

DOI : [http://doi.org/10.22438/jeb/39/5\(S1\)23](http://doi.org/10.22438/jeb/39/5(S1)23)

JEB™

p-ISSN: 0254-8704  
e-ISSN: 2394-0379  
CODEN: JEBIDP

## Fish diversity of an agriculturally influenced river in Bangladesh: Current profile, threats and management perspectives



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### Key words

Anthropogenic factors  
Ecosystem  
Endangered species  
Fish conservation  
Fish diversity

### Publication Info

Paper received : 09.07.2017  
Revised received : 07.10.2017  
Re-revised received : 25.11.2017  
Accepted : 28.12.2017

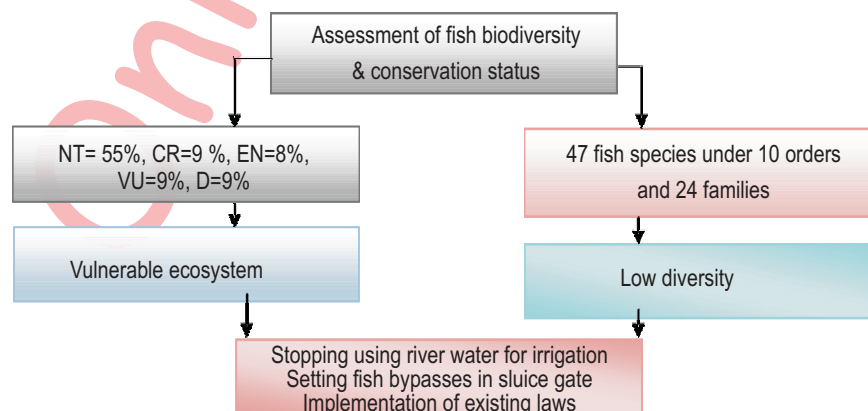
### Abstract

**Aim :** Local and global stressors such as agricultural activities, climate change, habitat loss, eutrophication and pollution are the major causes of declining fish diversity. Therefore, for the management of fisheries and ecosystems, it is important to know the fish diversity of Little Feni River. The study was performed to know the diversity status of fishes in Little Feni River, Bangladesh during April - December, 2015.

**Methodology :** Fishes and their related data were collected from the Little Feni River of fish landing centers, fish markets, interviewing fishermen and *arotdar* (or known as commission agent).

**Results :** From this study, 47 species under 24 families were recorded in which 31 (66%) species were from freshwater and the remaining 16 (34%) species were from marine sources. Of the collected fishes, 26 species were categorized as not threatened (NT), 9 vulnerable (VU), 4 critically endangered (CR), 4 endangered (EN) and the remaining 9 could not be classified under the said list due to data deficient (DD). The results indicated the alarming decline of fish diversity in the investigated area in general and/or perhaps in the country as whole.

**Interpretation :** Long-term investigation, appropriate evaluation and proper documentation are urgently needed so that the public, investigators and policy makers would be able to know about the current status of fish diversity, and can take initiatives for proper conservation management practices towards the gradual decline of wild fish abundance in Little Feni River.



## Introduction

Inland water fishery plays a major role in the animal protein supply of Bangladesh (Kibria and Ahmed, 2005; Hossain *et al.*, 2006). In terms of overall production, Bangladesh is ranked fifth in inland fish production in the international fish market. In the country, there are 260 local fresh water fish species available (Rahman, 2005). These number vary on the basis of ecological characters of aquatic habitats (Rahman, 2005). Among the fish species, 54 species have been listed as threatened by International Union for Conservation of Nature (IUCN) from Bangladesh (DoF, 2005). Recent reports reveal that approximately 20 indigenous species have become extinct over the last 10 years due to various anthropogenic stresses including usage of varieties of nets for catching, insecticides and chemical fertilizers, as well as habitat depletion (DoF, 2012). If proper management steps are not taken and the scenario continues, nearly 70% of the local fish population may decline within short time which may cause severe extinction (DoF, 2012). Currently, reduction in the abundance of fish species from the inland waters of Bangladesh is a burning issue (Galib *et al.*, 2009). Several studies on fish biodiversity have been reported throughout the world including the studies of Hasan (2007), Shinde *et al.* (2009), Emmanuel *et al.* (2010), Hossain *et al.* (2015), Khan (2011), Meye and Ikomi (2012) and Nyanti *et al.* (2012). Nowadays, fish biodiversity and management of associated habitats is a great challenge (Dudgeon, 2006). In addition, the conservation of aquatic biodiversity has gained great ecological importance over recent years (Hossain, 2012). However, the investigations are limited to assess the present status of fish diversity in Bangladesh. More importantly, no complete study has been conducted to reveal the status and causes of declining fish diversity in many parts of the country and Little Feni River is one of them. Hence, in this study an attempt was made to assess the status of fish diversity in Little Feni River, Bangladesh.

## Materials and Methods

**Data collection :** Fish samples were collected during April 2015 - December 2015 from Little Feni River adjacent fish landing centers and fish markets (Fig. 1). Data were collected by preparing a questionnaire interview, focus group discussion and cross check from the local people. Local names, distribution, availability of the species were also collected from the study sites. Secondary data were gathered from various published and unpublished relevant documents of various sources. Journal articles, conference proceedings and published books on the fish fauna of Bangladesh were also consulted to compile the previous data of abundance and availability for assessing the diversity status of the fish population from Little Feni River.

**Design and test of questionnaire :** A set of interview schedule was designed for data collection. Both closed and open form of questions were included in the questionnaire. Here, closed-

ended questions could be answered by a simple "yes" or "no," and open-ended questions were those that required more thought and more than a simple one-word answer. Thus, final questionnaire was developed in logical sequence so that the fishermen could answer chronologically.

**Collection of fish species and identification :** Fish species were collected from the study area and preserved in a plastic container containing 10% formalin. The collected individuals were transported to the laboratory and for species identification, based on their morphometric and meristic characters following the methodology of Bhuiyan (1964), Rahman (2005), Talwar and Jhingran (1991) and Nelson (2016).

**Data processing and analysis :** The collected data were checked and summarized carefully before tabulation. After that, all the collected information was accumulated and analyzed in Excel program (ver. 2013). Finally, the data was presented in textual, tabular and graphical forms to understand the present fish population status of Little Feni River.

## Results and Discussion

A total of 47 fish species under 24 families were collected from the study area (Table 1). The percentage analysis of the fish species showed the highest occurrence belonged to the following orders as follows: Perciformes (38%), Siluriformes (26%), Clupiformis (11%), Decapoda (11%) and others (2-4%) (Fig. 2a). The family based percentage analysis of the fish species demonstrated the highest occurrence belonged to the family Bagridae (13%), followed by Palaemonidea, Schilibeidae and Channidae (9%), Engraulidae and Gobiidae (6%) and others (2-4%) (Fig. 2b). Based on conservation status, the recorded species were categorized under five statuses: not threatened (NT = 55%), critically endangered (CR = 9%), endangered (EN = 8%), vulnerable (VU = 9%) and data deficient (DD = 9%) (Fig. 2c). The inland water fish status was much higher before twentieth century. Doha (1973) reported 106 species from Mymensingh and Tangail district; Islam and Hossain (1983) recorded 110 species from the river Padma; Hasan (2007) reported 33 species from Chitra and Fatki rivers; Zafar *et al.* (2007) reported 75 species from Pagla river; Bhuiyan *et al.* (2008) reported 73 species from Padma river near Rajshahi; Moumita *et al.* (2011) reported 59 species from Bangali river, Bogra and Ullah *et al.* (2016) mentioned 63 species from both freshwater and marine water bodies of selected mid coastal region of Bangladesh. So based on the available information, the current status of the fish population has been reduced, especially after twentieth century.

Also the results of this study clearly demonstrated the declining trends of fish diversity in Bangladesh. During this study it was observed that the anthropogenic causes such as, use of agrochemicals (pesticides and fertilizers) were the dominant declining causes of fish species in the investigated area. It was

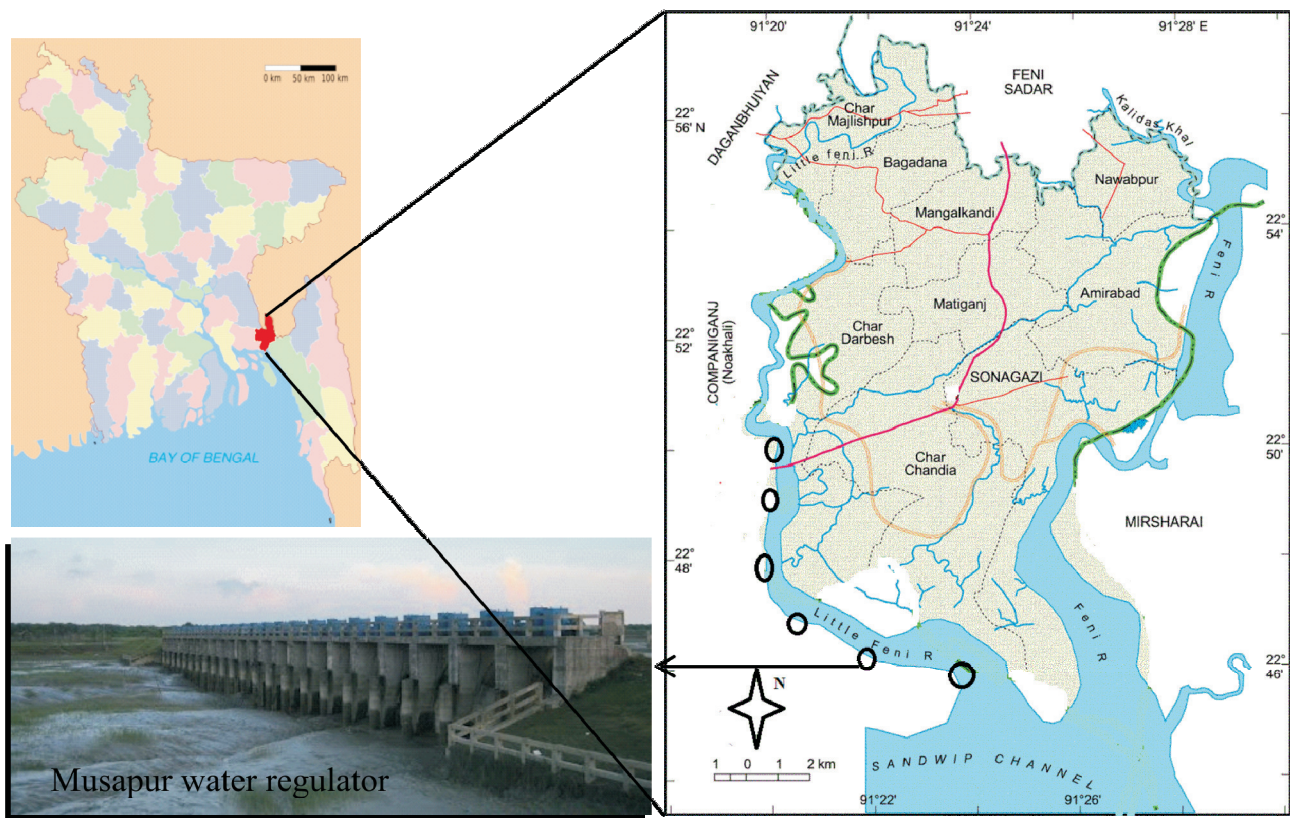


Fig. 1: Map showing the study area, Little Feni River. Photo (left-hand corner) shows the water control structure constructed across the river to facilitate agricultural activities during dry season

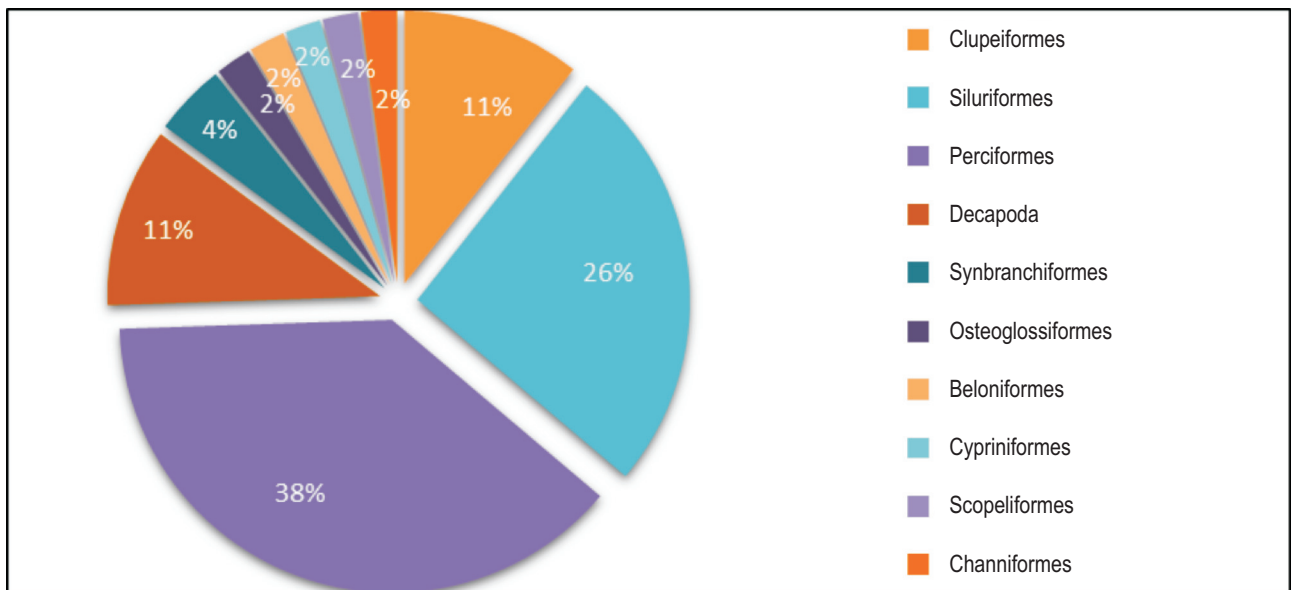


Fig. 2a: Percentage of fish species composition (Order level) in the Little Feni River

observed that dam constructed across the river was impeding the water flow, and ultimately affecting the whole ecosystem of the Little Feni River. In addition, excess use of river water for irrigation, over exploitation, degradation of spawning grounds, catching of brood fish and fingerlings etc., are affecting the survival and existence of the fish fauna. The results of the present study were similar to the findings of Department of Fisheries (DoF, 2012), which reports that already 16 species of fishes are extinct from the Baral River due to the above mentioned reasons.

Toufique et. al. (1997) also reported similar declining causes of fish diversity of inland water bodies and recommended measure to enhance the survival of fish population. IUCN reported that 56 freshwater fishes (out of 260 species) are critically endangered and 50 species of fishes have become rare which were abundant in Bangladesh in last few decades (Hilton-Taylor and Craig, 2000).

**Conservation and management perspective :** Fishes, in

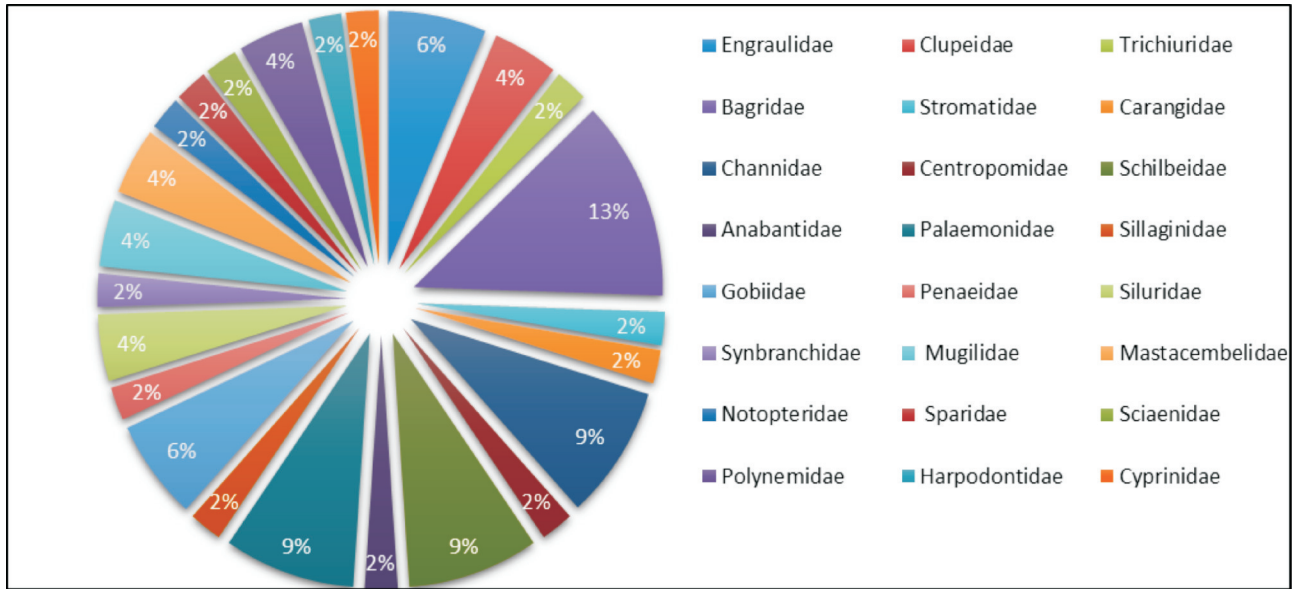


Fig. 2b : Percentage of fish species composition (Family level) in the study area

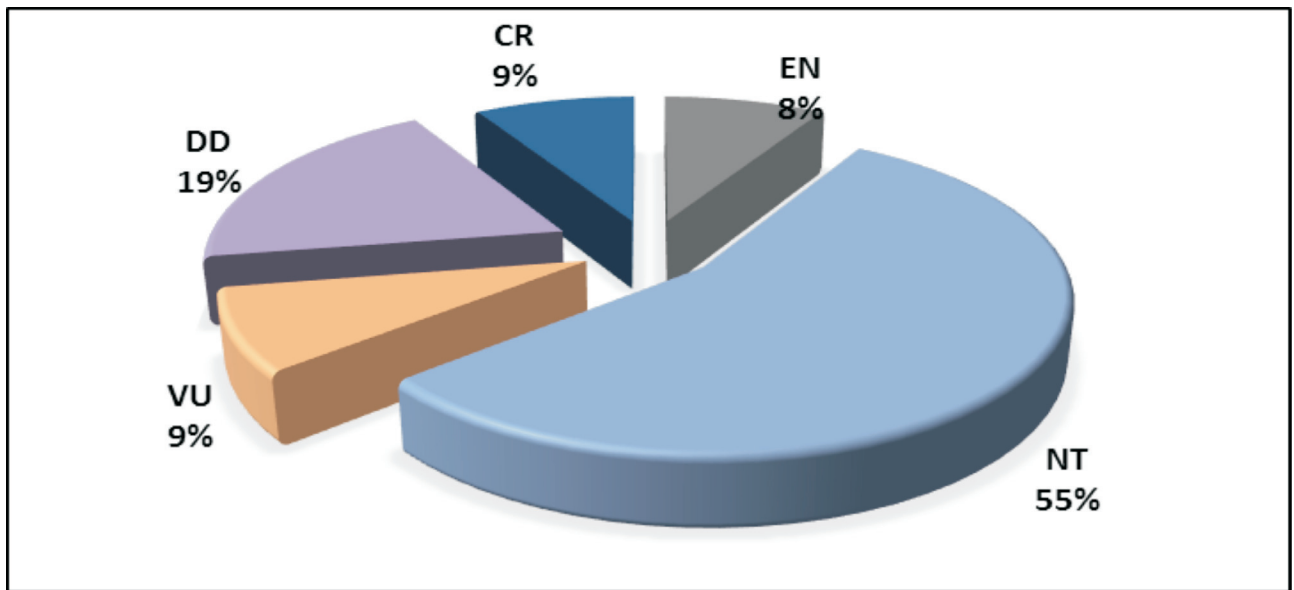


Fig. 2c : Conservation status of the fish species in the Little Feni River (classification based on IUCN National Categories, 2000)

**Table 1 :** Fish diversity in the Little Feni River with their conservation status

Order	Family	Species	English name	Local name	Status*	
Clupeiformes	Engraulidae	<i>Setipinna phasa</i>	Gangetic Hairfin Anchovy	Phasa	NT	
	Clupeidae	<i>Tenuulosa ilisha</i>	River Shad	Ilish	NT	
	Clupeidae	<i>Gudusia chapra</i>	Indian River Shad	Chapila	NT	
	Engraulidae	<i>Coilia dussumieri</i>	Gold spotted Grenadier Anchovy	Olua	NT	
	Engraulidae	<i>Setipinna taty</i>	Scaly Hairfin Anchovy	Teli Phasa	NT	
Siluriformes	Bagridae	<i>Batasio batasio</i>	Tista Batasio	Batasi	EN	
	Siluridae	<i>Wallago attu</i>	Freshwater shark	Boal	NT	
	Schilbeidae	<i>Eutropiichthys vacha</i>	Batchwa Bacha	Bacha	CR	
	Bagridae	<i>Mystus tengara</i>	Stripped Dwarf Catfish	Bajari Tengra	NT	
	Bagridae	<i>Rita rita</i>	Rita	Rita	CR	
	Bagridae	<i>Sperata aor</i>	Long whiskered catfish	Ayer	VU	
	Siluridae	<i>Ompok pabda</i>	Pabda Catfish	Madhu Pabda	EN	
	Schilbeidae	<i>Eutropiichthys murius</i>	Murius Bacha	Muri Bacha	DD	
	Bagridae	<i>Hemibagrus menoda</i>	Menoda catfish	Gang Tengra	NT	
	Bagridae	<i>Mystus gulio</i>	Gulio catfish	Nuna Tengra	NT	
	Schilbeidae	<i>Clupisoma garua</i>	Garua Bacha	Gagra	CR	
	Schilbeidae	<i>Ailia coila</i>	Gangetic Ailia	Kajuli	NT	
	Perciformes	Sparidae	<i>Acanthopagrus latus</i>	Yellow Seabream	Datina	DD
		Sciaenidae	<i>Otolithoides pama</i>	Pama	Poa	NT
		Mugilidae	<i>Liza parsia</i>	Goldspot Mullet	Khalla Bata	NT
Mugilidae		<i>Rhinomugil corsula</i>	Corsula Mullet	Bata	NT	
Gobiidae		<i>Apocryptes bato</i>	Goby	Chewa Bele	NT	
Gobiidae		<i>Glossogobius giuris</i>	Tank Goby	Bele/Baila	NT	
Trichiuridae		<i>Rastrelliger kanagurata</i>	Trichiuridae	Champa	DD	
Stromatidae		<i>Scomberomorus guttatus</i>	Spanish Mackerel	Maitta	NT	
Polynemidae		<i>Polynemus paradiseus</i>	Paradise threadfin	Riksha	CR	
Carangidae		<i>Decapterus russelli</i>	Indian shad	Surma	NT	
Channidae		<i>Channa marulius</i>	Great snakehead	Gozar	EN	
Channidae		<i>Channa punctata</i>	Spotted snakehead	Taki	NT	
Channidae		<i>Channa striata</i>	Snakehead murrel	Shol	NT	
Anabantidae		<i>Anabus testudineus</i>	Climbingperch	Koi	NT	
Centropomidae		<i>Lates calcarifer</i>	Sea Bass	Koral	NT	
Sillaginidae		<i>Sillaginopsis panijus</i>	Gangetic Sillago	Tular Dandi	NT	
Polynemidae		<i>Polynemus paradiseus</i>	Paradise Threadfin	Taposi	NT	
Gobiidae		<i>Parapocryptes batoides</i>	Goby	Chiring	NT	
Decapoda		Palaemonidae	<i>Macrobrachium mirabilis</i>		Lotia icha	DD
		Penaeeidae	<i>Penaeus monodon</i>	Tiger Shrimp	Bagda icha	DD
		Palaemonidae	<i>Macrobrachium dolichodactylus</i>		Goda icha	DD
		Palaemonidae	<i>Macrobrachium rosenbergii</i>	Freshwater Prawn	Golda icha	DD
	Palaemonidae	<i>Macrobrachium villosimanus</i>	Freshwater Prawn	kokori icha	DD	
Synbranchiformes	Mastacembelidae	<i>Mastacembelus armatus</i>	Zig-zag eel	Baim	EN	
	Mastacembelidae	<i>Macrognathus aculeatus</i>	Lesser spiny eel	Tara baim	VU	
Osteoglossiformes	Notopteridae	<i>Notopterus notopterus</i>	Bronze featherback	Foli/Hoilla	VU	
Beloniformes	Belonidae	<i>Xenentodon cancila</i>	Freshwater garfish	Kaikya	NT	
Cypriniformes	Cyprinidae	<i>Amblypharyngodon mola</i>	Molacarplet	Mola	NT	
Scopeliformes	Harpodontidae	<i>Harpodon nehereus</i>	Bombay duck	Loitta	DD	
Channiformes	Channidae	<i>Channa orientalis</i>	Walking Snakehead	Gachua	VU	

\*Note : CR: Critically endangered; EN: Endangered; VU: Vulnerable; NT: Not threatened & DD: Data deficient. Source: Red Book, IUCN, (2000)

Bangladesh where undernourishment remains a major development challenge, is an irreplaceable animal-source protein in the diet of millions. Fisheries sector contributes 60% of the animal protein to daily diet, 5.25% to GDP, and 6% to the

export earnings of Bangladesh (Ullah *et al.*, 2016). Being a tropical country Bangladesh is blessed with more than 200 rivers and 20 estuaries with high fisheries biodiversity. However, there is an increasing concern that a large number of fish fauna in the

**Table 2:** Available fishes (Marine water) in the study areas during survey period

Local name	English name	Scientific name
Phasa	Gangetic Hairfin Anchovy	<i>Setipinna phasa</i>
Tular Dandi	Gangetic Sillago	<i>Sillaginopsis panijus</i>
Chapila	Indian River Shad	<i>Gudusia chapra</i>
Ilish	River Shad	<i>Tenualosa ilisha</i>
Poa	Coiter Crocker	<i>Otolithodes pama</i>
Koral	Sea Bass	<i>Lates calcarifer</i>
Riksha	Paradise threadfin	<i>Polynemus paradiseus</i>
Gagra	Garua Bacha	<i>Clupisoma garua</i>
Bata	Corsula Mullet	<i>Rhinomugil corsula</i>
Chiring	Goby	<i>Parapocryptes batoides</i>
Muri vacha	Murius vacha	<i>Eutropiichthys murius</i>
Loitta	Bombay duck	<i>Harpodon nehereus</i>
Surma	Indian shad	<i>Decapterus russelli</i>
Teli Phasa	Scaly Hairfin Anchovy	<i>Setipinna taty</i>
Gang Tengra	Menoda catfish	<i>Hemibagrus menoda</i>
Olua	Gold spotted Grenadier	<i>Coilia dussumieri</i>

**Table 3:** Available fishes (Fresh water) in the study areas during survey period

Local name	English name	Scientific name
Batasi	Tista Batasio	<i>Batasio batasio</i>
Boal	Freshwater shark	<i>Wallago attu</i>
Bacha	Batchwa Bacha	<i>Eutropiichthys vacha</i>
Bajari Tengra	Stripped Dwarf Catfish	<i>Mystus tengara</i>
Rita	Rita	<i>Rita rita</i>
Ayer	Long whiskered catfish	<i>Sperata aor</i>
Madhu Pabda	Pabda Catfish	<i>Ompok pabda</i>
Nuna Tengra	Gulio catfish	<i>Mystus gulio</i>
Kajuli	Gangetic Ailia	<i>Ailia coila</i>
Datina	Yellow Seabream	<i>Acanthopagrus latus</i>
Khalla Bata	Goldspot Mullet	<i>Liza parsia</i>
Chewa Bele	Goby	<i>Apocryptes bato</i>
Bele/Baila	Tank Goby	<i>Glossogobius giurus</i>
Champa	Trichiuridae	<i>Rastrelliger kanagurata</i>
Maitta	Spanish Mackerel	<i>Scomberomorus guttatus</i>
Gozar	Great snakehead	<i>Channa marulius</i>
Taki	Spotted snakehead	<i>Channa punctata</i>
Shol	Snakehead murrel	<i>Channa striata</i>
Koi	Climbingperch	<i>Anabus testudineus</i>
Taposi	Paradise Threadfin	<i>Polynemus paradiseus</i>
Lotia icha		<i>Macrobrachium mirabilis</i>
Bagda icha	Tiger Shrimp	<i>Penaeus monodon</i>
Goda icha		<i>Macrobrachium dolichodactylus</i>
Golda icha	Freshwater Prawn	<i>Macrobrachium rosenbergii</i>
Kokori icha		<i>Macrobrachium villosimanus</i>
Baim	Zig-zag eel	<i>Mastacembelus armatus</i>
Tara baim	Lesser spiny eel	<i>Macrogathus aculeatus</i>
Foli/Hoilla	Bronze featherback	<i>Notopterus notopterus</i>
Mola	Molacarplet	<i>Amblypharyngodon mola</i>
Gachua	WalkingSnakehead	<i>Channa orientalis</i>
Kaikya	Freshwater garfish	<i>Xenentodon cancila</i>

coastal region of Bangladesh are still out of assessment due to insufficient research. Over the last decade, fish biodiversity of riverine and estuarine ecosystems across Bangladesh have reduced considerably due to anthropogenic affects, tourism, pollution, natural hazards and climate change that resulted in destruction of migratory routes, altered habitats and deteriorated water quality (Hossain *et al.*, 2015; IUCN Bangladesh, 2013). Therefore, IUCN, categorized many species as endangered in Bangladesh (IUCN Bangladesh, 2013). Based on the observation and findings of present investigation, the following conservation measures and management strategies are suggested to conserve the biodiversity of fish species in this area:

- A long term thorough study of biodiversity, distribution and life history of fishes to inform management agencies to help them in decision making and improve the management policies and strategies.
- Raising awareness about the importance of fish and their habitat conservation through proper channel (or communication), cooperation and education.
- Introduction of fish bypasses in water control structures to ease fish migration.
- Reducing or stopping use of river water for irrigation, especially when water level and flow is low.
- Banning of fishing during spawning season, and use of illegal and destructive fishing gears to reduce overfishing.
- Stopping indiscriminate catching of fry and fingerlings.
- Declaration of fish sanctuary in the major depressions of the river.
- Increasing more wild fish in aquaculture systems.
- Enhancing fisheries resources through restocking.
- Effective implementation of existing fisheries regulations e.g., National Fisheries Policy (1998), National Fisheries Strategy (2006), The Protection and Conservation of Fish Rules (1985) etc.
- Therefore, it is an urgent need to facilitate alternative income-generating activities for rural fishermen to reduce dependency on fishing.

#### Acknowledgments

We would like to thank the Department of Fisheries and Marine Science, Noakhali Science and Technology University for providing all sorts of laboratory facilities during the study period. We are also thankful to the fishermen and other relevant stakeholders of the study area for their help in collecting samples and providing important information to carry out the research

work.

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