## ICHTHYODIVERSITY OF THE FIVE LINKED RIVERS OF CHATTOGRAM BANGLADESH

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Abstract: Faunal records are essential to understand, manage and conserve any ecosystem if altered due to anthropogenic or natural causes. In the south eastern Bangladesh five linked rivers, Karnaphuli, Halda, Sikalbaha, Chandkhali and Sangu play a significant role in the country's fisheries sector. In this study ichthyofauna of the three linked rivers, Karnaphuli, Shikalbaha and Chandkhali From these three important linked rivers a total of 130 are presented. ichthyofaunal species, of which 112 finfish and 18 shellfish species were recorded during May 2010 to February 2020. Out of 130 species of finfish and shellfish, 128 species (110 fin and 18 shell fish) from the River Karnaphuli, 85 species (74 fin and 11 shell fish) from the River Shikalbaha and 83 species (72 fin and 11 shell fish) from the River Chandkhali were recorded. A total of 112 finfish species including four exotics belonged to 20 orders, 47 families, and 90 genera and 18 shellfish species were under one order, 3 families and 7 genera. Maximum finfish and shellfish species were under the families Cyprinidae (22 species) and Palaemonidae (9). Amongst the 112 finfish, one was critically endangered, six endangered and eleven was vulnerable. Systematic list of the ichthyofauna with local names is given. Status of local availability of species along with those reported as data deficient and not reported by IUCN (2015) are also provided. This study will help the fishery scientists, policy makers and planners to manage and conserve the fish faunal diversity in the three important linked rivers of Chattogram.

**Key words:** Ichthyofauna, Karnaphuli River, Sikalbaha River, Chandkhali River, finfish, shellfish, Chattogram.

#### INTRODUCTION

The trans boundary River Karnaphuli  $(22^{\circ}12'60.00" \text{ N}, 91^{\circ}47'59.99" \text{ E}, 270 \text{ km long})$  is known as the gate way of hill tracts of South Eastern Bangladesh (Fig.1). It supports the biggest sea port of the country, the

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<sup>©2020</sup> Zoological Society of Bangladesh DOI: https://doi.org/10.3329/bjz.v48i2.52364

Chattogram port, contributes a lion share in the national economy every year (Tk.2717.18 crore, plus 650 crore Taka FDR during 2016-17, personal communication). The Karnaphuli or Kaptai reservoir (68,800 ha) was created in 1961 by damming the River Karnaphuli at Kaptai point, to produce only hydropower (242 MW in 2016-17) of the country. Besides hydroelectricity, the reservoir also contributes a remarkable amount of freshwater fish yearly (13751 MT during 2018-19 year, BFDC 2019). There are five big tributaries of the River Karnaphuli, namely Myani, Chengi, Rainkhiang, Ichamati and Halda.

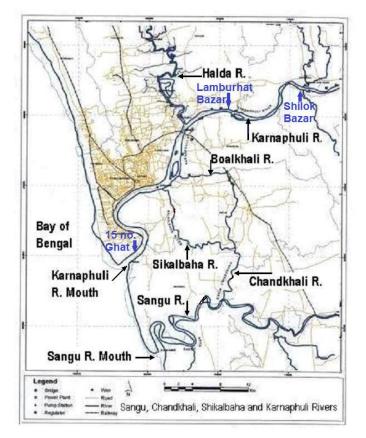


Fig. 1. Map showing the study area in the three linked rivers (Karnaphuli, Sikalbaha, & Chandkhali) along with five interconnected rivers (Halda, Karnaphuli, Sikalbaha, Chandkhali and Sangu) of Chattogram river system.

Except Ichamati major carps breed and spawn during monsoon in other four tributaries of the river Karnaphuli (Azadi 2019, 1985). Egg collection and fry production of major carps is regularly practiced in Halda River. Amongst the other four tributaries, only from Myani River BFDC collects the major carp's eggs during monsoon and hatches the same in artificial hatching tank. Hatched fries are reared to fingerlings in the reservoir creeks and later released in the Kaptai lake. Most of the ethnic communities of Chittagong hill tracts are dependent on this river for their livelihood from very beginning of their settlement and make this river as a common cultural heritage. Sikalbaha and Chandkhali are the two important linked rivers which are also linked with the Sangu and Halda rivers via the River Karnaphuli, which facilitate the migration of major carps from the River Sangu to the River Halda during breeding season and also movement of other migratory fresh and estuarine fishes in these five interconnected rivers (Fig. 1). Isolated by physical barrier of land and sea from the Ganges-Brahmaputra river system the freshwater riverine and estuarine fish stock of the Karnaphuli-Sangu river system needed a distinctive attention for detailed taxonomic study.

During 2007 an amendment was made on "The Protection and Conservation of Fish Rules, 1985" for the protection and conservation of fish spawning in Halda River, as per regulations suggested by Khan and Azadi (2006). According to this regulation about 40 km waterways of the River Halda (Kalurghat Bridge to Nazirthat Bridge) was declared as fish sanctuary where fishing is prohibited throughout the year. Halda adjacent canals and rivers including the rivers Karnaphuli, Sangu, Sikalbaha and Chandkhali were declared as seasonal sanctuary where fishing is closed from February to July, and in the 16 tributaries of the River Halda from March to July. Operation of engine and mechanized boats are also prohibited in Halda Rver during prespawning, spawning and post spawning time (March to July) for facilitating migration of brood carps (Bangladesh Gazette 2007, 2010). If the regulations in the Bangladesh Gazette (2007 and 2010) are fully implemented, the disappeared fish species might be restored in those rivers.

Some works on freshwater ichthyofauna of different rivers and water bodies including Karnaphuli River estuary, Halda, and Sangu rivers of Chittagong were done by Ahmed and Hasan (1981), Tsai *et al.* (1981), Gafur and Bhuiyan (1983), Hafizuddin *et al.* (1989), Haroon *et al.* (1989), Alamgir *et al.* (1990), Halder *et al.* (1991), Hossain *et al.* (2007), Rashed-Un-Nabi *et al.* (2011), Azadi and Arshad-ul-Alam (2011, 2013, 2014), Arshad-Ul-Alam and Azadi (2017). Although ichthyofauna of Halda and Sangu rivers have been done (Azadi and Arshad-ul-Alam 2011, 2013, 2014) but no detailed works were found on Ichthyofauna of the three linked tidal rivers of Halda i.e. Karnaphuli, Chandkhali and Sikalbaha. The present investigation was carried out to find out the ichthyofauna of these three linked rivers along with their status. This work might be useful to protect and conserve the fish fauna of the three important rivers which connect the River Sangu with the River Halda.

### **MATERIAL AND METHODS**

For this study fish samples were collected from the three linked tidal rivers namely Karnaphuli, Sikalbaha and Chandkhali (Fig.1) at monthly intervals in fresh condition during May 2010 to April 2012 from the catch of 38 kinds of active fishing gears immediately after emptying the gears. Regular monthly field trips were made during this period for catch assessment using mechanized boat. Fish samples were also collected through irregular field visit during May 2012 to February 2020 upto Shilok Bazar, Rangunia at Karnaphuli River (22.44, 92.08) (17 km upstream from Lambur Hat Bazar) (Fig.1). Structured questioners and data sheets were used for catch assessment and sampling survey in the regular sampling area from the 15 No. Ghat near Karnaphuli mouth (22.24, 91.82) to Lambur Hat Bazar, Raozan (35 km stretch of the Karnaphuli River) (22.42, 91.94) and entire Shikalbaha River (river mouth 22.32, 91.86 to Murali ghat 22.24, 91.96) and entire Chandkhali River (Murali Ghat 22.24, 91.96 to Keshua 22.18, 91.94), which connected the River Karnaphuli with the River Sangu (Fig 1). Photographs of fish samples were taken and colour pattern were noted in fresh condition. Specimens were preserved in 10% formaldehyde for detailed study later. Identification was made after reviewing external features and finer morphometric and meristic details with the help of works of Day (1889), Shafi and Quddus (1982), Rahman (2005) and IUCN (2000 and 2015). Regional threatened status was confirmed using IUCN (2015). Availability of the species was stated after analysis of catch assessment data. Classificatory scheme was mostly followed as proposed by Nelson et al. (2016). Accepted species name was confirmed from FishBase website.

#### **RESULTS AND DISCUSSION**

A total of 112 finfish species under 20 orders, 47 families and 90 genera and a total of 18 shellfish (16 prawns and 2 crabs) under 1 order, 3 families and 7 genera were identified from the rivers Karnaphuli, Sikalbaha and Chandkhali during ten years study period from May 2010 to February 2020. A list of finfish and shellfish species recorded from the Karnaphuli, Sikalbaha and Chandkhali rivers is given below (Table 1). The taxonomic list and systematic index of ichthyofauna with scientific name, local name, common name, habitat, regional Red List Category, threatened status as per IUCN Bangladesh Red List (2000, 2015) and abundance are presented in the list.

Taxonomic List of the recorded finfish and shellfish from the three studied linked rivers along with fishes previously recorded from the Sangu and Halda rivers are given in Table 1.

Karnaphuli, Sikalbaha and Chandkhali are three linked rivers which are also linked with the Halda and Sangu rivers (Fig.1). In spite of being blocked by the Kaptai Dam, Karnaphuli River is still in touch with the Kaptai reservoir through the outlet (spill way) water, which is apparent during heavy monsoon shower when some fish species of Kaptai lake are seen in Halda and lower Karnaphuli rivers, which arrive through the discharged excess water of the lake through the spill ways. There is a variation of species and also in their number in different estuarine rivers. In advent of time due to over fishing, new techniques of fishing and fishing gears, climate change and human intervention, the number of species has not only varied in different rivers but also in the same river. Gafur and Bhuiyan (1983) documented 67 species of estuarine finfish from the Karnaphuli river estuary. Azadi and Arshad-Ul-Alam (2011) reported 83 species of finfish and 9 species of shellfish from Halda river. Azadi and Arshad-Ul-Alam (2014) reported 109 species of finfish and 18 species of shellfish from Sangu River (river mouth to Bandarban District Sadar). Arshad-Ul-Alam and Azadi (2017) first recorded a new carp species namely horned carp, Schismatorynchos nukta from hilly stream zone of upper Sangu River, Bangladesh. Ahmed and Hasan (1981), Hafizuddin et al. (1989) and Alamgir et al.(1990) reported 48, 58 and 72 species of finfish respectively from Kaptai lake. Halder et al. (1991) documented 64 finfish from the Feni River estuary, which included freshwater dependent 35, estuarine dependent freshwater 11, estuarine 7, estuarine dependent marine 9 and marine 2. Hossain et al. (2007) documented and illustrated 98 species of finfish, 23 species of prawn, 13 species of crab from the Naaf River. Rashed-Un-Nabi et al. (2011) recorded 45 estuarine species (35 finfish and 10 shrimps) from Bakhkhali River estuary. Pramanik et al. (2017) documented 107 finfish species from Meghna River. While Hossain et al. (2012) recorded 53 fin fish species from Meghna River estuary. Chowdhury et al. (2019) recorded 51 finfish species from Surma River, Sylhet Sadar, Bangladesh.

In the above-mentioned rivers maximum number of finfish species (110) was found in the river Meghna (Pramanik *et al.* 2017) and maximum number of shell fish (23) and crab species (13) in the River Naaf (Hossain *et al.* 2007), whereas minimum number of fin fish species (45) and shell fish species (10) were found in the estuarine River Bakhkhali (Rashed-Un-Nabi *et al.* 2011). In

Table 1. Taxonomic list and ecological note of Finfish and shellfish in the five interconnected Rivers(Karnaphuli, Sikalbaha, Chandkhali, Halda and Sangu) of Chattogram. (Abbreviation used: For population status : A- Abundant, C-Common, F-Few, VF-Very few, S-Scarce, NF-Not found.For threatened status : CR-Criticality endangered, EN-Endangered, VU-Vulnerable, NT -Near threatened, LC - Least concern, NO -Not threatened (were used in IUCN 2000), DD -Data deficient, NE -Not evaluated, NR -Not reported by IUCN or by others from inland waters of Bangladesh).

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se	Megalopidae Muraenidae Ophicththidae Moringuidae Anguillidae Notonteridae				Karnaph uli River	Sikalbah a River	Chandkh ali River	Halda River	Sangu Sangu	INCN 2000	IUCN 2015
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Des	Ophicththidae Moringuidae Anguillidae Notonteridae		Indian mud morav: Baim	River and estuary	5	NF	NF	NF	S	NON	NE
ues	Moringuidae Anguillidae Notonteridae		Rice-paddy eel: Nolbaim	River, estuary and sea	Ľ.	н	F	н	Ľ	NO	LC
ues	Anguillidae Notonteridae	4. Moringuamacrocephalus(Bleeker, 1863)	Spagheti-eel; Baim	Estuary and sea	s	NF	NF	S	NF	NR	NR
2	Anguillidae Notonteridae	5. Moringuaraitaborua(Hamilton, 1822)	Purple spaghetti-eel; Rata boura	River and estuary	s	s	NF	VF	S	NO	NE
50	Notonteridae	6. Anguilla bengalensis(Gray, 1831)	Indian mottled eel; Bamosh	River, Migratory catadromous	F	NF	NF	VF	н	NU	VU
		<ol> <li>Notopterusnotopterus(Pallas, 1769)</li> </ol>	Bronze featherback; Foli	Pond, lake, beel and floodplain	VF	VF	VF	VF	VF	EN	NN
	Engraulidea		Goldspotted grenadier anchovy; Olua	Lower estuary and sea	VF	NF	NF	NF	VF	NO	LC
			Gangetichairfin anchovy; Phaissha	River and estuary	C I	н	C	0	0	ON.	FC
	3		Scaly hairfin anchovy; Phaissha	Lower estuary and sea	VF	NF	NF	NF	VF	NON	FC
	Clupeidae	11. CoricasobornaHamilton, 1822	Ganges river sprat; Kachki	Wide freshwater	V	V	A	V	A	NO	LC
		12. Gonialosamanmina(Hamilton, 1822)	Ganges river gizzard shad; Chapila	River and estuary	VF	S	S	NF	NF	NO	LC
		13. Gudusiachapra(Hamilton, 1822)	Indian river shad; Chapila	Wide freshwater	F	F	ц	Ŀ	н	NO	N
		14. Tenualosailisha(Hamilton, 1822)	Hilsa shad; Ilish	River, estuary and sea	F	S	F	н	14	NO	LC
	Cyprinidae	15. Banganaariza(Hamilton, 1822)	Arizalabeo; Bata, Lasso	River and estuary	F	NF	NF	VF	ш	NR	٨U
		*16.Labeoangra(Hamilton, 1822)	Angralabeo. Angrot	Upland River, Hill stream	NF	NF	NF	NF	н	NO	LC
		17. Labeocalbasu(Hamilton, 1822)	Orange fin labeo; Kalibaush, Kalighoni	River	VF	VF	VF	VF	VF	EN	LC
		18. Labeogonius(Hamilton, 1822)	Kurialabeo; Shadaghoni	River	VF	NF	NF	VF	VF	EN	NT
		19. Labeorohita(Hamilton, 1822)	Roholabeo; Rui	River	F	н	F	VF	Ľ.	NO	LC
		20. Gibelioncatla(Hamilton, 1822);	Catla; Catla	River	F	ч	н	VF	ш	NO	LC
		21. Cirrhinusmrigala(Hamilton, 1822)	Mrigal; Mrigal	River	F	F	F	VF	ц	NO	NT
		22. Cirrhinusreba(Hamilton, 1822)	Reba carp; Raik, Laacho	River	VF	NF	NF	NF	S	NN	IN
		23. Hypopthalmichthysnobilis(Richardson, 1845)	Bighead carp; Bighead	River, Exotic	s	NF	NF	VF	s	NE	NE
		24. Hypopthalmichthysmolitrix(Valenciennes, 1848)	Silver carp; Silver carp; River	River, Exotic	s	NF	NF	s	s	NE	NE
		25. Amblypharyngodonmola(Hamilton, 1807)	Molacarplet; Mola	Wide freshwater	F	н	F	VF	ц	NO	LC
		*26. Neolissochilushexagonolepis(McClelland, 1839)	Copper mahseer, Coropmahal	Upland River, Hill stream	NF	NF	NF	NF	н	DD	EN
		*27. Schismatorhynchosnukta(Sykes, 1839)	Horned carp, Singwalarui	Hill stream	NF	NF	NF	NF	Ŀ	NR	NR
		*28. Schismatorhynchos sp.	Horned carp, Nak-kata rui	Hill stream	NF	NF	NF	NF	Ц	NR	NR
		*29. Opsariusbarna(Hamilton, 1822)	Barnabaril, Banikoksa	Upland River, Hill stream	NF	NF	NF	NF	ц	DD	EN
		*30. Bariliusbendelisis(Hamilton, 1822)	Hamilton's barila, Koksa	Upland River, Hill stream	NF	NF	NF	NF	ц	EN	EN
		31. Laubukalaubuca(Hamilton, 1822)	Indian glass barb; Chep chela	River, flood plain	VF	VF	VF	VF	VF	EN	LC
		32. Chela cachius(Hamilton, 1822)	Silver hatchet barb, Chep chela	River, flood plain	NF	VF	VF	NF	NF	DD	ΝŪ
		33. Crossocheiluslatius(Hamilton, 1822) [Fig.2]	Stone roller; Kala bata	River	VF	VF	NF	VF	VF	EN	EN
		34. Osteobramacotio(Hamilton, 1822)	Cotio; Dhela, Nak kata	Wide freshwater	VF	NF	NF	VF	VF	EN	IN
		35. Puntiuschola(Hamilton, 1822)	Swamp barb; Cholaputi	Wide freshwater	F	NF	NF	NF	н	NO	LC
		36. Puntiussophore(Hamilton, 1822)	Pool barb; Jatiputi	Wide freshwater	н	ц	н	1	н	NO	LC
		37. Pethiaticto(Hamilton, 1822)	Ticto barb; Tit puti	Wide freshwater	0	U I	U	LL	0	NN	P/
			Golden barb; Jeliputi	Wide Ireshwater	-	-	N	-	-	nn	N
			<ol> <li>Oxteobramocoto(Hamilton, 1822)</li> <li>Sterobramocoto(Hamilton, 1822)</li> <li>Furtiviscophone(Hamilton, 1822)</li> <li>Pethioticto(Hamilton, 1822)</li> <li>Pethioticto(Hamilton, 1822)</li> </ol>		Coticy Dhela, Nak kata Swamp barb; Cholaputi Peol barb; Jatputi Ticto barb; Tic puti Golden barb; Jeliputi	Cotio: Dhelea, Mak kata Wirde freshwater Swamp karb; Cholaputi Wide freshwater Pool bach; Tir pudi Wide freshwater Ticto bach; Tir pudi Wide freshwater Golden barb; Jeliputi Wide freshwater	Cotio) Dhela, Nak kata Wide freshwater VF Swamp barts: Cholaputi Wide freshwater F Pool barty, Janputi Wide freshwater F Ticto barty, Tenputi Wide freshwater F Golden barty, Jeliputi Wide freshwater F	Cotio; Dheid, Nak kata Wide fireshwater VF NF Swamp barb; Cholaputi Wide fireshwater F NF Pool barb; Jatiputi Wide fireshwater F F F Ticto barb; Jatiputi Wide fireshwater C C G Golden barb; Jeliputi Wide fireshwater F F	Cotic) Dhela, Mak kata Wide freshwater VF NF NF NF Swamp Janb; Cholaputi Wide freshwater F F NF NF Pool barb; Jatputi Wide freshwater F F F F Ticto barb; Jatputi Wide freshwater C C C C Golden barb; Jelputi Wide freshwater F F NF	Cotio         Dhela, Nak kata         Wide freshwater         V.F         N.F         N.F         V.F           Swamp bands, Cholaputi         Wide freshwater         F         N.F         T.C         Dot bar.7         Toto bar.7         Toto bar.7         Toto bar.7         N.F         N.F         N.F         F         F         F         F         Golder bar.7         E         Onder bar.7         F         N.F         F         F         F         Golder bar.7         F         N.F         Tot b	Cotio         Dhela, Nak kata         Wide freshwater         V.F         N.F         N.F         V.F           Swamp bands, Cholaputi         Wide freshwater         F         N.F         T.C         Double ''s full putition in the intert in the intert in the intert

						St	Status in this study	ły	Azadi& Arshad- ul-Alam 2013	Azadi&Ar shad-ul- Alam 2014, Arshad-ul-	st	SI
Order	ц	Family	Species	Common name, Local name	Habitat	Karnaph uli River	Sikalbah a River	Chandkh all River	Halda	Alam&Aza di 2017 River River	IUCN 2000 Stati	IUCN 2015 State
6 Siluriformes	10 11	Cobitidae Siluridae	<ol> <li>Pethiaconchonius(Hamilton, 1322)</li> <li>Rasboarostoor(Hamilton, 1322)</li> <li>Atta Sadarostoor(Hamilton, 1322)</li> <li>Salmophosiobacidoorolide/Hamilton, 1322)</li> <li>Salmophosiophulo (Hamilton, 1322)</li> <li>Salecuricutoper (Hamilton, 1322)</li> <li>Leptodecepholichthysgurae (Hamilton, 1322)</li> <li>Compositionatoris(Biolot, 1737)</li> <li>Compositionatoris(Biolot, 1737)</li> </ol>	Rosy barry, fanchonputi Rosy barry, fanchonputi Large razontelly minnow, Chela Finescalerazontelly minnow, Chela Finescalerazontelly minnow, Chela Guntea barb, Guttu Guntea barb, Guttu Pakaha natrik pakaja	Wide freshwater Wide freshwater Wide freshwater Wide freshwater Upland River, Hill stream Wide freshwater Wide freshwater	VF F NF C C VF C	VF NF C C VF C	NF F N C C F C	VF F VF NF VF	VF F F C C V C	NO NO NO NO	EN LA
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	15	Sisoridae	<ul> <li>*51. Mystusbheeker(Jay, 1877)</li> <li>*51. Mystusbheeker(Jay, 1827)</li> <li>53. Mystusvitatus(Bloch, 1794)</li> <li>54. Mystusvitatus(Bloch, 1294)</li> <li>55. Speratoor(Hamilton, 1822)</li> <li>56. Speratoor(Hamilton, 1822)</li> <li>56. Speratoor(Hamilton, 1822)</li> <li>58. Gootstooredenfamilton, 1322)</li> <li>58. Gootstooredenfamilton, 1322)</li> </ul>	Day's mystus, Guishatengra Makes cardiby. Muatengra Stripted dwarf cardiby, Guilla Guing-whikkerd cardiby, Ayre, GuijjaAyre Gaint river cardish, Ayre, GuijaAyre Gaint river cardish, Ayre, GuijaAyre	Wide freshwater Migratory anaformous Wide freshwater Wide freshwater Wide freshwater Wide freshwater River River	NFFNF CVFFNC	NF F NF F F NF	NF F NF NF	NF VF NF NF NF	и и и и и и и и U	NO CR NO	C C C C C C C C C C C C C C C C C C C
C. Although a second	11 11 11 11 10	Schilbeidae Claridae Heteropneustidae Aridae	59. 60. 61. 65. 65. 65.	Kamaphuligagata, Gang tengra Garubabetha, Shavua; Niver Garubabetha; Shavua; Niver Muriuwacha; Muribacha Batchunancha; Bacha Indian potac; Futhengra Magur cathich; Magur Stinging cathich; Kaa maach Scigor cathich; Kaa maach	River River River River River River River Wide freshwater Wide freshwater Lover estuary	F F VF F VF	NF F VF NF NF NF	NF F NF VF VF VF	NF F VF VF VF NF NF	F F VF F VF F F V F F V F	N N N N N N N N N N N N N N N N N N N	F N C C C C C E C N
/ GODIORIES	20 21		<ol> <li>Bernszucki andmico, Jazz.J.</li> <li>Eleotrójsociforster, 1801.)</li> <li>Eleotrójsociforster, 1801.)</li> <li>Eleotrójsociforya, 1873.</li> <li>Eleotrójsociforya, 1823.</li> <li>T. Awousgrammepomusifienken, 1822.)</li> <li>T. Awousgrammepomusifienken, 1822.)</li> <li>Stechypobuscylanich, 1822.1</li> <li>Steudopocryptes elengates (Lovier, 1816)</li> <li>F. Pervadoportistes elengates (Lovier, 1846)</li> <li>Stermaportisticopia (Baeker, 1849)</li> <li>Stynchriberseterratestichkundson, 1387/jeg.2)</li> <li>Stynchriberseterratestichkundson, 1387/jeg.20</li> <li>Stynchriberseterratestichkundson, 1846)</li> <li>Stynchriberseterratestichkundson, 1823</li> <li>Stigmatogobiussadenundio(Hamilton, 1822)</li> </ol>	Ill steeper; byta steeper; Bhotbyta steeper; Bhotbyta goby; Shilaya the goby; Shilaya in goby; Subachring al goby; Sobulchrin al goby; Sobulchrin al goby; Sobulchrin al goby; Sobulchrin al goby; Sobulchrin steepen; Burguni on; Burguni	Lower estancy and sea Lower estancy and sea Lower estancy and sea Wide freshwater River and estancy River and estancy Lower estancy and sea Lower estancy and sea Lower estancy Lower estancy Lower estancy River and estancy River and estancy River and estancy	VF VF A A A VF A C C A VF VF F F A C C VF	C C A C A C A F C A C A F C A F F C A F F F F	N N N N N N N N N N N N N N N N N N N	ч ч ч ч ч ч ч ч ч ч ч ч ч ч ч ч ч ч ч	NF F A C A F F W F F	N N N N N N N N N N N N N N N N N N N	SCREESE SCEESE
8 Mugiliformes	22 23	Gobioididae Mugilidae	<ol> <li>Periopthalmodonschiosseri(Pallas, 1770)</li> <li>B2. Bolecphthalmusboddarril(Pallas, 1770)</li> <li>B3. Teomödeschrecklist(NL), 1821)</li> <li>B4. Odontomblyoptusrubiotundus(Hamilton, 1822)</li> <li>B5. Tripauchen vagina (Bloch &amp; Schneider, 1801)</li> <li>B5. Cheforperscheffamilton, 1822)</li> <li>B7. Rhinomuglicostuo(Hamilton, 1822)</li> </ol>	Dawknining Dawknining Blue sported mudskipper, Dawkmach Blue sported mudskipper, Jahwan Rubicundus ed goby, Shada chew Burrowing goby, Chewa Stry multer Badamach Corsula multer, Badamach	Lower estuary Lower estuary Shada chew Lower Estuary River and estuary River and estuary	VF VF NF F	C F N VF	VF VF VF C F	NF VF VF	VF VF C NF C		3 333333

	IЛСИ 2015 IЛСИ 2000	NO VU														DD NT					NO NE			NO LC			NO LC			NE LC	NE LC	NE LC	NE LC	NE LC
Alam 2014, Alam 2014, Arshad-ul- Alam&Aza di 2017	Sangu River	line o	s c	NF	VF	VF	VF	<u>н</u>	VF	S	s s	s	S H	- 0	ш	Α	L	- M	VF -	VF	VF	N	4	F	VF	ía.	S	H	Y	C A	14	ţ.	<u>Lin</u>	٤.
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Status in this study	Sikalbah a River	<u> </u>	n ()	VF	VF	VF	VF	БH	VF	S	s s	s	S H	- 0	NF	A F		NF	NF	NF	NF	N	ш. <u> </u>	F Y	NF	NF	S	74 74	A	ς υ	н	24	щ	NF
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Habitat	A 1953	River	Wide freshwater, Exotic Fshiary	River	Wide freshwater	Wide freshwater	Wide freshwater	Wide freshwater	Pond, lake, beel and floodplain River Exotic	Wide freshwater	Wide freshwater Pond Jake heel and floodnlain	Pond, lake, beel and floodplain	Pond, lake, beel and floodplain	River and estuary	River and estuary	Wide freshwater Wide freshwater	11-1-1-1-1-1-1-1-1-1-1-1-1-1-1-1-1-1-1	Lower estuary	Lower estuary and sea coast	Lower estuary and sea coast Lower estuary and sea	Lower estuary and sea	Sta	River and estuary	Estuary	Estuary and sea, Migratory	Lower estuary and sea	Lower estuary and sea	Lower estuary and sea Finfish richness	River and estuary	River River and estuary	Wide freshwater	River	River and estuary	Wide freshwater
											÷				irerkhil	achanda t; Kata		lora koi											E.	cha			Godaicha,	Shulicha,
Local name		Bada	nijeura	c, Thuitta	c Ekthuitta	ikkuni	aim	Suchibaim	oi Kholisha	Kholisa	hotakholisa d- Cheng m:	d; Taki	t, Shol	e; Kukur jib	pefish; Kum	chiet; Lomb sy perchie	-	r tiger fish; C	erra; Chanda	tara	Irguni	engmaach	hotabyla	c; Thopshe a; Esuarine			undra	P	Golda chin	7; Dimuaichi awn- Chatka	, the	Kairaicha		prawn;
Common name, Local name		Yellow tail mullet; Bada	Nile tilapia; Nilotika River rire fich- Kapniloura	Congaturi halfbeak; Thuitta	Wrestling halfbeak, Ekthuitta	Freshwater garrish; Kakila Blue panchax; Chukkuni	Zig-zag eel; Kata baim	Barred spiny eel; Guchibaim	Climbing perch; Koi Croaking gourami Kholisha	Banded gourami; Kholisa	Honey gourami; Chotakholisa Walking snakehead- Cheng mach	Spotted snakehead; Taki	Striped snakehead; Shol	Oriental sole, Nukur Jib Bengal tongue sole; Kukur Jib	Crocodile-tooth pipefish; Kumirerkhil	Elongate glass-perchlet; Lombachanda Himalayan glassy perchlet; Kata	chanda	Four banded silver tiger fish; Dora koi	Deep-bodied mojarra; Chanda	Sootted scat: Bishtara	Jarbuaterapon; Burguni	Birdled jaw fish; Bengmaach	Bartail flathead; Chotabyla	Paradise threadfin; Thopshe Coltor croaker; Poa; Esuarine	Cuja bola; Kujapoa	Pama croaker; Poa	Flathead sillago; Sundra	Silver siliago; sundra	Giant river prawn; Golda chingri	Dimua river prawn; Dimualcha Moncoon river prawn: Chatkairha	Pinterson Codeba	Kiver prawn, souancia Kaira river prawn: Kairaicha	Hairy river	Birma river
Species		88. Sicamugilcoscosia(Hamilton, 1822)	<ol> <li>Oreochromismioticus[Linnaeus, 1/58]</li> <li>Oruviaciancenal(Hamilton 1822)</li> </ol>		92. Dermogenyspussifus(Kuhl and van Hasselt, 1823)	<ol> <li>Senemtodorcancila(Hamilton, 1822)</li> <li>Aplocheiluspanchax(Hamilton, 1822)</li> </ol>	95. Mastacembelusarmatus(Lacepede, 1800)	90. Macrograthuseurostonen, 1700) 97. MacrograthuspuncalusHamilton, 1822	<ol> <li>Anabustestudineus (Bloch, 1792)</li> <li>Trichonsisuittata (Crusier 1831) (Eie 2)</li> </ol>	100. TrichogasterfasciatusBloch and Schneider, 1801	101. Trichogasterchuna(Hamilton, 1822) 102. Channonciontriks(Bloch and Schneider 1801)	103. Channapunctata(Bloch, 1793)	104. Channastriata(Bloch, 1793)	<ol> <li>Drachingsonemuschendingenoch and Schneider, Lout J 106. Cynoplossuscynoglossus(Hamilton, 1822)</li> </ol>	107. Microphiscuncalus(Hamilton, 1822)(Fig.2)	108. Chandanama(Hamilton, 1822)	109. Parambassispaculis[Hamilton, 1822]		-	<ol> <li>Latescarcarger(Blocn, 1/30)</li> <li>Scatophopusargus(Linnaeus, 1766)</li> </ol>	Terap	116. OpistognathusnigromarginatusRuppell, 1830		118. PolynemusparadiseusLinnaeus, 1758 119. Johniuscoitor(Hamilton, 1822)			122. Sillaginopsispanijus(Hamilton, 1822)	* Fishes recorded only from Sangu and not found in Karnaphuli, SikalbahaChandkhali or Halda.	1. Macrobrachiumrosenbergii (De Man, 1879)	<ol> <li>Macrobrachiumviliosimanus (Tiwari, 1947)</li> <li>Macrobrachiummalcolmsonii(H. Milne Edwards,</li> </ol>	1844) 4. Macrobrachiumdolichodactylus(Hilgendrof,	1879) 5. Macrobrachiumdavanus(Henderson 1893)		7. Macrobrachiumbirmanicum (Schenkel, 1902)
Family			Cicilildae Adrianichthvdae	Hemiramphidae	Zenarchopteridae	Aplocheilidae	Mastacembelidae		Anabantidae Osnhronemidae		Channidae		Calaidan	Cynoglossidae	Syngnathidae	Ambassidae		Datnioididae	Gerreidae	Scatophagidae	Teraponidae	Opistognathidae	Platycephalidae	Polynemidae Sciaenidae			Sillaginidae	nd not found in Kan	Palaemonidae					
Fan		2	24	56	27	63 63	30		31		::	0	10	8	36	37		38	39	9 4	4	45	4 :	6 4			47	I Sangu at	1					
Order			Cichlitornes Reloniformes			Cyprinodontiformes	Synbranchiformes		Anabantiformes				Disconstificante	LIGHT DROCHT DRINGS	Syngnathiformes	Perciformes							Scorpachiformes	Polynemitormes Acanthuriformes			Spariformes	es recorded only from	Decapoda					
P			0	2		=	12		2				-	r.	15	91							5	8 6			8	Fishe						

sufat	10CN 2015 S		FC	LC	LC	LC	DD	LC	IC	LC	LC	LC	LC		
sufat	INCN 2000 S	1	BE	RE	NE	NE	NE	NE	NE	NE	BR	NE	NE		
Azadi&Ar shad-ul- Alam 2014, Arshad-ul- Alam&Aza	Sangu B		V	щ	C	ц	VF	VF	ц	VF	s	C	н	18	129
Azadi& Arshad- ul-Alam 2013	Halda River	8	C	NF	F	NF	NF	NF	NF	NF	NF	U	NF	10	93
udy	Chandkh ali River	2	V	NF	C	14.	NF	NF	NF	NF	NF	C	s	11	83
Status in this study	Sikalbah a River	2	V	NF	C	ц	NF	NF	NF	NF	NF	C	S	п	85
	Кагпарћ иli River	-	V	F	C	н	VF	VF	ц	VF	S	C	н	18	128
Hahitat	140144		River and estuary	Wide freshwater and estuary	Estuary and sea	Estuary and sea	Estuary and sea	Sca	Sea	Estuary and sea	Estuary and sea	Wide freshwater	Estuary	Shellfish richness	<b>Total Species richness</b>
Common name. I cool name	Control teams, local status	Thanguaicha	Short-leg river prawn; Loittaicha	Roshma prawn; Gurachingri	Speckled shrimp; Harinachingri	Yellow shrimp; Laliachingri	Kadal shrimp, Gosachingri	Bird shrimp, Kuchochingri	Rainbow shrimp; Rodachingri, Bhagatarachingri	Banana shrimp; Baghachamachingri	Black tiger shrimp, Bagdachingri	Spiny crab; Cimtakakra	Giant mud crab; Shilakakra		
Gweeler	struge		<ol> <li>Macrobrachiummirabile (Kemp, 1917)</li> </ol>	<ol> <li>Exopalaemonstyliferus (H. Milne Edwards, 1840)</li> </ol>	10. Metapenaeusmonoceros (Fabricius, 1798)	<ol> <li>Metapenaeusbrevicornis(H. Milne Edwards, 1837)</li> </ol>	12. Metapenaeusdobson/Miers, 1878	13. Metapenaeuslysianassa(De Man, 1888)	14. Parapeanaeopsissculptilis(Heller, 1862)	15. Penaeusmerguiensis(De Man, 1888)	16. PenaeusmonodonFabricius, 1798	17. Acanthopotamonmartensi Wood Masoni	18. Scylla serrata(Forskal, 1775)		
Family	future t				Penaeidae							3 Portunidae			
Order					2							3			

the present investigation a total of 130 species of ichthyofauna (112 finfish and 18 shellfish) were recorded from the three linked rivers i.e. Karnaphuli, Sikalbaha and Chandkhali. Among the three rivers highest number of finfish (110) and shellfish species (18) and altogether 128 ichthyofauna were recorded from the River Karnaphuli, while a total of 74 fin fish and 11 shellfish, altogether 85 ichthyofauna and 72 finfish and 11 shellfish, altogether 83 ichthyofauna species were recorded from Sikalbaha and Chandkhali rivers respectively. The variation in the recorded numbers of finfish and shellfish species in these three linked estuarine rivers was due to the variation in river size (length, width and depth) and total area of the rivers as well as habitat condition and also having chance of directly joining with the sea by the River Karnaphuli, which was also true for the above mentioned other rivers studied by different authors. In context of presence of finfish numbers, Karnaphuli (110) showed higher species density than lower Sangu (109) and Halda (83), but equals to the Meghna (110) while in context of shell fish numbers both rivers Karnaphuli (18) and Sangu (18) occupied the second position after the river Naff (23) but higher than the Halda (10), Sikalbaha (11) and Chandkhali (11). Number of Ichthyofauna in other two studied rivers (Sikalbaha and Chandkhali) was moderate but lower than the River Halda, Karnaphuli and Sangu.

In earlier edition of Threatened Animals of Bangladesh (IUCN Bangladesh 2000) ten fish species were evaluated as freshwater but in update edition of IUCN Bangladesh (2015) these fish species were considered as marine. These ten species are Megalops cyprinoides, Moringua raitaborua, Gymnothorax tile, Lates calcarifer, Scatophagus argus, Terapon jarbua, Paraapocryptes serperaster, Oxyurichthys microlepis, Polynemus paradiseus and Brachirus orientalis. Six species were not evaluated in either edition of IUCN Bangladesh 2000, or IUCN Bangladesh 2015, as they are marine exclusively. These are Moringua macrocephalus, Hexanematichthys sagor, Giuris margaritacea, Sillago sihama, Gerri's erythrourus and Opistognathus nigromarginatus, but they are occasional invaders in river. Four freshwater fish species not reported in IUCN Bangladesh 2000, but reported in IUCN Bangladesh 2015 are Bangana ariza (VU), Oryzias dancena (DD), Pseudapocryptes elongates (LC), and Macrognathus aculeatus (NT).

Under the genus *Cirrhinus* only *Cirrhinus mrigala* was reported from the Halda River (Azadi and Arshad-Ul-Alam 2013). Karnaphuli is enriched with another congeneric species, *Cirrhinus reba*. No specimen of *Cirrhinus cirrhosus* was found in the three studied rivers, which was also not reported from Sangu and other rivers of Chattogram (Azadi and Arshad-Ul-Alam 2014, Personal communication). *Cirrhinus cirrhosus is* characterized by two pairs of well-

developed barbels, rostral pair is longer than maxillary barbel, *Cirrhinus mrigala* has rostral pairs only. It is noticeable that a single specimen of *Cirrhinus cirrhosus* (Fig.2) was collected by the present authors from Chowmuhani *Arong* (*Arong* is the local name of village market in Cumilla) of Devidwar Upazilla Sadar of Cumilla district. Although the seller primarily claimed it as Gomti river fish, but he did not ascertain whether it was collected from captured or cultured stock. In the present study, several attempts were taken to collect more *Cirrhinus cirrhosus* from different fish markets and fishermen of Chattogram and Devidwar upazilla but failed.

Rahman (2005) stated *Cirrhinus mrigala* as a synonym of *Cirrhinus cirrhosus* (p.140). Day (1878, 1889), Talwar and Jhingran (1991), Dahanukar (2010), (IUCN 2019), Rema Devi and Ali (2011), (IUCN 2019), Menon 2004 (IUCN 2019), Menon (1999) (Fishbase) and Roberts (1997) (Fishbase) described *Cirrhinus mrigala* and *Cirrhinus cirrhosus* as two distinct species with morphological differences and with different geographical distribution.

According to Day (1878, 1889), Talwar and Jhingran (1991), Goswami *et al.* (2012), FishBase and IUCN Red List (accessed on 24 March 2020) *Cirrhinus mrigala* is native of northern India, Pakistan and Bangladesh; however the native range of *Cirrhinus cirrhosus* is the Godavari, Krishna and Cauvery rivers of South India. Both the species have been introduced to other regions of India and many countries outside of India. In the present study the recorded *Cirrhinus cirrhosus* from Gomti river of Comilla may be introduced or invaded in Bangladesh river waters from Indian Tripura region or Barak river drainage.

*Oryzias dancena* was reported as data deficient (DD) in recent Redlist of Bangladesh (IUCN Bangladesh, 2015) although it might be considered as least concern (LC) as per guidelines for using the IUCN Red List categories and criteria (IUCN Standards Petitions Subcommittee 2014). In first edition of IUCN Bangladesh (2000) it was not reported and was first reported by Azadi and Arshad-Ul-Alam (2013) from the river Halda. This tiny fish was found common in the catch of enclosure net (locally called Ghera jal of 2 mm mesh) used in the Rivers Halda, Karnaphuli, Sangu and their tributaries (Azadi and Arshad-Ul-Alam 2014).

Laubuka laubuca was reported as endangered in IUCN Bangladesh (2000) and as least concern in IUCN Bangladesh (2015). This species was recorded as very rare in Halda and Sangu by the present authors (Azadi and Arshad-Ul-Alam 2013, 2014).

*Plotosus canius* locally known as 'Gang magur' is a euryhaline species found mostly in estuary and coastal area and in this study it was recorded from the lower Karnaphuli near to Karnaphuli mouth estuary. Recently, present authors collected an individual of juvenile *Plotosus canius* from the electrofishing catch in the Remakri river, a remote hilly upstream tributary of Sangu river.

*Trichopsis vittata* reported as an unintentionally invaded ornamental fish (Norén *et al.* 2017) was recorded from Turag, Dhaleshwari and Titas rivers. It was recorded as abundant in Turag river but not found in southeastern Bangladesh (Chittagong division) during 2015 and northeastern Bangladesh

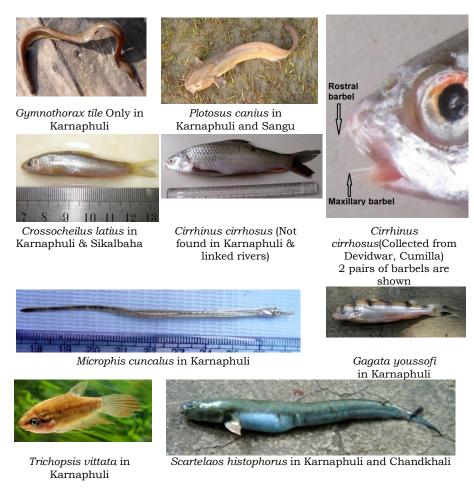


Fig. 2. Photographs of some fishes found in studied rivers excluding Cirrhinus cirrhosus.

(Sylhet division) during 2016 (Norén *et al.* 2017). However, in recent survey during April 2018, considerable number of this species was found in Set-Bag net catch in Karnaphuli river, although no such specimen was found in previous

eight years extensive survey. This species was also reported during 2017 from the hilly up stream of Chittagong University Campus (Azadi and Mandol 2017).

Out of 112 finfish species, 76 species and out of 18 shell fish species, 11species were common in three linked rivers. However, 40 species of finfish and 7 species of shellfish were only found in the river Karnaphuli. *Chela cachius* and *Dermogenys pussilus* were not found in Karnaphuli river. There was no example of the recorded species being found only in Chandkahli or Sikalbaha rivers. It might be due to the quality of water, size of the rivers in respect of length, width, depth and total area of the studied rivers.

# CONCLUSION

Out of the five linked rivers of Chattogram River system, ichthyofaunal study of two linked Rivers, Halda and Sangu (lower Sangu) have been done earlier (Azadi and Arshad-Ul-Alam 2013, 2014). With the study of three more linked rivers, Karnaphuli, Sikalbaha and Chandkhali, icthyofaunal study of five linked rivers has been completed. In this study a total of 130 ichthyofaunal species have been recorded from the three rivers, out of which 128 species (110 fin and 18 shell fish) were from the River Karnaphuli, 85 species (74 fin and 11 shell fish) were from the River Shikalbaha and 83 species (72 fin and 11 shell fish) were from the River Chandkhali. Ichthyofauna of other two linked rivers, Halda and Sangu were found to be 93 species (83 fin fish and 10 shell fish) and 127 species (109 fin fish and 18 shell fish) respectively (Azadi and Arshad-Ul-Alam 2013, 2014). Among the five linked rivers highest number of ichthyofaunal species were recorded from the River Karnaphuli (128) while second, third, fourth and fifth highest were recorded from the Rivers Sangu (127), Halda (93), Sikalbaha (85) and Chandkhali (83). This variation was due to different river size, length, depth and absence or presence of diversified habitat in different rivers. This study will be helpful to the policy makers, planers and researchers to protect, manage, conserve and for further study of the important fin and shell fishes of the five linked rivers of Chattogram.

Acknowledgement: This is a part of study conducted under the grants for advanced research in education entitled "Limnology, Hydrology and Fish and Fisheries of the River Halda and its four linked rivers (Sangu, Chandkhali, Sikalbaha and Karnaphuli)" sponsored by the Ministry of Education Bangladesh during 2010-2013. In this paper only ichthyofaunal part is included, conducted during the mentioned period and also personal continuation of the work up to 2020.

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(Manuscript received on 27 May, 2020 revised on 15 December, 2020)