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Fish biodiversity of river Dakatia and its conservation aspects in Bangladesh

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Abstract

The study was conducted from March 2016 to December 2017 to identify River and biodiversity threats and to suggest recommendations for conservation. River encroachment, river pollution, excess aquatic vegetation, Jakh and bamboo fencing system, use of illegal harmful nets, silt bed, were recorded as major threats to River Dakatia and its fish biodiversity. In this study, 72 fish species were recorded including 12 orders and 27 families. Cypriniformes constitutes highest number of fish population (28%). Cyprinidae shares the highest percentage (19%) among the recorded family. Catfish was found to be the biggest group (27%) among the recorded 14 common groups. The biggest habitat was found to be River-Estuary (43%). Among the identified threatened fish species (20) of River Dakatia, 11 species (55%) were recorded as Vulnerable (VU), 8 species (40%) as Endangered (EN) and 1 species (5%) as Critically Endangered (CR). For the conservation of fish biodiversity as well as to save the River Dakatia, the proper authority should give highest concern on strict implementation of existing fisheries legislations.

Keywords: Dakatia River, biodiversity, threatened species, conservation, Bangladesh

Introduction

Bangladesh is a low-lying riverine country located in southern Asia that has been formed as the largest deltaic plain at the confluence of the Ganges, the Brahmaputra (Jamuna) and the Meghna rivers and their tributaries. It has a common border to the west, north and east with India, a short border with Myanmar in the southeast, and is bounded by the Bay of Bengal in the south^[1].

Origin: One of the trans-boundary Rivers of Bangladesh is River Dakatia. From India's Tripura state at Bagsara of Comilla district it enters Bangladesh. It is a tributary of the Meghna. Kakrai River was the main source of flow of this river, but the Little Feni River cuts back and captured its upper portion. At present Chauddagam Khal has been the main source of River Dakatia connecting Little Feni River. A southward channel from River Dakatia forms the Noakhali Khal. The main channel meanders westward to Shekherhat, from where the old course goes south to join the Meghna at Raipur. The new and stronger channel passes through Chandpur Khal to join the Meghna west of Chandpur town^[2].

Length: The length of the River is 207 km.

Width: The average width of the river is 180 meter.

Depth: The average depth of the river is 9 meter.

Area: The area of the river in the river basin is 38.78 square kilometer.

Water Flow: Dakatia River receives tidal currents through the River Meghna for three-fourths of the year.

Myth: Most likely, the Magh-Firingi pirates entered the Noakhali and Comilla districts through this river. This river was robbed by them. Due to the robbery in this River, the name of the river is believed to have been Dakatia. The picture of pirate violence was found in a letter submitted to the court of Director of the Council of the East India Company in Calcutta, on 17 January, 1758. There it is written:

Being advised from Lakshmipur that the Maghs and other robbers are making depredations in

Their neighborhood and they are apprehensive that they attempt our factory itself which is no state of deface we have ordered the gentlemen at Dacca to send part of their sepoy to Lakshampur and shall supply them from hence with a few pieces of cannon and ammunition. Vide liong's selections from the unpublished records of the government. Letter No. 276, p.116-quote

Another opinion is heard in the name of Dakatia River. Once the River Dakatia was severe torrent. This branch of the Meghna flows in the River Dakatia. As a result of the devastating form of River Dakatia, the people on both sides of the river lost all their possessions. Many people lost their lives while passing through the River Dakatia. Dakatia has been named because of rapacious nature like a robber. Once upon a

time the goods were transported to different areas of the country including Barisal, Bhola, Shariatpur, Faridpur, Narayanganj, Dhaka, Narsingdi [3].

In Bangladesh, brief study on the fish biodiversity of river has not been done yet. This study aims to investigate i) threats on River Dakatia and its biodiversity ii) document fish species available in the River Dakatia with their present conservation status.

Materials and Methods

Study sites: To complete the study a total of 5 sampling sites were selected. A GPS meter was used to record the corresponding GPS reading of those sites.

Table 1: Sampling Stations with corresponding GPS values

Sampling Station No.	Name of the Sampling Stations	District	Latitude	Longitude
1	Mach Bazar, Dhakshin matha, Raipur	Luxmipur	23° 02' 20.984" N	90° 46' 09.567" E
2	Moddha Bazar, Faridganj	Chandpur	23° 08' 09.776" N	90° 44' 49.045" E
3	Icholi ghat	Chandpur	23° 23' 19.121" N	90° 45' 00.853" E
4	Dhali ghat	Chandpur	23° 20' 29.432" N	90° 67' 32.391" E
5	Haziganj Dhakshin Bazar, Haziganj	Chandpur	23° 14' 56.085" N	90° 51' 30.467" E
6	Doulatganj Mach Bazar, Laksham	Comilla	23° 14' 02.855" N	91° 07' 19.896" E

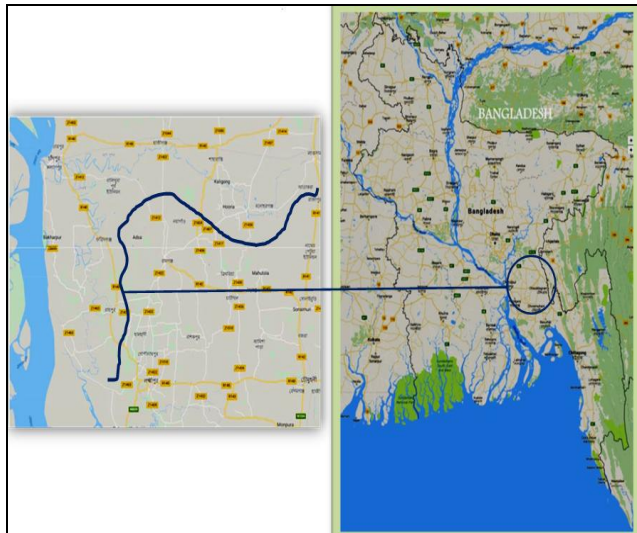


Fig 1: Map of River Dakatia, Bangladesh

Study period: The study period was from March 2016 to December 2017 (Twenty two months).

Data Collection Framework: A semi-structured questionnaire was used for data collection. Following methods were used:

- a. **FGD:** FGD was conducted in fish landing centers, fish bazar adjacent to the river and fishers village of the selected sampling sites.
- b. **Key informant interviews:** Key informants such as boat owners of commercial fishing vessels, fish retailer, fish traders, fisherman, riverside settlers and local community leaders were interviewed face to face.
- c. **Direct observation:** The present status of Dakatia River and fish catch were assessed through personal field observation.
- d. **Information crosscheck:** Information was crosschecked by the different literature and books.

Fish specimen identification: At first fish specimens were collected from fish bazar and fisherman's catch. Photos of different fish specimens were taken by a digital camera. Then collected fish samples were identified by analyzing their morphometric and meristic characteristic following [4]. By checking Catalogue of Fishes [5], valid scientific names of the identified species were ensured.

Threat identification

Threats on River and its fish biodiversity were determined after evaluating the data collected through different methods described in data collection framework.

Determination of conservation status

Local and Global conservation status were determined by following the database of IUCN Bangladesh [6] and IUCN 2017 [7] respectively.

Data analysis: For data analysis and graphical presentation computer software Microsoft Excel 2013 was used.

Results

Status of physical trends: The River Dakatia is one of the important rivers of Bangladesh. Lot of changes has been recorded during the study period are shown in the Table 2:

Table 2: Status of physical trends of Dakatia River

Past	Present
150 feet wide	40-50 feet wide
Torrential	Less current
Wide	Less especially in bazar or factory area
Well navigation route throughout the year (Steamer, Launch, Big boats, Trawler)	Lower part is navigable only in the rainy season
Well business route	Business route is almost closed
Fresh environment	Dirty environment
Abundant fish	Less fish abundance
Less use of illegal nets	High use of illegal nets

River and Fish biodiversity Threats

- 1. Illegal river encroachment:** During the study period many illegal establishments were developed through encroachments.
- 2. River water pollution:** River water was being polluted by Rice mills sewage, Garbage, Plastics pesticides and insecticides.
- 3. Construction of dam:** Dams which were constructed for irrigation might create threats to the river.
- 4. Use of river bank soil and withdrawal of sand from the river** Use of river bank soil and massive withdrawal of sand from the river were found to be very harmful.
- 5. Increase of water hyacinth:** Excessive water hyacinth was found during the study period.
- 6. Illegal fish farming:**
 - a. Jakh/Brush shelter system:** During the study period almost 3000 jakh/brush shelter were recorded (Fig.4).
 - b. Bamboo Fence system:** Approximately 20-22 Bamboo fence were recorded in the river especially in Raipur, Lakshampur area (Fig.4).
- 7. Use of harmful nets:** Various harmful nets (such as gill net/current jal, mosquito net) with different mesh size were found to be used tremendously to harvest fish.
- 8. Rise of submersible char:** During the study period, submersible char (silt bed) were recorded creating immense threat to fish species composition.
- 9. the river was noticed.**
- 4. Degradation of river ecosystem:** Degradation of river ecosystem was also observed.
- 5. Changes in river course:** River flow was found to be changed and less current was noticed.
- 6. Sudden flooding:** Sudden flooding might occur as a result of less river depth.
- 7. Closed naval route:** Due to the rising of silt bed in the river the navigation route is almost close.
- 8. River bank erosion:** As a result of unplanned and massive withdrawal of sand, river bank could be eroded.
- 9. Decrease of fish abundance:** The abundance of fish were found to be decreased a lot.
- 10. Decreased survival of eggs and juveniles:** Survival rate of eggs and juveniles will be decreased as a result of massive river water pollution.
- 11. Interruption in fish movements:** Fish movements could be interrupted by silt bed.
- 12. Loss of fish habitat:** Loss of fish habitat was also noticed.
- 13. Decreased fish production:** Fish production will be decreased heavily.
- 14. Extinction of fish species:** Some of the fishes were already being threatened and some are under serious threat.
- 15. Degradation of biodiversity:** Fish biodiversity could be negatively impacted.

Impact of River and Fish biodiversity Threats

- 1. Decrease of river wideness:** The River Dakatia is getting narrower day by day.
- 2. Destruction of natural river environment:** Destruction of natural river environment was observed.
- 3. Decrease of river depth:** Decrease of average depth of

Fish Biodiversity

From the 5 sampling stations a total 72 species were recorded including 12 orders and 27 families. List of existing fish species of River Dakatia with their taxonomic position (Order and Family name), scientific name, local name, common group, habitat and their conservation status in Bangladesh and global aspects are presented in Table 3:

Table 3: List of Fish species collected from the River Dakatia

Order	Family	Scientific name	Local name	Group name	Habitat	IUCN Conservation Status (BD)	IUCN Conservation Status (GB)
Pleurinectiformes	Soleidae	<i>Brachirus pan</i>	Kathal pata	Soles	E-R	-	LC
Syngnathiformes	Syngnathidae	<i>Microphis cunocalus</i>	Kumirer khil	Pipe fishes	R-E	VU	LC
Anguilliformes	Moringuidae	<i>Moringua raitaborua</i>	Rata boura	Eels	E-R	NT	NE
	Ophichthidae	<i>Pisodonophis boro</i>	Bamosh	Eels	E-R	LC	LC
Synbranchiformes	Synbranchidae	<i>Monopterusuchia</i>	Kuchia	Eels	R-E	VU	LC
	Mastacembelidae	<i>Mastacembelus armatus</i>	Baim	Eels	R-E	EN	LC
		<i>Macrognathus pancalus</i>	Guchi, Baim	Eels	R-E	LC	LC
		<i>Macrognathus aculeatus</i>	Tara baim	Eels	R-E	NT	NE
Tetraodontiformes	Tetraodontidae	<i>Tetraodon cutcutia</i>	Potka	Puffer fishes	R-E	LC	LC
Beloniformes	Belonidae	<i>Xenentodon cancila</i>	Kakila	Gars	R-E	LC	LC
Channiformes	Channidae	<i>Channa punctatus</i>	Taki	Snakeheads	E-R	LC	NE
Cypriniformes	Cyprinidae	<i>Salmostoma acinaces</i>	Chela	Barbs & Minnows	R	LC	LC
		<i>Chela cachius</i>	Chep chela	Barbs & Minnows	R-B	VU	LC
		<i>Aspidoparia morar</i>	Morari	Barbs & Minnows	R	VU	LC
		<i>Esomus danricus</i>	Darkina	Barbs & Minnows	R-E	LC	LC
		<i>Devario devario</i>	Banspata	Barbs & Minnows	R	LC	LC
		<i>Megarasbora elanga</i>	Along	Barbs & Minnows	R	EN	LC
		<i>Amblypharyngodon mola</i>	Mola	Barbs & Minnows	R	LC	LC
		<i>Osteobrama cotio</i>	Dhela	Barbs & Minnows	R	NT	LC
		<i>Puntius sarana</i>	Sarpunti	Barbs & Minnows	R-E	NT	LC
		<i>Pethia ticto</i>	Tit punti	Barbs & Minnows	R	VU	LC
		<i>Puntius phutunio</i>	Phutani punti	Barbs & Minnows	R	LC	LC
		<i>Puntius sophore</i>	Bhadi punti	Barbs & Minnows	R	LC	LC
		<i>Pethia conchoniis</i>	Kanchan punti,	Barbs & Minnows	R	LC	LC
		<i>Labeo calbasu</i>	Kalibaus	Carp	R	LC	LC
		<i>Labeo rohita</i>	Rui	Carp	R-E	LC	LC

		<i>Labeo bata</i>	Bata	Carps	R	LC	LC
		<i>Gibelion catla</i>	Catla	Carps	R-E	LC	LC
		<i>Cirrhinus mrigala</i>	Mrigal	Carps	R-E	NT	LC
		<i>Cirrhinus reba</i>	Raek	Carps	R	NT	LC
	Cobitidae	<i>Lepidocephalus guntea</i>	Gutum	Loaches	R-B	LC	LC
Siluriformes	Siluridae	<i>Wallago attu</i>	Boal	Catfishes	R-E	VU	NT
		<i>Ompok pabda</i>	Modhu pabda	Catfishes	R	EN	NT
		<i>Ompok pabo</i>	Pabda	Catfishes	R	CR	NT
	Chacidae	<i>Chaca chaca</i>	Cheka	Squire-head catfish	R	EN	LC
	Schilbeidae	<i>Silonia silondia</i>	Shilong	Catfishes	R-E	LC	LC
		<i>Ailia coila</i>	Kajuli	Catfishes	R-E	LC	NT
		<i>Neotropius atherinoides</i>	Batasi	Catfishes	R-E	LC	LC
		<i>Eutropichthys vacha</i>	Bacha	Catfishes	R-E	LC	LC
		<i>Clupisoma garua</i>	Gharua	Catfishes	R-E	EN	LC
	Pangasidae	<i>Pangasius pangaius</i>	Pangas	Catfishes	R-E	EN	LC
	Bagridae	<i>Rita ritra</i>	Rita	Catfishes	R-E	EN	LC
		<i>Sperata aor</i>	Air	Catfishes	R-E	VU	LC
		<i>Sperata seenghala</i>	Guizza air	Catfishes	R-E	VU	LC
		<i>Mystus bleekeri</i>	Gulsha tengra	Catfishes	R	LC	LC
		<i>Mystus vittatus</i>	Tengra	Catfishes	R-E	LC	LC
		<i>Mystus cavasius</i>	Golsha,	Catfishes	R-E	NT	LC
		<i>Mystus tengara</i>	Bhajari-tengra,	Catfishes	R	LC	LC
Clupeiformes	Clupeidae	<i>Corica soborna</i>	Kachki	Clupeids	R-E	LC	LC
		<i>Gudusia chapra</i>	Chapila	Clupeids	R	VU	LC
	Engraulidae	<i>Setipinna phasa</i>	Phasa	Anchovies	E-R	LC	LC
Osteoglossiformes	Notopteridae	<i>Notopterus notopterus</i>	Foli	Featherbacks	R-E	VU	LC
		<i>Chitala chitala</i>	Chitol	Featherbacks	R-E	EN	NT
Perciformes	Mugilidae	<i>Rhinomugil corsula</i>	Khursula	Mulletts	E-R	LC	LC
	Anabantidae	<i>Anabas testudineus</i>	Koi	Perches	R	LC	DD
	Osphronemidae	<i>Trichogaster lalius</i>	Lal kholisa	Perches	R	LC	LC
		<i>Ctenops nobilis</i>	Neftani	Perches	R-E	LC	N
	Centropomidae	<i>Lates calcarifer</i>	Koral	Perches	E-R	NE	NE
	Eleotridae	<i>Eleotris lutea</i>	Kuli	Sleepers	E-R	DD	NE
		<i>Eleotris fusca</i>	Budh bailla	Sleepers	E-R	LC	LC
	Ambassidae	<i>Chanda nama</i>	Nama chanda	Perches	R-E	LC	LC
		<i>Parambassis ranga</i>	Ranga chanda	Perches	R-E	LC	LC
	Nandidae	<i>Nandus nandus</i>	Vheda	Perches	R-E	NT	LC
		<i>Nandus meni</i>	Meni	Perches	R	NE	NE
	Gobiidae	<i>Parapocryptes batoides</i>	Dali chewa	Mudskippers	E-R	LC	NE
		<i>Awaous grammepomus</i>	Bele	Mudskippers	E-R	VU	LC
		<i>Glossogobius giuris</i>	Bele	Mudskippers	E-R	LC	LC
		<i>Awaous guamensis</i>	Baila	Mudskippers	E-R	LC	LC
		<i>Taenioides cirratus</i>	Chewa	Mudskippers	E-R	LC	DD
		<i>Brachygobius numus</i>	Nuna baila	Mudskippers	E-R	LC	NE
		<i>Odontamblyopus rubicundus</i>	Lal chewa	Mudskippers	E-R	LC	NE
		<i>Apocryptes bato</i>	Chiring	Mudskippers	E-R	LC	NE

*Not Evaluated (NE), Data Deficient (DD), Least Concern (LC), Near Threatened (NT), Vulnerable (VU), Endangered (EN), Critically Endangered (CR)

*River (R), River- Estuary (R-E), Estuary- River (E-R), River-Brackish (R-B)

*BD=Bangladesh, GB=Glob



Fig 2: Pictorial view of establishments in both sides of the River Dakatia at Laksham, Comilla



Fig 3: Pictorial View of water pollution of River Dakatia at Haziganj, Chandpur



Fig 4: Pictorial view of Bamboo fencing in the River Dakatia at Raipur, Luxmipur



Fig 5: Pictorial view of Jakh farming in the River Dakatia at Dhali ghat, Chandpur

Percentage composition of Dakatia River fish species

The total identified fish species (72) of the River Dakatia is 21 % of the total fresh water fish species (265) recorded by Rahman [8] (Fig.6).

Order wise percentage of Dakatia River fish species

The most dominant order was found to be Cypriniformes which consists 28% of the total fish population followed by Perciformes (27%) and Siluriformes (24%) (Fig.7).

Family wise percentage of Dakatia River fish species

Cyprinidae was found to be the richest family (19%) followed by Gobiidae (8%) and Bagridae (7%) (Fig.8).

Different common groups of Dakatia River fish species

In the present study fourteen (14) common groups were recorded. Catfishes were found to be the highest contributor (27%) followed by Barbs and Minnows (20%) (Fig.9).

Habitat percentage of Dakatia River fish species

The biggest habitat for the maximum number of fishes was found to be River-Estuary (43%) followed by River (30%) and Estuary-River (24%) revealed from the present study (Fig.10). River-Brackish constitutes only 3%.

Local conservation status of Dakatia River fish species

From River Dakatia, 20 fish species were recorded which is 24% of total threatened fishes (64) of Bangladesh reported by IUCN Bangladesh [6] (Fig.14).

The threatened species was 22% of the total identified species of Dakatia River. Out of the 20 fish species, 11 species (55%) were found as Vulnerable (VU), 8 species (40%) as Endangered (EN) and 1 species (5%) as Critically Endangered (CR) (Fig.13).

The highest percentage was recorded as Least Concern (56%) followed by Vulnerable (15%), Endangered (11%) category calculated from the analysis of local conservation status of Dakatia River fish species. Only 1% fish species were occupied by Critically Endangered category respectively (Fig.12).

Global conservation status of Dakatia River fish species

The highest percentage of fish species was constituted by the Least Concern category (75%) followed by Not Evaluated (14%) and Near Threatened (8%) category according to IUCN 2017 [7]. Data Deficient category shared only 3% of the total fish species (Fig.11).

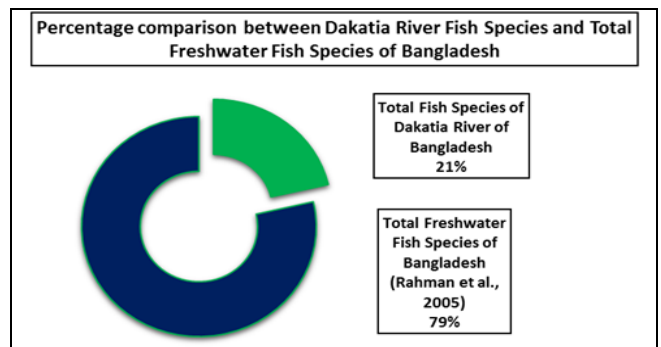


Fig 6: Percentage comparison between Dakatia River Fish Species and Total Freshwater Fish Species of Bangladesh

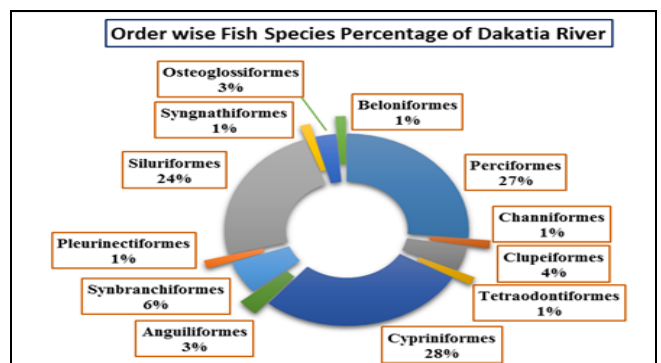


Fig 7: Order wise Fish Species Percentage of Dakatia River

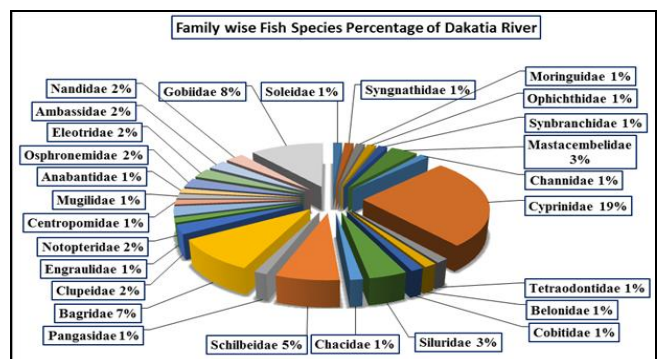


Fig 8: Family wise Fish Species Percentage of Dakatia River

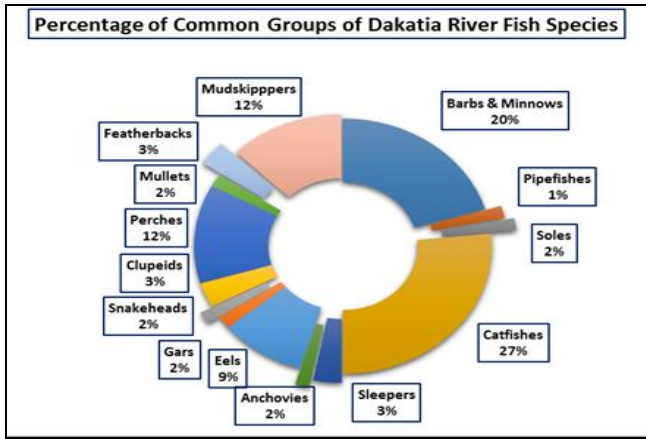


Fig 9: Percentage of Common Groups of Dakatia River Fish Species

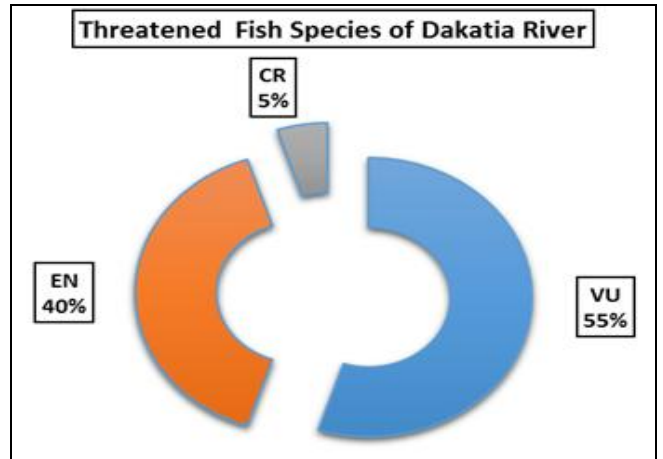


Fig 13: Threatened Fish Species of Dakatia River

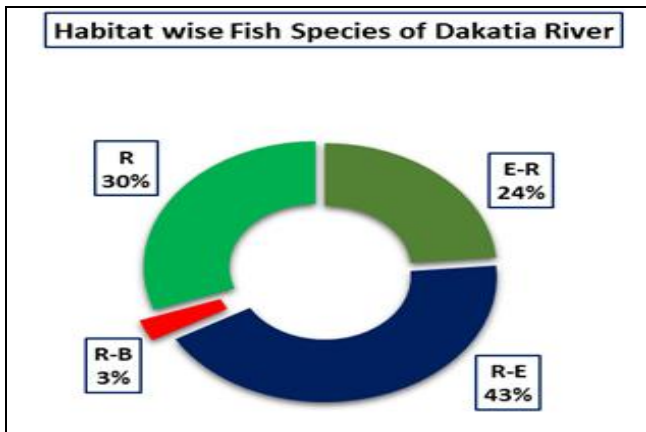


Fig 10: Habitat wise Fish Species of Dakatia River

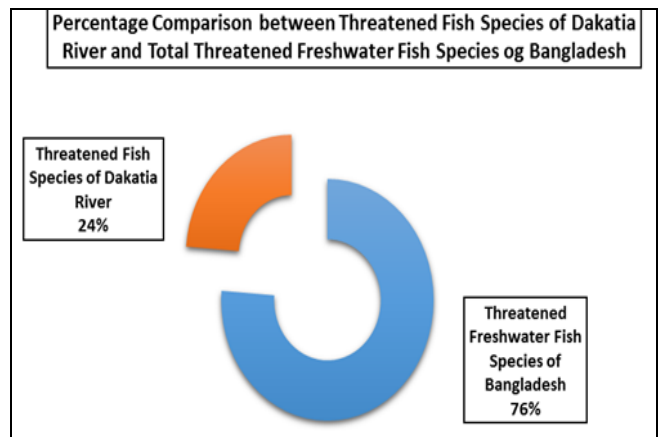


Fig 14: Percentage Comparison between Threatened Fish Species of Dakatia River and Total Threatened Freshwater Fish Species of Bangladesh

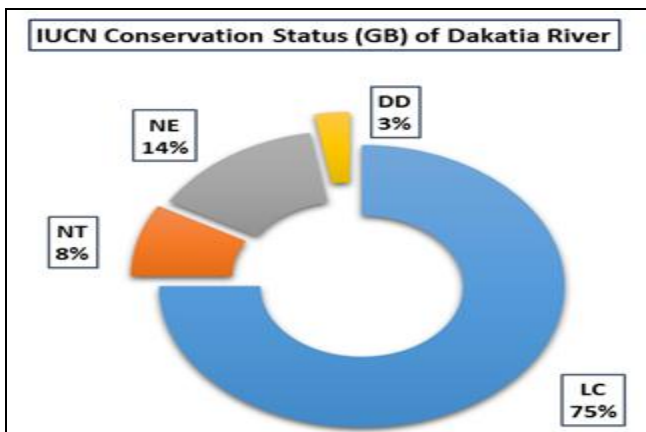


Fig 11: IUCN Conservation Status (GB) of Dakatia River

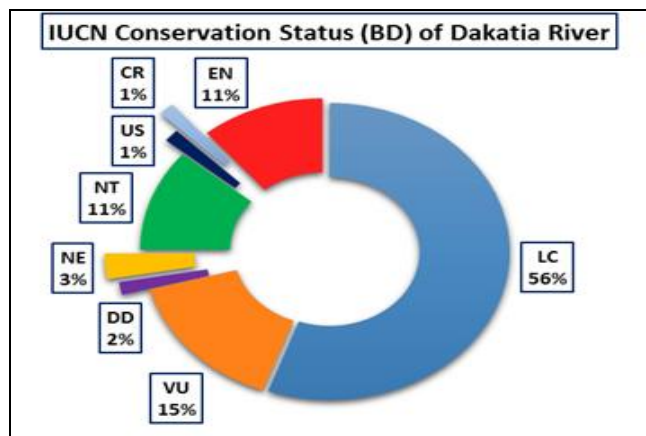


Fig 12: IUCN Conservation Status (BD) of Dakatia River

Discussion

For a country like Bangladesh, River is considered as life line which serves the people in many aspects. Increases in pollution and increased exploitation and extraction of the resources might have severe negative impact on the river [9]. Fish of River Dakatia were found to be exploited through jakh/brush shelter system which creates threats to the biodiversity of fishes.

In Bangladesh several authors reported different fish species composition for different rivers. Very little work had been done previously on the River Dakatia and its fish biodiversity. A list of 293 fresh water fish species was given by Hossain *et al.* [10] which include 13 orders and 61 families. A list of 265 freshwater fish species was documented by Rahman [8] in Bangladesh belonging to 154 genera and 55 families. A total 72 species were recorded including 12 orders and 27 families in the River Dakatia. Pramanik and Hasan [11] recorded 56 fish species under 9 orders and 23 families in the River Dhonagoda and Pramanik *et al.* [12] recorded a total of 107 species under 13 orders and 36 families in the River Meghna. Cypriniformes was found to be the most dominant order in the present study whereas Pramanik and Hasan [11] recorded Siluriformes as the most diversified order in the River Dhonagoda.

Cyprinidae was found to be the most dominant family among the recorded family which is similar to the study of Pramanik and Hasan [11] and Pramanik *et al.* [12]. The dominance of this family in the fresh water fishes of Bangladesh showed by Rahman [8].

Catfish was recorded to be the most dominant group in the River Dakatia which is similar to the findings of Pramanik and Hasan ^[11] and Pramanik *et al.* ^[12].

River-Estuary shared the biggest habitat for the fishes found from the present study which is different to the study of Pramanik *et al.* ^[12] who recorded Estuary-River as the biggest habitat in the River Meghna.

20 fishes were found to be threatened revealed from the present study which is very close to the study of Pramanik *et al.* ^[12] who found 21 threatened fishes in the River Meghna.

75% species were recorded as Least Concern category in terms of Global conservation status whereas Pramanik and Hasan ^[11] recorded only 68% in the River Dhonagoda.

Not a single species of the identified fishes was found under threatened category in the Global conservation aspects. As for example, *Chaca chaca* is considered Endangered (EN) at present in Bangladesh but it is categorized as Least Concern (LC) globally.

Conclusions and Recommendations

The status of fish biodiversity and river has been found under serious threat. For conservation of fish biodiversity as well as to save the River Dakatia, following recommendations should be followed:

- River encroachment around the port bazar area should be stopped
- Excess aquatic vegetation should be controlled
- Ferry movement should be facilitated
- River pollution should be stopped
- River dredging should be conducted
- Pesticides, insecticides using should be restricted
- Currents friendly dams, bridges should be constructed
- Sufficient forest trees should be planted
- Collaboration among Govt. and the political parties should be initiated
- Jakh and bamboo fencing system for fish harvesting should be banned
- Native juvenile fish species should be stocked every year
- River-centric Community based organizations should be appreciated
- Treatment of rice mills waste should be initiated
- Use of illegal harmful nets should be controlled
- Laws should be made and strictly implemented against illegal fishing
- Mass awareness should be built.

Acknowledgement: The authors are thankful to the fisher's community of Dakatia River for their co-operation during data collection.

Conflict of interest

There is no conflict of interest.

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