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Collection, preservation, and identification of freshwater fish species in middle to north-east Bangladesh with special notes on phenotypic plasticity

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Authors' Contribution | **Hasan, M.** plans the research, execute the sampling and write the manuscript. **M.S. Islam** partly supports to prepare the table, figures and scientific writing.

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ABSTRACT

A checklist of 110 species of fishes belonging to 10 orders, 31 families and 78 genera was recorded with their scientific, common and Bangla or local names. These fish specimens were collected from the rivers, beels, haors, ponds and swamps of middle to north-east Bangladesh (Jamalpur, Netrokona, Kishorganj, Munshiganj and Bogra Districts). The order Cypriniformes (37%) was recorded higher followed by Perciformes (24%), Siluriformes (23%), Clupeiformes (6%). The global and national IUCN categories of these species were also provided. Based on local IUCN criteria, around 23% fish species belongs to threatened level and 5, 8 and 10% are denoted as critically endangered (CR), endangered (EN) and vulnerable (VU), respectively. Although collection and preservation is comparatively hassle-free, however, due to mingle nature of few fish species; it seems difficult to error free identification of the collected fishes by morphological traits alone. Two individuals from Sanondabari, Jamalpur (MHBSFMSTU Fish 92 and Ghaglajur Bazar, Netrokona (MHBSFMSTU Fish 84), morphologically very similar but they are completely two separated species i.e. *Gagata cenia* and *G. youssoufi*, respectively. Phenotypic plasticity is a barrier to name the fish species accurately, suggesting the presence of putative candidate species or existence of hidden diversity in the collected specimens of *Sisoridae* family. Due to anthropological effects, the biodiversity and fishing grounds are losing their qualities, resulting the low number of freshwater fish species in these sampling sites. The systematic, ecology, distribution, habitats of these fish fauna need to be studied exclusively and a well-planned conservation strategy need to implement as early as possible for protecting our valuable freshwater tasty fishes. Further, the output of the current study will also guide the government and non-government organization to come forward and take necessary measure for the betterment of the country, its economy, and fisheries resources.

Keywords: Bangladesh; biodiversity; freshwater species; identification; morphology; phenotypic plasticity.

INTRODUCTION: Bangladesh is a biologically rich country due to its unique site of Indo-Burma and Eastern Himalaya region, and is traversed by three of Asia's largest rivers, the Ganga, Brahmaputra, and Meghna, which reach to the Bay of Bengal. Warm water temperature, plentiful rainfall, and nutritive silty clay-loam soil make this low land a good resource of fishes. These attribute makes Bangladesh is the third largest aquatic fish biodiversity in Asia, after China, Pakistan, and India, with about more than 800 species in fresh, brackish, and marine waters (Hussain and Mazid, 2001; Gul, 2020). Many people (>17 millions), particularly the low-income people find a source of income and livelihood in the fisheries and aquaculture sector. Therefore, fish and fisheries have a powerful influence on the economy, nutrition, and culture of Bangladesh. However, due to anthropological affect and climate change many fishes are now under threat or near to extinct from Bangladesh (Hasan and Tripti, 2021). In the last century, due to degradation of aquatic biodiversity, Bangladesh has lost many important tasty fish species like Labeo nandina, L. dyoceilus, Esomus lineatus, Bangana dero etc.

Fish cannot breed properly due to lack of comfortable fishing grounds, because; industrial and other effluents are being discharged into the river regularly. Therefore, habitat destruction is a common issue now-a-day. We are losing our valuable tasty fishes. Healthy ecosystem is also a good indicator for better living of fishes (Simon and Lyons, 1995). Since the problem of aquatic ecosystem is severe here in Bangladesh. Therefore, it is urgent to make a satisfactory initiative to solve the predicament. Firstly, the accountability of freshwater fish species in Bangladesh evaluated by Hamilton in 1822 during the British period. Later, after a long gap, a details study was undertaken by Rahman (2005) and revealed 265 species of freshwater species list fewer than 55 families. This information has been frequently used in the academic and research purposes until 2011. However, Hossain *et al.* (2012) argued that this information is misleading, and he proposed 293 freshwater species in Bangladesh. In his accountability, he included the brackish water species under the freshwater species list, because brackish water species may go upstream and stay here long time without any physiological changes. Beside these, some sporadic study was occurred in some regions. For example, Bhuiyan (1964) described 71 species from Dhaka district while Doha (1973) reported 106 species in Mymensingh and Tangail district. In addition, some other studies were taken to record fish species list in river basin. Ahmed and Hasan (1981) prepared a checklist from Karnaphuli river, Hossain *et al.* (2007) enlisted 97 species from Naaf river.

Morphological traits alone cannot be able to identify the species due to phenotypic plasticity of fishes. This is one of the colossal obstacles in systematic study. Consequently, identification of species by our naked eye is frequently misleading. In addition, phenotypic mingle nature of fishes make confusion to the

ichthyologists to identify the cryptic or morphologically similar species. Therefore, many researchers are using DNA barcode to overcome this constrain. Using of DNA data in contemporary time is highly appreciated and day by day this technique is getting popularity. Updating species list is an intermittent and continuous process. A few works has been done randomly and these data are sometimes worthless due to lack of proper vouchering number or even lack of photography. Due to political unrest and/or civil revolution, government failed to emphasize to document the entire freshwater species list in Bangladesh. Further, there is no research has been undertaken previously to update the freshwater species list in the middle to north-east part in Bangladesh. Therefore, in the present study, we prepare an update freshwater species list with their voucher and corresponding photograph in this region which may help for further documenting, naming, and assessment of biodiversity. These data will be helpful to go for further research on molecular basis.

OBJECTIVES: The objective of this study were as follows: (1) to update the freshwater fish species list in Bangladesh with comments on the threatened species status, (2) to argue how phenetic similarities make confusion for conservation of fish species and (3) to suggest proper conservation plan for sustainable use of freshwater species in Bangladesh.

MATERIALS AND METHODS:

MATERIALS AND METHODS: The selected sites were surveyed fortnightly from July 2018 to June 2020. The fishes were collected by seine nets, dip nets, cast nets, gill nets, traps, hooks, and wounding gear. Personal visits of different fishing landing centers, local fish markets and sometime also information gathered from the local fishermen. Photo of each specimen was recorded, and their initial information (sex and SVL) was observed. The collected samples were preserved in 90% ethanol. . After study the morphometric and meristic characters, the fishes were tagged as a voucher number and kept in the laboratory of "Evolution and Diversity", Bangamata Sheikh Fojilatunnesa Mujib Science and Technology University (BSFMSTU), Jamalpur Bangladesh. Identification and systematic accounts were done based on Rahman (2005) and IUCN Bangladesh (2015). Fish Base (2022) online portal was also used for the indentification. Primary data were recorded from consult with the fishermen and local experts. In addition, we also used the published and unpublished records, government agencies report for the local and scientific name.

RESULTS: About 110 fish species belonging to 31 families and 78 genera were recorded from selected areas (figure 1).

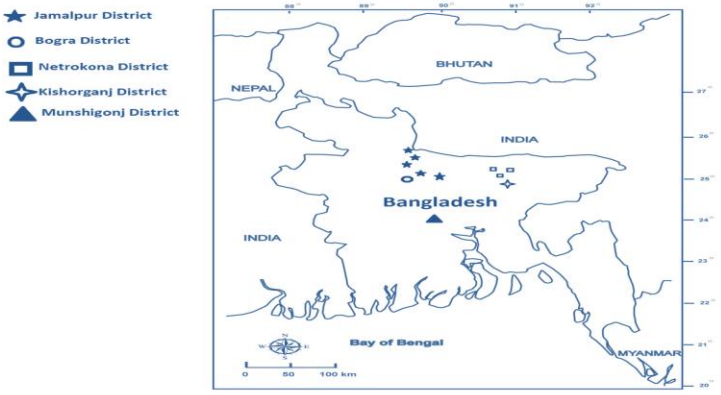

Figure 1: Locations of areas surveyed in Bangladesh.

This might be helpful for the local researchers and students for their fisheries practical work. The highest number of fishes (37%) belongs to order Cypriniformes whereas 24%, 23% and 6% fish species belongs to order Perciformes, Siluriformes, Clupeiformes, respectively (figure 2).

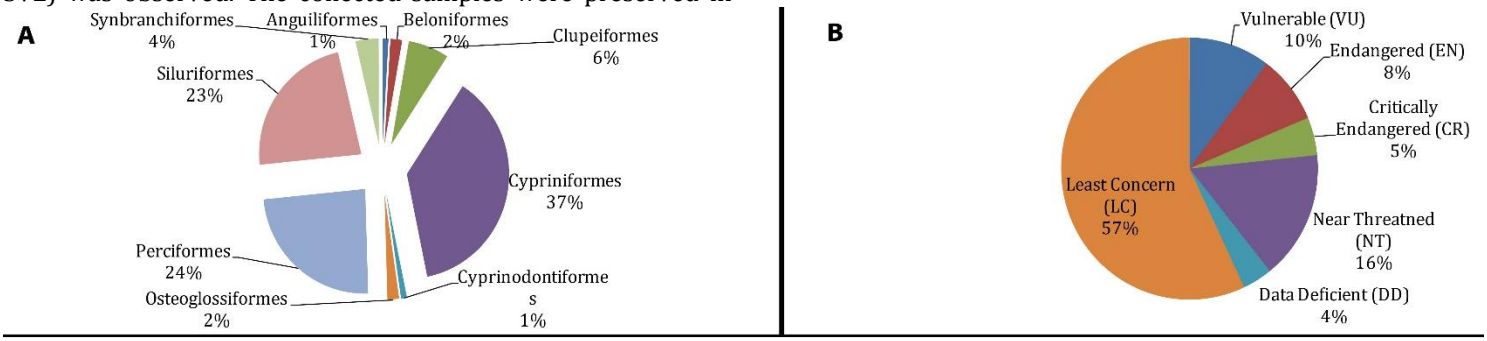

Figure 2: (A) Order wise percent distribution of fish abundance and (B) Percent distribution of different threatened level categories based on IUCN (2015) national category.

The global and national IUCN categories of these species are also provided (table 1). Based on local IUCN criteria, around 23% fish species belongs to threatened level and 5, 8 and 10% are denoted as Critically Endangered (CR), Endangered (EN) and Vulnerable (VU), respectively (table 1, figure 2). Sucker mouth catfish in the Old Brahmaputra River is a severe hazard, because it kills all SIS (Small Indigenous Fishes) which are essentially influential to our daily food. Further, a kind of small mesh size (locally known as China Duari Jal) net are indiscriminately killed the small fishes. From the current study, it seems that the biodiversity of this region is disrupted due to anthropological effect. River basin is filling by the loam and erosion of embankment of river is remarkable. Particularly in the month of June and July, the whole Brahmaputra River basin over flooded and create a miserable situation of the nearby people. The biodiversity of freshwater species in this area is going to narrow day by day due to above mentioned reasons. Most importantly, few species are so morphological similar that we could not identify them easily by our naked eye. Phenetic similarities are one of the greatest barriers to identify the species which eventually hamper the proper conservation policy.

Two individuals from Sanondabari, Jamalpur (MHBSFMSTU Fish 92 [serial no. 102 in table 1]) and Ghaglajur Bazar, Netrokona (MHBSFMSTU Fish 84 [serial no. 103 in table 1]) morphologically very similar but they are completely two separated species i.e., *Gagata cenia* and *G. youssoufi*, respectively (figure 2). Alternatively, the culture of carp fishes

i.e., exotic fishes is expanding relentlessly in these regions. Although, the people of Bangladesh are now getting the required protein from the fish but these comes from mostly in culture fishes. In this study, we did not include the exotic species.

DISCUSSION: Freshwater biodiversity disappearing faster to any other marine or terrestrial diversity due to decline of river flow rates increased warming temperature and withdrawal of water from rivers for agriculture and other human use (Vijaylaxmi *et al.*, 2010). It is well known that the water body of Bangladesh contains plenty of fishes, but systematic classification of these fishes not adequately studied in the past nor in the contemporary time. However, it is essential to assess the taxonomic status and/or accurate check list to undertake the any management and development program of fishes (Rahman, 2005). Therefore, identification of the fish fauna of the country is greatly needed. Assessment of biodiversity and conservation is also needed. The present work dealing with freshwater fishes only which comprises 110 species of 31 families in 78 genera. It is expected that extensive collection from the hill-streams and remote area may increase the number of new species. It is believed that the present work is an inspiration and stimulus work to further detail study of describes the new species with incorporating the molecular and ecological data. It is generally accepted that the abundance of freshwater fish species in Bangladesh is going to decrease due to various natural and anthropogenic effect. Biodiversity status of many water bodies particular the old Brahmaputra, the Kongshsa and the Jamuna River is really dilapidated.

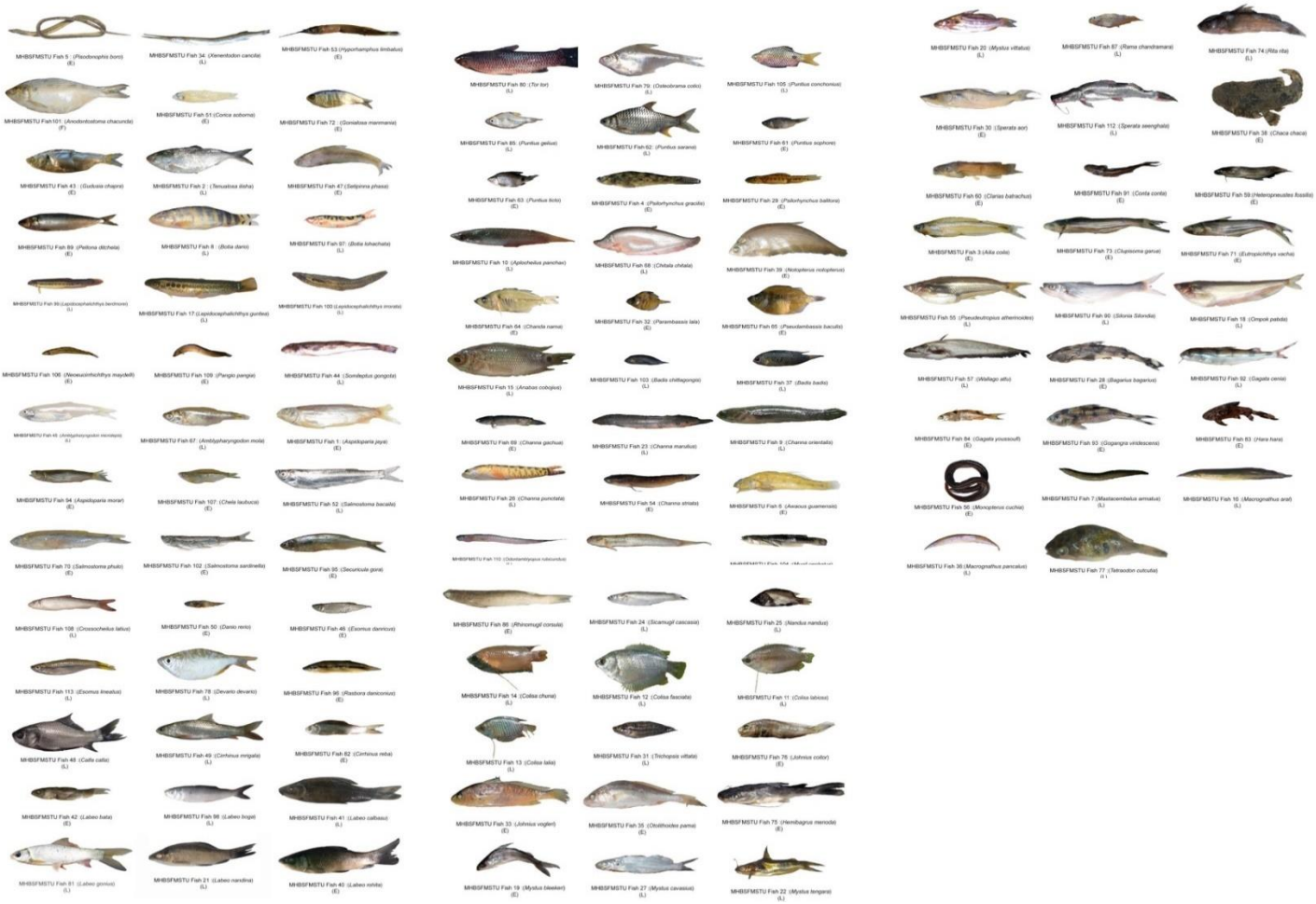

Figure 3: Photograph of live (L)/ethanol (E) preserved of 110 species (Chronology of pictures corresponds to table 1)

From our experiences, it is suggested that availability of fishes in the river is sharply decline which is beyond our imagination. Roughly, it is quantified that out of 4 fishes 1 species is threatened which is alarming for the future of fisheries resources in Bangladesh. Further, another 16% fish species is near threatened which means the degree of threatened is increasing clearly. Government of Bangladesh should take mega project to eliminate the sand/loam which makes Small Island in the middle of river and should maintain the navigation in the river all the year round. Further, concerned authority needs to implement Fish Law Act properly to save and sustainable use of the freshwater fishes all the year round. Considering all these points, it is recommended that conservation of our indigenous fish species is urgently needed with the incorporation of administrative support. This result is aligned with the findings of other researchers (Hasan and Tripti, 2021; Mamun, 2022). This kind of decreasing trend also observed in other wildlife diversity in the Islands of the Padma River, Rajshahi and also in fisheries bio-resources from the Farkka barrage to the Shampur Nagar Ghat, Rajshahi of the Padma River channel in Bangladesh

Although collection of fishes seems comparative less hassle-free, but the identification of each preserved specimen is difficult. Difficulty comes when we use our naked eye for identification. Sometimes, we do not find a good image with high resolution to avoid the doubter identification of species. A good image with DNA data is more informative than a poorly

SL No.	Voucher Id	Family	Genus	Species	English name	Local Name	IUCN Status		Location
							National	Global	
Order (Anguiliformes) (1Family) (1 genera) (1fishes)									
001	MHBSFMSTU Fish5	Ophichthidae	Pisodonophis	*Pisodonophis boro*	Rice-paddy Eel	Bamush/ Kharu	LC	LC	Sariakandi, Bogra
(Beloniformes) (2Family) (2 genera) (2 fishes)									
002	MHBSFMSTU Fish34	Belonidae	Xenentodon	*Xenentodon cancila*	Freshwater Garfish	Kakila	LC	NE	Jaliar haor, Netrokona
003	MHF053	Hemiramphidae	Hyporhamphus	*Hyporhamphus limbatus*	Congaturi halfbeak	Ekthhota	LC	NE	Kendua, Netrokona
Clupeiformes) (3Family) (7 genera) (7 fishes)									
004	MHBSFMSTU Fish101	Clupeidae	Anodontostoma	*Anodontostoma chacunda*	Chacunda Gizzard Shad	Chacunda	LC	NE	Defla Bazar, Jamalpur
005	MHBSFMSTU Fish 51	Clupeidae	Corica	*Corica soborna*	Ganges River Sprat	Suborna kaski	LC	LC	Kongso, Netrokona
006	MHBSFMSTU Fish 72	Clupeidae	Gonialosa	*Gonialosa manmina*	Gange River Gizzard Shad	Goni Chapila	LC	LC	Sariakandi, Bogra
007	MHBSFMSTU Fish 43	Clupeidae	Gudusia	*Gudusia chapra*	Indian River Shad	Deshi Suiya/ Chapila	VU	LC	Guthail, Jamalpur
008	MHBSFMSTU Fish 2	Clupeidae	Tenualosa	*Tenualosa ilisha*	Hilsha Shad	Ilish	LC	LC	Sariakandi, Bogra
009	MHBSFMSTU Fish 47	Clupeidae	Setipinna	*Setipinna phasa*	Gangetic Hairfin Anchovy	Chibuk chela/ Phasha	LC	LC	Guthail, Jamalpur
010	MHBSFMSTU Fish 89	Clupeidae	Pellona	*Pellona ditchela*	Indian Pellona	Choukka	LC	NE	Maloncho, Jamalpur
Order (Clupeiformes) (3Family) (7 genera) (7 fishes)									
011	MHBSFMSTU Fish 8	Cobitidae	Botia	*Botia dario*	Queen Loach	Bou mach	LC	NE	Sariakandi, Bogra
012	MHBSFMSTU Fish 97	Cobitidae		*Botia lohachata*	Reticulated Loach	Bou/Rani	EN	NE	Sokal Bazar, Jamalpur
013	MHBSFMSTU Fish 99	Cobitidae	Lepidocephalichthys	*Lepidocephalichthys berdmorei*	Burmese Loach	Balichata/ Puiya	LC	LC	Sanondabari, Jamalpur
014	MHBSFMSTU Fish 17	Cobitidae		*Lepidocephalichthys guntea*	Peppered Loach	Moricha puiya/Gutum	LC	LC	Jaliar haor, Netrokona
015	MHBSFMSTU Fish 100	Cobitidae		*Lepidocephalichthys irrorata*	Loktak Loach	Balikhura/ Puiya	VU	LC	Sanondabari, Jamalpur
016	MHBSFMSTU Fish 106	Cobitidae	Neoeucirrhichthys	*Neoeucirrhichthys maydelli*	Goalpara Loach	Gual Para puiya	CR	LC	Guthail, Jamalpur
017	MHBSFMSTU Fish 109	Cobitidae	Pangio	*Pangio pangia*	Cinnamon Loach	Kuttapuiya/ Panga/ Kolipuiya	LC	LC	Guthail, Jamalpur
018	MHBSFMSTU Fish 44	Cobitidae	Canthophrys	*Somileptus/ Canthophrys gongota*	Gongota Loach	Pahari puiya	NT	LC	Jaliar haor, Netrokona
Order (Cypriniformes) (3 Family) (22 genera) (41 fishes)									
019	MHBSFMSTU Fish 45	Cyprinidae	Amblypharyngodon	*Amblypharyngodon microlepis*	Indian Carplet	Mola	LC	NE	Jaliar haor, Netrokona
020	MHBSFMSTU Fish 67	Cyprinidae		*Amblypharyngodon mola*	Mola Carplet	Fakase mola	LC	LC	Jaliar haor, Netrokona
021	MHBSFMSTU Fish 1	Cyprinidae	*Aspidoparia*	*Aspidoparia jaya*	Jaya	Pieli	LC	NE	Sariakandi, Bogra
022	MHBSFMSTU Fish 94	Cyprinidae		*Aspidoparia morar*	Aspidoparia	Murli, Murari	VU	NE	Dewangonj bazar, Jamalpur
023	MHBSFMSTU Fish 107	Cyprinidae	Chela	*Chela laubuca*	Indian Glass Barb	Chep chela	LC	NE	Guthail, Jamalpur
024	MHBSFMSTU Fish 52	Cyprinidae	Salmostoma	*Salmostoma bacaila*	Large Razorbelly minnow	Narikeli Chela/Katari	LC	LC	Sokal Bazar, Jamalpur
025	MHBSFMSTU Fish 70	Cyprinidae	Salmostoma	*Salmostoma phulo*	Finescale Razorbelly minnow	Ful chela	NT	LC	Sokal Bazar, Jamalpur
026	MHBSFMSTU Fish 102	Cyprinidae	Salmostoma	*Salmostoma sardinella*	Sardinella Razorbelly Minnow	Chela	DD	LC	Sokal bazar, Jamalpur
027	MHBSFMSTU Fish 95	Cyprinidae	Securicula	*Securicula gora*	_	Gura chela	NT	LC	Sokal Bazar, Jamalpur
028	MHBSFMSTU Fish 108	Cyprinidae	Crossocheilus	*Crossocheilus latius*	Gangetic Latia	Matikhora/ kalabata	EN	LC	Guthail, Jamalpur
029	MHBSFMSTU Fish 50	Cyprinidae	Danio	*Danio rerio*	Zebra Danio	Zebra anju/ Zebra	NT	CR	Kongso, Netrokona
030	MHF046	Cyprinidae	Esomus	*Esomus danricus*	Flying barb	Darkina	LC	LC	Sokal Bazar, Jamalpur
031	MHBSFMSTU Fish 113	Cyprinidae	Esomus	*Esomus lineatus*	Stripped Flying Barb	Darkina	DD	NE	Mawaghat, Munshigonj
032	MHBSFMSTU Fish 78	Cyprinidae	Devario	*Devario devario*	Sind Danio	Hingrakatapunti/Deb ari/ Chapchela	LC	LC	Ghaglajur Bazar, Netrokona
033	MHBSFMSTU Fish 96	Cyprinidae	Rasbora	*Rasbora daniconius*	Blackline Rasbora	Darkina	LC	LC	Kendua, Netrokna
034	MHBSFMSTU Fish 48	Cyprinidae	Catla	*Catla catla*	Catla	Katol	LC	NE	Sokal Bazar, Jamalpur
035	MHBSFMSTU Fish 49	Cyprinidae	Cirrhinus	*Cirrhinus mrigala*	Mrigal Carp	Mrigel	NT	VU	Sanondobari, Jamalpur
036	MHBSFMSTU Fish 82	Cyprinidae	Cirrhinus	*Cirrhinus reba*	Reba	Tatkini/Bhagna/Raik/ Laacho,bata	NT	LC	Balikhula, Kishorgonj
037	MHBSFMSTU Fish 42	Cyprinidae	Labe	*Labeo bata*	Bata Labeo	Bhangon bata	LC	LC	Balikhula, Kishorgonj

038	MHBSFMSTU Fish 98	Cyprinidae	Labeo	*Labeo boga*	Boga Labeo	Vangon Gonari	CR	LC	Sokal Bazar, Jamalpur
039	MHBSFMSTU Fish 41	Cyprinidae	Labeo	*Labeo calbasu*	Orangefin labeo	Kalibaush	LC	LC	Sokal Bazar, Jamalpur
040	MHBSFMSTU Fish 81	Cyprinidae	Labeo	*Labeo gonius*	Kuria labeo	Gonia	NT	LC	Sokal Bazar, Jamalpur
041	MHBSFMSTU Fish 21	Cyprinidae	Labeo	*Labeo nandina*	Nandi Labeo	Nandina	CR	NT	Mawaghat, Munshiganj
042	MHBSFMSTU Fish 40	Cyprinidae	Labeo	*Labeo rohita*	Rohu	Rui	LC	LC	Sokal Bazar, Jamalpur
043	MHBSFMSTU Fish 80	Cyprinidae	Tor	*Tor tor*	Tor Mahsheer	Mohashol	CR	NT	Sokal Bazar, Jamalpur
044	MHBSFMSTU Fish 79	Cyprinidae	Osteobrama	*Osteobrama cotio*	Cotio	Dhela	NT	LC	Gaglajur Bazar, Netrakona
045	MHBSFMSTU Fish 105	Cyprinidae	Puntius	*Puntius conchonius*	Rosy barb	Kanchonputi/Tak puti	LC	LC	Guthail, Jamalpur
046	MHBSFMSTU Fish 85	Cyprinidae	Puntius	*Puntius gelius*	Golden dwarf barb	Gili punti/puti	NT	LC	Ghaglajur Bazar, Netrrokona
047	MHBSFMSTU Fish 62	Cyprinidae	Puntius	*Puntius sarana*	Olive barb	Shor punti	NT	LC	Sokal Bazar, Jamalpur
048	MHBSFMSTU Fish 61	Cyprinidae	Puntius	*Puntius sophore*	Spotfin swamp barb	Jat punti/ Bhadi puti	LC	LC	Jaliar Haor, Netrokona
049	MHBSFMSTU Fish 63	Cyprinidae	Puntius	*Puntius ticto*	Two-spot Barb	Tit punti	VU	LC	Sokal Bazar, Jamalpur
050	MHBSFMSTU Fish 4	Psilorhyncidae	Psilorhynchus	*Psilorhynchus gracilis*	Rainbow Minnow	Bali mach	NT	LC	Sariakandi, Bogra
051	MHBSFMSTU Fish 29	Psilorhyncidae	Psilorhynchus	*Psilorhynchus balitora*	Balitora Minnow	Balitora	LC	LC	Kongso, Netrokona
052	MHBSFMSTU Fish 10	Aplocheilidae	Aplocheilus	*Aplocheilus panchax*	Blue panchax	Kanpona	LC	LC	Danger Beel, Jamalpur
053	MHBSFMSTU Fish 68	Notopteridae	*Chitala*	*Chitala chitala*	Clown Knifefish	Chitol	EN	NT	Balikhola, Kishorganj
054	MHBSFMSTU Fish 39	Notopteridae	Notopterus	*Notopterus notopterus*	Bronze Featherback	Foli	VU	LC	Sokal Bazar, Jamalpur
055	MHBSFMSTU Fish 64	Ambassidae	Chanda	*Chanda nama*	Elongate Glass-perchlet Asian, Glass Fish	Chanda (lomba)	LC	LC	Balikhula, kishorgonj
056	MHBSFMSTU Fish 32	Ambassidae	Parambassis	*Parambassis lala*	Highfin Glassy Perchlet	Lal chanda	LC	NE	Jaliar haor, Netrokona
057	MHBSFMSTU Fish 65	Ambassidae	Pseudamba	*Pseudambassis baculis*	Indian Glassy Fish	Chanda (Gol)/ Phopa	NT	LC	Kendua, Netrokona
058	MHBSFMSTU Fish 15	Anabantidae	Anabas	*Anabas cobojius*	Gangetic Koi	Koi	DD	DD	Danger Beel, Jamalpur
059	MHBSFMSTU Fish 103	Ambassidae		*Badis chittagongosis*		Napit koi	-	-	-
060	MHBSFMSTU Fish 37	Badidae	Badis	*Badis badis*	Badis	Napit koi	NT	LC	Jaliar haor, Netrokona
061	MHBSFMSTU Fish 69	Channidae	Channa	*Channa gachua*	Dwarf Snakehead	Cheng	LC	LC	Danger beel, Jamalpur
062	MHBSFMSTU Fish 23	Channidae	Channa	*Channa marulius*	Giant Snakehead	Gojar	EN	LC	Ghaglajur Bazar, netrokona
063	MHBSFMSTU Fish 9	Channidae	Channa	*Channa orientalis*	Asiatic Snakehead	Raga	LC	LC	Jaliar haor, Netrakona
064	MHBSFMSTU Fish 26	Channidae	Channa	*Channa punctata*	Spotted Snakehead	Taki	LC	LC	Jaliar haor, Netrokona
065	MHBSFMSTU Fish 54	Channidae	Channa	*Channa striata*	Snakehead Murrel	Shol	LC	LC	Kendua, Netrokona
066	MHBSFMSTU Fish 6	Gobiidae	Awaous	*Awaous guamensis*	Scribbled goby	Bocha bele	VU	LC	Sariakandi, Bogra
067	MHBSFMSTU Fish 110	Gobiidae	Odontamblyopus	*Odontamblyopus rubicundus*	Rubicundus Eelgoby	Lal chewa	LC	NE	Mawaghat, Munshigonj
068	MHBSFMSTU Fish 111	Gobiidae	Parapocryptes	*Parapocryptes batoides*	Gobi	Chewa/ Chiring	LC	NE	Mawaghat, Munshigonj
069	MHBSFMSTU Fish 104	Mugilidae	Mugil	*Mugil cephalus*	Flathead Mullet	Flathead mullet	LC	LC	Sokal Bazar, Jamalpur
070	MHBSFMSTU Fish 86	Mugilidae	Rhinomugil	*Rhinomugil corsula*	Corsula	Folla, khalla, halla, khorsula	LC	LC	Balikhula, Kishorgonj
071	MHBSFMSTU Fish 24	Mugilidae	Sicamugil	*Sicamugil cascasia*	Yellowtail Mullet	Kachkibata	VU	LC	Mawaghat, Munshigonj
072	MHBSFMSTU Fish 25	Nandidae	Nandus	*Nandus nandus*	Mottled Nandus	Bheda	NT	LC	Jaliar haor, Netrokona
073	MHBSFMSTU Fish 14	Osphronemidae	Colisa	*Colisa chuna*	Honey Gourami	Chuna Kholisha	LC	LC	Danger Beel, Jamalpur
074	MHBSFMSTU Fish 12	Osphronemidae	Colisa	*Colisa fasciata*	Banded gourami	Boro Kholisha	LC	LC	Danger Beel, Jamalpur
075	MHBSFMSTU Fish 11	Osphronemidae	Colisa	*Colisa labiosa*	Thick-lipped Gourami	Kholisha	LC	LC	Danger Beel, Jamalpur
076	MHBSFMSTU Fish 13	Osphronemidae	Colisa	*Colisa lalia*	Dwarf gourami	Lal Kholisha	LC	LC	Danger Beel, Jamalpur
077	MHBSFMSTU Fish 31	Osphronemidae	Trichopsis	*Trichopsis vittata*	Croaking Gourami	Poka Kholisha	LC	LC	Mawaghat Munshigonj
078	MHBSFMSTU Fish 76	Sciaenidae	Johnius	*Johnius coitor*	Big-eyed Jewfish	Heowa/ Koitor/ Koitorpua	LC	LC	Ghaglajur Bazaar, Netrokona
079	MHBSFMSTU Fish 33	Sciaenidae	Johnius	*Johnius vogleri*	River perch	Poa	_	NE	Kongso, Netrokona
080	MHBSFMSTU Fish 35	Sciaenidae	Otolithoides	*Otolithoides pama*	Pama Croaker	Poa	LC	NE	Mawaghat Munshigonj
(Siluriformes) (8 Family) (21 Genera) (25 Fish)									

081	MHBSFMSTU Fish 75	Bagridae	Hemibagrus	*Hemibagrus menoda*	Menoda Catfish	Hugli/Arwari/Ghagla	NT	LC	Ghaglajur bazaar, Netrokona
082	MHBSFMSTU Fish 19	Bagridae	Mystus	*Mystus bleekeri*	Bleeker's Mystus	Gulsha	LC	LC	Jaliar haor, Netrokona
083	MHBSFMSTU Fish 27	Bagridae	Mystus	*Mystus cavasius*	Gangetic Mystus	Kabashi Tengra	NT	LC	Mawaghat, Munshigonj
084	MHBSFMSTU Fish 22	Bagridae	Mystus	*Mystus tengara*	Tengara Mystus	Bujuri	LC	LC	Jaliar haor, Netrokona
085	MHBSFMSTU Fish 20	Bagridae	Mystus	*Mystus vittatus*	Striped Dwarf Catfish	Tengra	LC	LC	Jaliar haor, Netrokona
086	MHBSFMSTU Fish 87	Bagridae	Rama	*Rama chandramara*	Asian Cory	Jolbujuri	LC	LC	Ghaglajur Bazar, Netrokona
087	MHBSFMSTU Fish 74	Bagridae	Rita	*Rita rita*	Rita	Rita	EN	LC	Balikhola, Kishorgonj
088	MHBSFMSTU Fish 30	Bagridae	Sperata	*Sperata aor*	Long-whiskered Catfish	Air	VU	LC	Kongso, Netrokona
089	MHBSFMSTU Fish 112	Bagridae	Sperata	*Sperata seenghala*	Giant River-catfish	Guizza air	VU	LC	Kongso, Netrokona
090	MHBSFMSTU Fish 38	Chacidae	Chaca	*Chaca chaca*	Squarehead Catfish	Bengachaca	EN	LC	Gaglajur Bazar, Netrokona
091	MHBSFMSTU Fish 60	Clariidae	Clarias	*Clarias batrachus*	Walking catfish	Magur	LC	LC	Guthail, Jamalpur
092	MHBSFMSTU Fish 91	Erethistidae	Conta	*Conta conta*	Conta catfish	Lal Kutakanti	NT	NE	Kawniar char, Dewangonj,
093	MHBSFMSTU Fish 59	Heteropneustidae	Heteropneustes	*Heteropneustes fossilis*	Stinging Catfish	Shing	LC	LC	Dangar beel, Jamalpur
094	MHBSFMSTU Fish 3	Schilbeidae	Ailia	*Ailia coila*	Gangetic Ailia	Bash patari/ Kajuli	LC	NT	Sariakandi, Bogra
095	MHBSFMSTU Fish 73	Schilbeidae	Clupisoma	*Clupisoma garua*	Garua Bacha	Ghaura	EN	NE	Mawaghat, Munshigonj
096	MHBSFMSTU Fish 71	Schilbeidae	Eutropiichthys	*Eutropiichthys vacha*	Batchwa Vacha	Bacha	LC	LC	Ghaglajur, Netrokona
097	MHBSFMSTU Fish 55	Schilbeidae	Pseudeutropius	*Pseudeutropius atherinoides*	Indian Potasi	Batai	LC	LC	Kendua, Netrokona
098	MHBSFMSTU Fish 90	Schilbeidae	Silonia	*Silonia Silondia*	Silond catfish	Shilong	LC	LC	Kawniar char, Dewangonj
099	MHBSFMSTU Fish 18	Siluridae	Ompok	*Ompok pabda*	Pabda catfish	Pabda/ Modhu pabda	EN	NT	Gaglajur bazaar, Netrokona
100	MHBSFMSTU Fish 57		Wallago	*Wallago attu*	Freshwater shark	Boal	VU	NT	Kongso, Netrokona
101	MHBSFMSTU Fish 28	Sisoridae	Bagarius	*Bagarius bagarius*	Gangetic Goonch	Baghair	CR	NT	Kongso, Netrokona
102	MHBSFMSTU Fish 92		Gagata	*Gagata cenia*	Indian gagata	Kutakanti, Cenia, Jangla, Kaowa, Gang tengra	LC	LC	Sanondabari, Jamalpur
103	MHBSFMSTU Fish 84		Gagata	*Gagata youssoufi*	Gangetic gagata	Gum/ Gagata	NT	LC	Ghaglajur Bazar, Netrokona
	MHBSFMSTU Fish 93		Gogangra						
104				*Gogangra viridescens*	Huddah Nangra	Gang Tengra	LC	LC	Dewangonj bazar, Jamalpur
105	MHBSFMSTU Fish 83		Hara	*Hara hara*	Huddah Nangra	Kutakanti	LC	LC	Ghaglajur Bazaar, Netrokona
(Synbranchiformes) (2Family) (4 Genera) (4 Fish)									
106	MHBSFMSTU Fish 56	Synbranchidae	Monopterus	*Monopterus cuchia*	Swamp eel	kuchia	VU	VU	Sokal Bazar, Jamalpur
107	MHBSFMSTU Fish 7	Mastacembelidae	Mastacembelus	*Mastacembelus armatus*	Tire-track Spinyeel	Shal Baim	EN	NE	Sariakandi, Bogra
108	MHBSFMSTU Fish 16		Macrognathus	*Macrognathus aral*	One-stripe Spiny Eel	Tara Baim	DD	LC	Jaliar haor, Netrokona
109	MHBSFMSTU Fish 36		Macrognathus	*Macrognathus pancalus*	Stripped Spinyeel	Chikra/ Guji baim	LC	LC	Jaliar haor, Netrokona
(Tetraodontiformes) (1Family) (1 Genera) (1 Fish)									
110	MHBSFMSTU Fish 77	Tetraodontidae	Tetradon	*Tetradon cutcutia*	Ocellated pufferfish	Pati potka	LC	LC	Bramaputra, Jamalpur

Table 1: List of freshwater species (110 species: Order=10, Family=31 and Genus=78) recorded in the middle to north-east area in Bangladesh. LC=Least Concern, DD= Data Deficient, NT= Near Threatened, VU= Vulnerable, EN= Endangered, CR= Critically Endangered and NE= Not Evaluated.

preserved holotype (Vences, 2020). Some fishes of Sisoridae family are morphologically very similar. For example, two individuals from Sanondabari, Jamalpur (MHBSFMSTU Fish 92 [serial no. 102 in table 1]) and Ghaglajur Bazar, Netrokona (MHBSFMSTU Fish 84 [serial no. 103 in table 1]) morphologically very similar but they are completely two separated species i.e., *Gagata cenia* and *G. youssoufi*, respectively (figure 2). Similar kinds of species complexity were found in *Cirrhinus reba* from the north-west Bangladesh (Kibria *et al.*, 2013) and in frog species in Bangladesh (Hasan *et al.*, 2012). In general, *Fejervarya limnocharis* is a widely distributed species in South Asia and principally in Bangladesh. However, after molecular and post mating isolation studies, it has been found that *F. limnocharis* divided into three groups which named was given as *F.* small type, *F.* middle type and *F.* large type (Islam *et al.*, 2008; Hasan *et al.*, 2012). This kind of species complexity also exists in the freshwater species in Bangladesh (Habib *et al.*, 2019; Rahman *et al.*, 2019; Hasan and Tripti, 2021). Therefore, we assume that more than one species might be incorporated into this family unintentionally. This speculation is supported by the recent molecular work of Rahman *et al.* (2019). As a result, now it is highly time demanding appeal to do molecular work to unveil the true species identification of these groups.

CONCLUSION: In view of the species, genera and families of fishes reported herein that middle to north-eastern part of Bangladesh is less abundant. In addition, many indigenous species are dwindling day by day. Phenotypic plasticity is a barrier to identify the species accurately, suggesting the presence of putative sibling species or

or existence of hidden diversity among the fish species, interpreting the immediate need for comprehensive studies on fish fauna of the region. Further work need to accomplish to know the systematic, ecology, distribution, habitats of these fish fauna of this notable region. The findings of the present work can help for proper documenting, naming, and assessment of fisheries biodiversity in this region. A well-planned conservation strategy needs to implement as early as possible for protecting our valuable freshwater tasty fishes.

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