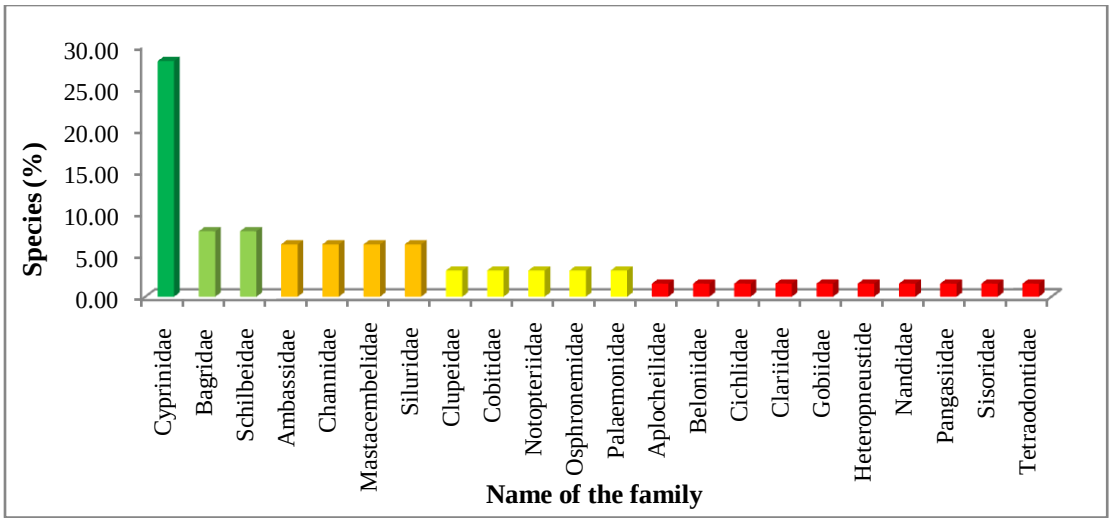

Figure 3: Percentage of fish species diversity under different family in the Khiru River

Chowdhury et al. (2010) reported 98 fish species in the Naaf River. Islam et al. (2015) recorded a total of 114 fish species from the Payra River. The later mentioned four studies indicate higher fish diversity than the present study. Mohsin and Haque (2009) reported 56 fish species in the Mahananda River and Nabi et al. (2011) identified 35 species of fish from Bakkhali River which are lower than the present study.

Maximum (20) species were recorded from the Cypriniformes order which consists of 31.25% of the total fish population. Siluriformes (28.13%) was the second most leading order containing 18 species (Figure 2; Table 1). Cypriniformes was the dominant order contributing 31.25% of the total fish species followed by Siluriformes, Perciformes, and Clupeiformes (Rahman et al., 2012). These are almost similar to the findings of present study.

From the records of the study Cyprinidae was the leading family among the 22 families where maximum (18) fish species were recorded from this family which consisting of 28.13% of the total fish population (Figure 3).

Cyprinidae contributed a large number of species in different open water bodies of Bangladesh (De et al., 2011) and South-West Sundarbans of India (Mohan and Singh, 2004; Giri et al., 2004). Mohsin et al. (2013) found Cyprinidae as dominant family from the Padma River. Azadi and Alam (2013) recorded Cyprinidae (19 species) as dominant family from the Halda River, Chittagong which support the findings of the present study.

A total of 23 (35.94%) fish species were available, 19 (29.69%) fish species were less available, 13 (20.31%) fish species were rare and 9 (14.06%) species of fish species were found as very rare in the study area (Figure 4). These rare and very rare species indicate that if proper measures are not taken to preserve them, there is a great possibility of their extinction in future. For instance, local fishers living around the Soma Nadi *Jalmohal* of Sunamganj district mentioned that the rare species would be disappeared from the *Jalmohal* soon (Pandit et al., 2015b).

Islam et al. (2015) categorized the recorded species on the basis of availability as available (43.86%), less available (29.82%), rare (18.42%) and very rare (7.89%) from the Payra River. Flowra et al. (2013) recorded available (45.01%), less available (33.33%), rare (13.33%) and very rare (8.33%) from the Baral River, Natore, Bangladesh. Both the results more or less supported the present findings.

Table 1: Present status of fish diversity in the Khiru River

Order	Family	Local name	English name	Scientific name	Present status	IUCN status
Channiformes	Channidae	Taki	Spotted snakehead	*Channa punctatus*	A	LC
		Cheng	Asiatic snakehead	*Channa orientalis*	A	LC
		Shol	Snakehead murrel	*Channa striatus*	LA	LC
		Gozar	Giant snakehead	*Channa marulius*	R	EN
Clupeiformes	Clupeidae	Ilish	Hilsa shad	*Tenualosa ilisha*	VR	LC
		Chapila	Indian river shad	*Gudusia chapra*	LA	VU
Beloniformes	Beloniidae	Kakila	Freshwater gar fish	*Xenentodon cancila*	LA	LC
Tetraodontiforms	Tetraodontidae	Potka	Ocellated puffer fish	*Tetraodon cutcutia*	LA	LC
Synbranchiformes	Mastacembelidae	Borobaim	Zig-zag eel	*Mastacembelus armatus*	LA	EN
		Guchibaim	Barred spiny eel	*Macrognathus pancalus*	A	LC
		Tara baim	Lesser spinyeel	*Macrognathus aculeatus*	A	NT
		Kuchia	Mud eel	*Monopterus cuchia*	R	VU
Cyprinodontiformes	Aplocheilidae	Kanpona	Blue panchax	*Aplocheilus panchax*	VR	LC
Osteoglossiforms	Notopteriidae	Chital	Humped featherback	*Notopterus chitala*	VR	EN
		Foli	Grey featherbak	*Notopterus notopterus*	R	VU
Perciformes	Ambassidae	Lambachanda	Elongated glass perchlet	*Chanda nama*	A	LC
		Lalchanda	Indian glass perchlet	*Parambassis lala*	R	LC
		Golchanda	Indian glassfish	*Parambassis ranga*	A	LC
		Koi	Climbing perch	*Anabas testudineus*	A	LC
	Cichlidae	Tilapia	Mozambique tilapia	*Oreochromis mossambicus*	R	EX
	Gobiidae	Bele	Tank goby	*Glossogobius giuris*	LA	LC
	Osphronemidae	Chotokhalisha	Honey gourami	*Colisa chuna*	A	NO
		Lalkhalisha	Dwarf gourami	*Colisa lalia*	R	NO
	Nandidae	Meni	Mud perch	*Nandus nandus*	R	NT
Siluriformes	Bagridae	Gulsha	Long whiskered catfish	*Mystus cavasius*	LA	NT
		Bujuri	Long bled catfish	*Mystus tengra*	A	LC
		Tengra	Striped dwarf catfish	*Mystus vittatus*	A	LC
		Ayre	Long whiskered catfish	*Sperata aor*	VR	VU
		Rita	Whale catfish	*Rita rita*	VR	EN
	Clariidae	Magur	Walking catfish	*Clarias batrachus*	A	LC
	Heteropneustide	Shing	Stinging catfish	*Heteropneustes fossilis*	A	LC
	Pangasiidae	Pangus	Yellowtail catfish	*Pangasius pangasius*	VR	EN
	Schilbeidae	Bacha	Batchwavacha	*Eutropiichthys vacha*	R	LC
		Garua	Garuabachcha	*Clupisoma garua*	VR	EN
		Kajuli	Gangeticailia	*Ailia coila*	R	LC

		Batasi	Indian potasi	*Pseudeutropius atherinoides*	LA	NT
		Shillong	Silond catfish	*Silonia silondia*	VR	LC
	Siluridae	Boal	Freshwater shark	*Wallago attu*	LA	VU
		Pabda	Pabo catfish	*Ompok pabo*	A	CR
		Kanipabda	Butter catfish	*Ompok bimaculatus*	LA	EN
		Madhupabda	Pabdah catfish	*Ompok pabda*	LA	EN
	Sisoridae	Baghair	Dwarf goonch	*Bagarius bagarius*	VR	CR
Cypriniformes	Cobitidae	Gutum	Guntea loach	*Lepidocephalus guntea*	A	LC
		Bou/Rani	Necktie loach	*Botia dario*	LA	EN
	Cyprinidae	Catla	Indian major carp	*Catla catla*	A	LC
		Rohu	Indian major carp	*Labeo rohita*	A	LC
		Mrigal	Indian major carp	*Cirrhinus cirrhosus*	A	NT
		Carpio	Common carp	*Cyprinuscarpio* var.*Communis*	LA	LC
		Grass carp	Grass carp	*Ctenopharyngo donidella*	LA	EX
		Common carp	Common carp	*Cyprinus carpio*	A	EX
		Gonia	Kurialabeo	*Labeo gonius*	A	NT
		Silver carp	Silver carp	*Hypophthalmicthys molitrix*	R	EX
		Bata	Bata	*Labeo bata*	LA	LC
		Kalibauh	Black rohu	*Labeo calbasu*	LA	LC
		Chela	Fine scale razor belly minnow	*Chela cachius*	R	VU
		Mola	Molacarplet	*Amblypharyngodon mola*	LA	LC
		Darkina	Flaying barb	*Esomusdanricus*	A	LC
		Dhela	Cotio	*Osteobramacotio*	R	NT
		Tit punti	Ticto barb	*Puntiusticto*	A	VU
		Jatpunti	Spotfin swamp barb	*Puntiussophore*	A	LC
		Sarpunti	Olive barb	*Puntiussarana*	R	LC
		Raj punti	Java barb	*Puntiusgonoinotus*	LA	EX
Decapoda	Palaemonidae	Chatkaicha	Monsoon river prawn	*Macrobranchium malcolmsonii*	LA	NO
		Guraicha	Monsoon river prawn	*Macrobranchium amarre*	A	NO

CR: critically endangered, EN: endangered, VU: vulnerable, NT: near threatened, NO: not threatened, LC: least concern and EX: exotic species.

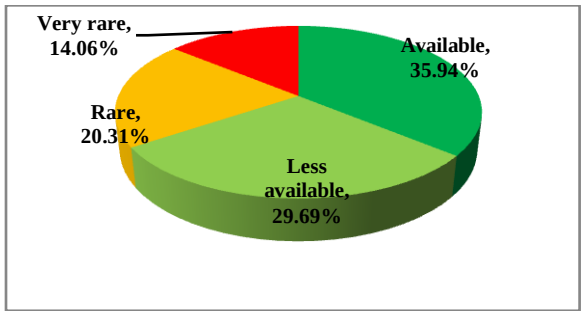

Figure 4: Availability status of fishes in the Khiru River

Status of threatened fish species

A total of 64 species are threatened in Bangladesh (25 species vulnerable, 30 species endangered and 9 species critically endangered) (IUCN Bangladesh, 2015). Thus, it is a matter of great concern that 18 species of those were recorded from the Khiru River where 2, 9, and 7 species were critically endangered, endangered, and vulnerable, respectively (Figure 5). Among these species 2 available, 6 less available, 4 rare and 6 very rare were identified in the study area (Figure 6).

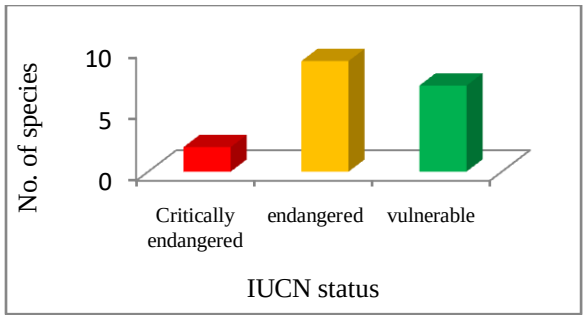

Figure 5: IUCN status of threatened fish species in the study area.

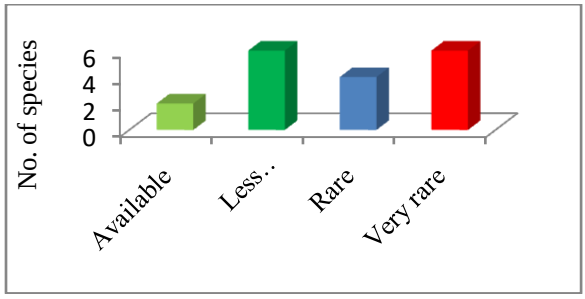

Table Present status of threatened species

Mohsin et al. (2014) found 2 critically endangered species, 3 endangered and 5 vulnerable fish species in the Andharmanik River. Hanif et al. (2015a) found 26 threatened species from the Sandha River. These findings support the present result. Azadi and Alam (2013) found 3 critically endangered 9 endangered and 8 vulnerable species according to IUCN Bangladesh (2000) from the Halda River in Chottagram. These results are similar to the results of present study.

Fishing gears used in the study area

Operational mode of gears in the study area found to be depended on various factors, like, water levels (current and depth) and rainfall. On the basis of seasonal availability of fish species and water level gear types, mesh sizes and lengths vary. A total of 10 fishing gears under 5 main categories *viz*. fish nets, fish trap, wounding gear, hook and lines, and fish aggregating device were documented. Cast nets, lift nets, gill nets, seine nets, hooks and lines were used as the major fishing gears by the fishers' (Table 2). Among those most of the gears were used from monsoon to post monsoon (July to January) except gill net, push net, *konch* (wounding gear) and cast net. *Morshari jal* and *dharma jal* (lift net) were used in July-November. Only one type of fish aggregating device, *katha*, was identified from the study area which was operated during November to January.

Ali et al. (2014) has detected 14 different types of fishing gears under four categories: fish nets, wounding gears, hooks and lines and fish traps. Sultana et al. (2016) recorded 18 types of fishing gears including nets, traps, wounding gears, hooks and line from the Payra River. Ali et al. (2015) has detected 8 major types of fishing gears from the Ramnabad River. Islam (2012) noted 8 types of fishing gears, namely cast net, *current jal*, seine net, push net, *khara jal*, *chandi bair*, *bair* and hooks and lines from the Tangon River.

Threats to the fish diversity of the Khiru River

According to the respondents, many manmade and natural causes are responsible for destroying the breeding, feeding and nursing grounds of fishes of the Khiru River. Themain threat to the fish diversity of the Khiru River was overfishing, followed by siltation and sedimentation, use of banned fishing gears, catching of brood fish and juvenile fishes, *katha* fishing, increasing fishing pressure, and so on (Table 3). Stoddard et al. (2006) found similar threats to the fish diversity of inland waters of Bangladesh. Rahman et al. (2012), Flowra et al. (2013), Islam et al. (2015), Pandit et al. (2015a), Sultana et al. (2017), Arefin et al. (2018), and Islam et al. (2019) found the similar types of causes responsible for species reduction in the inland waters of Bangladesh. Likewise, indiscriminate catching of fish fry and fingerlings, water flow reduction, modification and loss of fish habitat, are also reflected as major threats for declining freshwater species diversity (Chaklader et al., 2014; Hanif et al., 2015b; Hossain et al., 2015).

Table 2: Fishing gears used in the Khiru River

Category	Type of gear	Name of gear	Mesh size (cm)	Target species	Period (month)
Fish net	Cast net	*Jhakijal*	>1	All	Year round
Fish net	Lift net	*Dharma jal*	0.5-1	All	July-November
Fish net	Gill net	*Current jal*	0.5-2.5	All	Year round
Fish net	Seine net	*Berjal*	0.25-1	All	October-December
Fish net		*Morsharijal*	Fine meshed	All	July-November
Fish net	Drag net/ push net	*Thelajal*	0.25-1	All	Year round
Hook and line		*Ship borshi*	-	Carnivorous species	September-December
Wounding gear		*Konch*	-	Any kind of fishes	Year round
Fish trap		*Polo*	-	Punti, baim, and other SIS	October-December
Fish aggregating device		*Katha*	-	All	November-January

Table 3: Threats to the fish biodiversity of the Khiru River

Sl. no.	Threats to fish diversity	No. of respondents (percentage)
1	Overfishing	78 (97.50%)
2	Siltation and sedimentation	70 (87.50%)
3	Use of banned fishing gears	67 (83.75%)
4	Catching of brood and juvenile fishes	61 (76.25%)
5	*Katha* fishing, fishing by dewatering/irrigation	58 (72.50%)
6	Increasing fishing pressure	46 (57.5%)
7	Construction of various types of development and communication infrastructures like dams, embankments, bridge, etc.	45 (56.25%)
8	Low water depth and current	41 (51.25%)
9	Drought in summer	40 (50.00%)
10	Loss of connection of river with canal, *beel*, and other wetlands	38 (47.50%)
11	Creation of barrier and interruption in natural migration of fishes	36 (45.00%)
12	Over doses of insecticides and pesticides in agricultural land	35 (43.75%)
13	Water pollution	33 (41.25%)
14	Use of river water for irrigation	30 (37.50%)
15	Use of chemical fertilizers	16 (20.00%)

CONCLUSION

The Khiru River is remarkable for its affluent aquatic biodiversity. People surrounding this river depend on it for their livelihoods. Now the biodiversity of the river is in great risk as a result of overfishing, illegal fishing, siltation, and human settlement which create an adverse effect on river ecology. Consequently, water quality deterioration takes place which gradually decreasing fish and other species availability and diversity. The present study suggests that dredging, use of appropriate fishing gears, establishment of fish sanctuary, community based fisheries management, stocking of economically important indigenous fish species, implementation of fish acts/laws and increasing fishers' awareness may save valuable fish diversity of this river.

ACKNOWLEDGMENTS

The authors are profoundly thankful to the Department of Aquatic Resource Management, Sylhet Agricultural University, Sylhet to carry out the study.

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