INNSPUB

Journal of Biodiversity and Environmental Sciences (JBES)
ISSN: 2220-6663 (Print) 2222-3045 (Online)
Vol. 9, No. 6, p. 46-53, 2016
http://www.innspub.net

RESEARCH PAPER OPEN ACCESS

Diversity status of fishes of the Meghna river adjacent to Narsingdi district, Bangladesh

Md. Simul Bhuyan[*1], Abu Sayeed Muhammad Sharif[2], Aysha Akhtar[1], Md. Shafiqul Islam[1]

[1]*Institute of Marine Sciences and Fisheries, University of Chittagong, Chittagong, Bangladesh*

[2]*Bangladesh Oceanographic Research Institute, Ramu, Cox's Bazar, Bangladesh*

Article published on December 31, 2016

Key words: Diversity, Fish species, Taxonomy, Endangered, Meghna river

Abstract

The present experiment was conducted on the fish diversity of the Meghna River close to Narsingdi district from September, 2015 to March, 2016. Fish samples were collected from the fishermen for taxonomic study and thereby diversity of fishes was assessed. A total of 69 fish species were identified during the study under 23 orders and 28 families. Among 69 fish species; 26 were found belong to Cyprinidae family followed by Bagaridae (5), Schilbeidae (4), Channidae (4), Ambassidae (2), Belontiidae (3), Siluridae (2), Notopteridae (2), Mastacembelidae (2) and others (19). During the study period, 7 species were found critically endangered, 15 species were endangered and 12 species were vulnerable while 26 species were not found in threatened position.

***Corresponding Author:** Simul Bhuyan ✉ simulbhuyan@gmail.com

Introduction

Traditionally, Bangladesh is a land of rivers (Mohsin and Haque, 2009) that extensively endowed with fisheries resources as its water bodies consider as home of fish (Rahman, 2005). Fisheries sector plays a significant role in the economy, food and livelihood security (Priyadarsani and Abraham, 2016) of the country through the continuous supply of nutritious food (Pillai and Kathia, 2004). DoF (2005) mentioned that fisheries sector meeting 63% protein demand, generating employment and earning foreign currency. Moreover, it contributing 23% of the agricultural production, 5.69% total export earnings and 4.92% of the national income (DoF, 2005).

Notwithstanding, fisheries sector playing crucial role in the economy but unfortunately, this sector is being depleted as reported by (Galib, 2015; Joadder *et al.,* 2015; Chaki *et al.,* 2014; Mohsin *et al.,* 2014, 2013; Galib *et al.,* 2013) and in recent time it is the blazing question in the country (Imteazzaman and Galib, 2013; Galib *et al.,* 2009). The causes of the reduction of fisheries are degradation of riverine ecosystem, overexploitation and injudicious intrusion of human (Galib *et al.,* 2013; Hossain *et al.,* 2012b). That creating adverse environment especially for river fishes (Rahman *et al.,* 2012) which compelled to be diminished. Consequently, 54 fish species were identified as threatened to extinct under three categories namely Critically Endangered, Endangered and Vulnerable (IUCN, 2000). Moreover, lack of consciousness about the river water or open water fishes make the poor condition to worst.

As a result, it is urgent to measure diversity of the open water fisheries. In this context, several research have been carried out throughout the world on the diversity of fishes (Goswami *et al.,* 2012; Shinde *et al.* 2009 a, b; Raghavan *et al.* 2008). In Bangladesh there are very limited or no remarkable research and further study needed for the conservation of this precious resources (Imteazzaman and Galib, 2013; Hossain *et al.,* 2012 a, b; Rahman *et al.,* 2012; Galib *et al.,* 2009; Hossain *et al.,* 2009; Mohsin and Haque, 2009; Mohsin *et al.,* 2009; Zafar *et al.,* 2007; Ahmed *et al.,* 2004; Saha *et al.,* 2002; Shahjahan *et al.,* 2001).

The Meghna river is playing significant role in the economy of the country with its water and biological resources. Due to haphazard industrialization the fish resources of the Meghna River near Narsingdi area is being contaminated and decreased gradually (Bhuyan *et al.* 2016). This depletion pattern of fish make the living condition of fishermen worst (Bhuyan *et al.* 2016). But unfortunately, there is no scientific research so far on the decreasing pattern of fish that compelled us to conduct this present research to find out the present fisheries diversity status of the Meghna River. For the meaningful, marginalized and sustainable development of the country the river along with its resources must be conserved.

Materials and methods

Study Area and Duration

The present study was carried out in the Meghna River near Narsingdi district (23°54´37.13″N and 90°43´21.63”) from 2015 to 2016.

Fig. 1. Map showing sampling site of the Meghna river.

Sample Collection and Preservation

Fish samples were collected from the fishermen on the spot caught by cast nets, gill nets, fishing traps and also from the retail market close to the study area. Collected fish were identified preliminarily on the spot with the help of related books. Fishes those appeared difficult to identify on the spot, were preserved with 10% formalin and brought to the Biodiversity, Environment and Climate Change Research Laboratory (Institute of Marine Sciences and Fisheries, University of Chittagong) in plastic jars for further identification.

Identification

The fish specimens were identified based on the morphometric and meristic characteristics according to Bhuiyan (1964), Quddus and Shafi (1983), Quddus *et al.,* (1988), Rahman (1989, 2005) and Talwar and Jhingran (1991), Roy *et al.,* (2007), Rahman *et al.,* (2009). After identification, fishes were classified following Nelson (2006). Scientific names and authorities followed according to those of Froese and Pauly (2015), Thompson *et al.,* (2007).

Results and discussion

A total of 69 fish species were identified from the present study under 23 orders and 28 families (Table 1). Among 69 fish species, majority (26) were recorded from Cyprinidae family followed by Bagaridae (5), Schilbeidae (4), Channidae (4), Ambassidae (3), Belontiidae (3), Siluridae (2), Notopteridae (2), Mastacembelidae (2), Dasytidae (1), Bothidae (1), Sybranchidae (1), Tetradontidae (1), Belonidae (1), Cobitidae (1), Clariidae (1), Heteropneustidae (1), Chacidae (1), Pangasiidae (1), Clupeidae (1), Mugilidae (1), Anabantidae (1), Gobiidae (1), Nandidae (1), Pristolepidae (1), Cichlidae (1), Sciaenidae (1) (Fig. 2).

In the present study, 7 fish species were found critically endangered, 15 species were endangered, 12 species were vulnerable, 26 species were not threatened position, 1 species was most common, 1 species was rare and 8 species were not listed (IUCN, 2000) (Fig. 3).

No previous records of fisheries of this river was found, therefore comparison of present research findings with previous one was not possible.

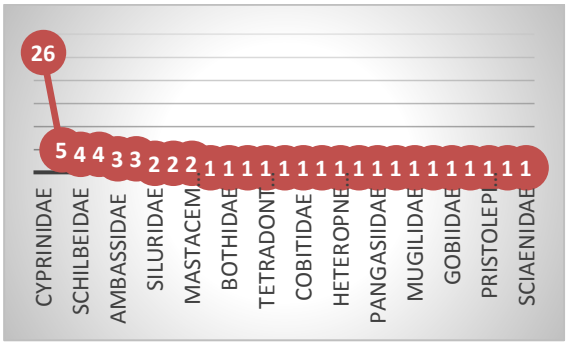

Fig. 2. Number of fish species with respective family.

This data deficiency indicates the research necessity and development of data base on fish diversity in Bangladesh. Islam and Hossain (1983) documented 110 fish species from Padma river near Rajshahi. Mortuza (1992) recorded 126 fish species from the Barnai project area near Padma river. Comparing with the above studies, the present research findings however, give an insight that there is visible decline of fish species during the last decade. In fact, the findings of the present research was almost 2 times lower than some other researchers conducted on other rivers of Bangladesh (Bhuiyan *et al.,* 2008; Rahman *et al.,* 2012). Nevertheless, more or less similar results were found from Galib *et al.,* (2013) conducted study on River Choto Jamuna and Mohsin and Haque (2009) carried out research on Mahananda river. Mohsin *et al.,* (2013) and Joadder *et al.,* (2015) recorded 69 and 69 fish species in river Padma. Samad *et al.,* (2010) found 57 small indigenous fish species (SIS) from the Padma River. All these results indicate a sharp gradual decline of fish diversity in the rivers. Most of the fish were found under the Cyprinidae family recorded in the present study. This finding was quite similar with Galib *et al.,* (2009), Mohsin and Haque (2009), Mohsin *et al.,* (2009) and Imteazzaman and Galib (2013).

Moreover, some exotic fishes (Silver carp, Grass carp, Common carp, Mirror carp, Nile Tilapia and Big head Carp) were recorded from the river during the study. These types of fish are very popular culture species in Bangladesh but getting escaped from the culture pond during heavy flood and enter into the river systems.

Table 1. Fish species found in the Meghna river along with IUCN status.

Serial no.	Local Name	Common Name	Scientific Name	IUCN Status
1	Shing	Stinging catfish	*Stinging catfish*	Not Threatened
2	Magur	Walking catfish	*Clarias batrachus*	Not Threatened
3	Tengra	Day's mystus	*Mystus bleekeri*	Not Threatened
4	Koi	Climbing perch	*Anabus testudineus*	Not Threatened
5	Rui	Rohu	*Labeo rohita*	Not Threatened
6	Catol	Catla	*Catla catla*	Not Threatened
7	Mrigel	Mrigal	*Cirrhinus cirrhosus*	Not Threatened
8	Chapila	Indian river shad	*Gudusiachapra*	Not Threatened
9	Khalisha	Banded Gourami	*Colisa fasciatus*	Not Threatened
10	Boal	Freshwater Shark	*Wallago attu*	Not Threatened
11	Gutum	Guntea loach	*Lepidocephalichthys guntea*	Not Threatened
12	Aila/Kajuli	Gangetic Ailia	*Aila coila*	Not Threatened
13	Mola	Mola carplet	*Amblypharyngnodon mola*	Not Threatened
14	Jat puti	Pool barb	*Puntius sarena*	Not Threatened
15	Bele, Baila	Tank goby	*Glossogobius giuris*	Not Threatened
16	Taki	Spotted snakehead	*Channa punctatus*	Not Threatened
17	Potka	Ocellated Pufferfish	*Tetraodon cutcutia*	Not Threatened
18	Kaikka	Freshwater Garfish	*Xenentodon cancila*	Not Threatened
19	Batasi	Indian Potasi	*Pseudeutropius atherinoides*	Not Threatened
20	Bojuri tengra	Tengara Mystus	*Mystus tengara*	Not Threatened
21	Ghagor	Menoda Catfish	*Hemibagrus menoda*	Not Threatened
22	Shol	Striped Snaked	*Channa striatus*	Not Threatened
23	Boicha	Dwarf Gourami	*Colisa lalia*	Not Threatened
24	Pan pata	Large Tooth Flounder	*Pseudorhombus arsius*	Not Threatened
25	Taka punti	Rosy Barb	*Puntius conchonius*	Not Threatened
26	Koitor poa	Coitor Croaker	*Johnius coitor*	Not Threatened
27	Silong	Silond Catfish	*Silonia silondia*	Endangered
28	Pabda	Pabdah Catfish	*Ompok pabda*	Endangered
29	Bata	Bata	*Labeo bata*	Endangered
30	Chitol	Clown Knifefish	*Chitala chitala*	Endangered
31	Gonia	Kuria Labeo	*Labeo gonius*	Endangered
32	kachki	Ganges river sprat	*Corica soborna*	Endangered
33	Dhela	Cotio	*Rohtee cotio*	Endangered
34	Gazar	Great Snakehead	*Channa marulius*	Endangered
35	Napit	Frail Gourami	*Ctenops nobilis*	Endangered
36	Naptey koi	Badis	*Badis badis*	Endangered
37	Ilish	Hilsa shad	*Tenualosa ilisha*	Endangered
38	Kalagoni	Black Rohu	*Labeo calbasu*	Endangered
39	Bangra	Squarehead	*Chaca chaca*	Endangered
40	Baim	Zig-zag eel	*Mastacembelus armatus*	Endangered
41	Silver carp	Silver carp	*Hypophthalmichthys molitrix*	Not Listed
42	Grass carp	Grass carp	*Ctenopharyngodon idella*	Not Listed
43	Mirror carp	Mirror carp	*Cyprinus carpio var specularis*	Not Listed
44	Nile Tilapia	Mozambique tilapia	*Oreochromis mossambicus*	Not Listed
45	Lal chanda	Highfin Glassy Perchlet	*Parambasis lala*	Not Listed
46	Boro Icha	Giant freshwater prawn	*Macrobrachium rosenbergii*	Not Listed
47	Big head Carp	Bighead carp	*Hypophthalmichthys nobilis*	Not Listed
48	Haush	Bleeker's Whipray	*Himantura bleekeri*	Not Listed
49	Sarputi	Punta Olive barb	*Barbodes sarana*	Critically Endangered
50	Kalibaus	Orange-fin labeo	*Labeo calbasu*	Critically Endangered

51	Pangas	Pungas	*Pangasius pangasius*	Critically Endangered
52	Snake eel	Longfin snake-eel	*Pisodonophis cancrivorus*	Critically Endangered
53	Rida	Rita	*Rita rita*	Critically Endangered
54	Ghaura	Garua Bacha	*Clupisoma garua*	Critically Endangered
55	Vacha	Batchwa Bacha	*Eutropichthys vacha*	Critically Endangered
56	Choto Kolisha	Dwarf gourami	*Colisa chuna*	Vulnerable
57	Tara baim	Lesser spiny eel	*Macrognathus aculeatus*	Vulnerable
58	Chanda	Elongate Glass-perchlet	*Chanda nema*	Vulnerable
59	Bheda	Gangetic Leaffish	*Nandus nandus*	Vulnerable
60	Ayre	Long whiskered catfish	*Aorichthys aor*	Vulnerable
61	Foli	Bronze Featherbac	*Notopterus notopterus*	Vulnerable
62	Tit puti	Ticto barb	*Puntius ticto*	Vulnerable
63	Gulsha	Gangetic mystus	*Mystus cavasius*	Vulnerable
64	RagaTaki	Walking Snakehead	*Channa orientalis*	Vulnerable
65	Tek chanda	Indian Glassy Fish	*Parambasis ranga*	Vulnerable
66	Icha	Freshwater prawn	Unidentified	Data deficient
67	Gura Icha	Freshwater prawn	Unidentified	Data deficient
68	Darkina	Flying barb	*Parluciosoma daniconius*	Rare
69	Common carp	Common Carp	*Cyprinus caprio*	Most common

(Source: Field Work, 2015-2016).

Being exotic species, they can pose great threat for the native fish species (Mukherjee *et al.,* 2002) and if these invasive species once get established; it might be difficult to eradicate them (Myers and Hinrichs, 2000).

Although, establishment of Silver carp in natural freshwater was attempted by Rahman *et al.,* (2007); Galib and Mohsin (2011). In the recent study, a total of 6 exotic fishes were recorded from the Meghna river.

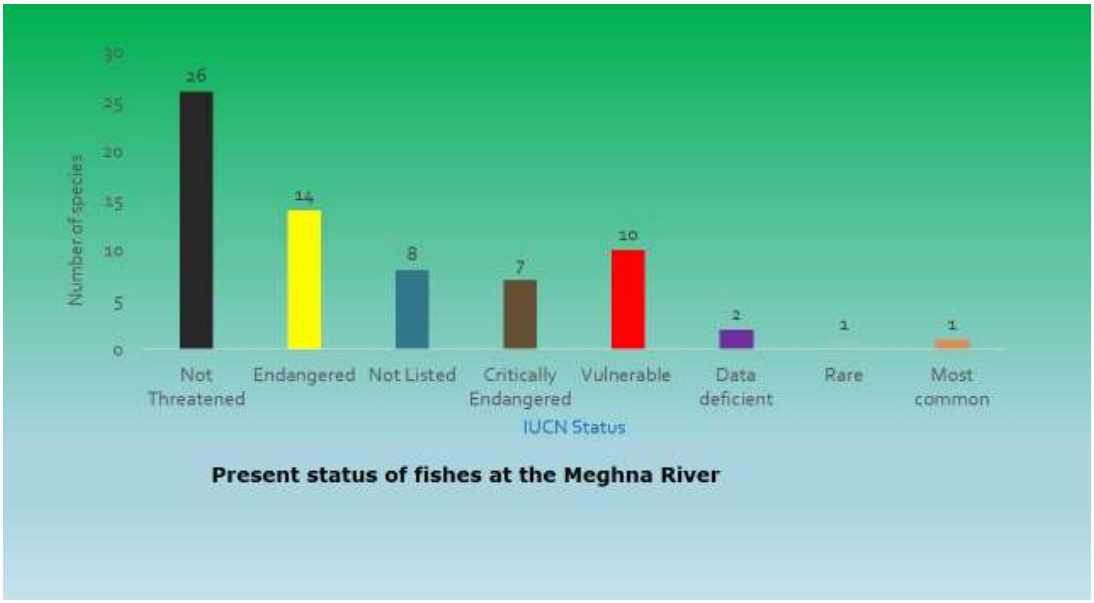

Fig. 3. Present status of fishes at the Meghna river.

More or less similar results were found by Galib *et al.,* (2013); Galib *et al.,* (2009); Imteazzaman and Galib (2013); and Mohsin *et al.,* (2009).

The main causes of the reduction of fishes in the Meghna river includes discharge of untreated industrial effluents, siltation, agricultural inputs and over fishing (Mohsin and Haque, 2009).

The present research shows that there is a clear indication of the gradual decline of fish diversity in the Meghna river. The findings on current fish diversity record may be beneficial for the successful management of fisheries resources and maintain ecological/nutritional and socio-economic equilibrium (Galib *et al.,* 2013).

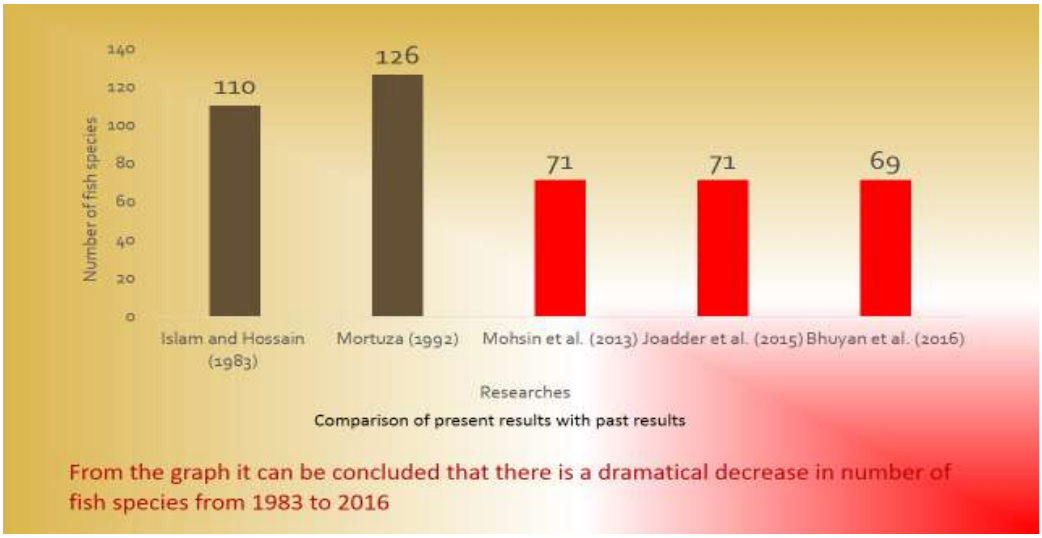

Fig. 4. Comparison of present status of fishes with past status at the Meghna river.

Conclusion

The fish diversity of Bangladesh undoubtedly undergoing critical stage than the past. On the basis of our research findings and other similar studies of recent times, we can conclude that high attention should be given on the conservation and management of riverine/open water fisheries diversity. To achieve the conservation goal, in depth research on different areas such as minimizing the pollution threats from the industries and agrochemical inputs in the river Meghna, use of destructive nets and indiscriminate fishing, impacts of invasive species on the native ones and maintaining data base of fish diversity etc. are a priority.

References

Ahmed KKU, Hasan RR, Ahamed SU, Ahmed T, Mustafa G. 2004. Ecology of Shakla beel (Brahmanbaria), Bangladesh. Bangladesh Journal of Fisheries Research **8**, 101-111.

Bhuiyan AL. 1964. Fishes of Dacca, Asiat. Soc. Pakistan, Pub. 1, No. 13, Dacca (Dhaka), Bangladesh 148.

Bhuiyan SS, Joadder MAR, Bhuiyan AS. 2008. Occurrence of fishes and non-fin fishes of the river Padma near Rajshahi, Bangladesh. University Journal of Zoology, Rajshahi University **27**, 99-100.

Bhuyan MS, Akhtar A, Saim KM, Islam, MS. 2016. Present status of socio-economic conditions of the fishing community of the Meghna river adjacent to Narsingdi District, Bangladesh, Journal of Entomology and Zoology Studies **4**, 641-646.

Bhuyan MS, Bakar MA, Akhtar A, Islam, MS. 2016. Heavy Metals Status in Some Commercially Important Fishes of Meghna river Adjacent to Narsingdi District, Bangladesh: Health Risk Assessment. American Journal of Life Sciences **4**, 60-70.

Chaki N, Jahan S, Fahad MFH, Galib SM, Mohsin ABM. 2014. Environment and fish fauna of the Atrai river: global and local conservation perspective. Journal of Fisheries **2**, 163-172.

Froese R, Pauly D. 2015. List of Freshwater Fishes reported from Bangladesh. Fish Base, World Wide Web electronic publication. www.fishbase.org, version (10/2015).

Galib SM, Mohsin ABM. 2011. Cultured and Ornamental Exotic Fishes of Bangladesh. Lambert Academic Publishing, Germany 176.

Galib SM, Naser SMA, Mohsin ABM, Chaki N, Fahad MFH. 2013. Fish diversity of the river Choto Jamuna, Bangladesh: Present status and conservation needs. International Journal of Biodiversity and Conservation **5**, 389-395.

Galib SM, Samad MA, Mohsin ABM, Flowra FA, Alam MT. 2009. Present status of fishes in the Chalan Beel-The largest beel (wetland) of Bangladesh. International Journal of Animal and Fisheries Science **2**, 214-218.

Galib SM. 2015. Fish fauna of the Brahmaputra River, Bangladesh: richness, threats and conservation needs. Journal of Fisheries **3**, 285-292.

Goswami UC, Basistha SK, Bora D, Shyamkumar K, Saikia B, Changsan K. 2012. Fish diversity of North East India, inclusive of the Himalayan and Indo Burma biodiversity hotspots zones: A checklist on their taxonomic status, economic importance, geographical distribution, present status and prevailing threats. International Journal of Biodiversity and Conservation **4**, 592-613.

Hossain MAR, Nahiduzzaman M, Sayeed MA, Azim ME, Wahab MA, Olin PG. 2009. The Chalan *beel* in Bangladesh: Habitat and biodiversity degradation, and implications for future management. Lakes & Reservoirs: Research and Management **14**, 3-19.

Hossain MS, Das NG, Sarker S, Rahaman MZ. 2012a. Fish diversity and habitat relationship with environmental variables at Meghna river estuary, Bangladesh. The Egyptian Journal of Aquatic Research **38**, 213-226.

Hossain MY, Rahman MM, Fulanda B, Jewel MAS, Ahamed F, Ohtomi J. 2012b. Length-weight and length-length relationships of the five threatened fishes from the Jamuna (Brahmaputra river distributary) river, Northern Bangladesh. Journal of Applied Ichthyology **28**, 275-277.

Imteazzaman AM, Galib SM. 2013. Fish Fauna of Halti Beel, Bangladesh. International Journal of Current Research **5**, 187-190.

Islam, MS, Hossain MA. 1983. An account of the fisheries of the Padma near Rajshahi, Rajshahi Fish Bulletin **1**, 1-3.

IUCN Bangladesh. 2000. Red book of threatened fishes of Bangladesh. IUCN- The world conservation Union 116.

Joadder MAR, Galib SM, Haque SMM, Chaki N. 2015. Fishes of the river Padma, Bangladesh: Current trend and conservation status. Journal of Fisheries **3**, 259-266.

Meyer L, Hinrichs D. 2000. Microhabitat preferences and movements of the weather fish, *Misgurnus fossilis*, in a drainage channel. Environmental Biology of Fishes **58**, 297-306.

Mohsin ABM, Haque E. 2009. Diversity of fishes of Mahananda river at Chapai Nawabganj district. Research Journal of Biological Sciences **4**, 828-831.

Mohsin ABM, Haque SMM, Galib SM, Fahad MFH, Chaki N, Islam MN, Rahman MM. 2013. Seasonal abundance of fin fishes in the Padma river at Rajshahi district, Bangladesh. World Journal of Fish and Marine Sciences **5**, 680-685.

Mohsin ABM, Hasan MM, Galib SM. 2009. Fish Diversity of Community Based Fisheries Managed Oxbow Lake (Bookbhara Baor) in Jessore, Bangladesh. Journal of Science Foundation **7**, 121-125.

Mohsin ABM, Yeasmin F, Galib SM, Alam B, Haque SMM. 2014. Fish fauna of the Andharmanik River in Patuakhali, Bangladesh. Middle-East Journal of Scientific Research **21**, 802-807.

Mortuza, MG. 1992. Fish and fisheries of the river Barnai: Flood plain fisheries (FCD) project. M.Sc. Thesis. Department of Zoology, Rajshahi University 157pp.

Mukherjee M, Praharaj A, Das S. 2002. Conservation of endangered fish stocks through artificial propagation and larval rearing technique in West Bengal, India. Aquaculture Asia **7**, 8-11.

Nelson JS. 2006. Fishes of the World, fourth edition, John Wiley & Sons, Inc. 601pp.
Pillai NGK, Kathia PK. 2004. Evolution of Fisheries and Aquaculture in India. Central Marine Fisheries Research Institute, Kochi, India 240.

Priyadarsani L, Abraham TJ. 2016. Water and sediment quality characteristics of medium saline traditional shrimp culture system (*Bheri*). Journal of Fisheries **4**, 309-318.

Quddus, MMA, Sarker, MN, Banerjee AK. 1988. Studies of the Chondrichthyes Fauna (Sharks, Skates and Rays) of the Bay of Bengal. The Journal of NOAMI **5**, 19-39.

Quddus, MMA, Shafi, M. 1983. Bangapa sagarer Matsya Sampad (The Fisheries Resources of the Bay of Bengal). Kabir Publications, 38/3, Bangla Bazar, Dhaka, Bangladesh 535.

Raghavan R, Prasad G, Ali PHA, Pereira B. 2008. Fish fauna of Chalakudy river, part of Western Ghats biodiversity hotspot, Kerala, India: patterns of distribution, threats and conservation needs. Biodiversity and Conservation **17**, 3119-3131.

Rahman AKA. 1989. Freshwater fishes of Bangladesh, first edition. Zoological Society of Bangladesh, Department of Zoology, University of Dhaka, Dhaka 1000, Bangladesh 364.

Rahman AKA. 2005. Freshwater Fishes of Bangladesh, 2nd edition, Zoological Society of Bangladesh, Department of Zoology, University of Dhaka, Dhaka 1000, Bangladesh 263.

Rahman AKA. 2007. Exotic fishes and their impact on environment. 16th Annual General Meeting and National Conference 2007, Zoological Society of Bangladesh, 30 March, Dhaka, Bangladesh 26-39.

Rahman MM, Hossain MY, Ahamed F, Fatematuzzhura Subba BR, Abdallah EM, Ohtomi J. 2012. Biodiversity in the Padma Distributary of the Ganges River, Northwestern Bangladesh: Recommendations for Conservation. World Journal of Zoology **7**, 328-337.

Rahman, AKA, Kabir, SMH, Ahmad, M, Ahmed, ATA, Ahmed, Z.U, Begum, ZNT, Hassan, M. A. Khondker, M. 2009. Encyclopedia of Flora and Fauna of Bangladesh. Asiatic Society of Bangladesh **24**, 2-57.

Roy BJ, Dey MP, Alam MF, Singha NK. 2007. Present Status of shark fishing in the marine water of Bangladesh.UNEP/CMS/MS/Inf/10.17p. www.cms.int/bodies/meetings/regional/ sharks/pdf_docs/Inf_10_Bangladesh_Presentation_ on_Shark_Fishing.pdf: Accessed 15 March, 2009.

Saha BK, Hossain MA. 2002. Saldu Beel fishery of Tangail. Bangladesh Journal of Zoology **30**, 187-194.

Samad MA, Asaduzzaman M, Galib SM, Kamal MM, Haque MR. 2010. Availability and Consumer Preference of Small Indigenous Species (SIS) of the River Padma at Rajshahi, Bangladesh. International Journal of Bio Research **1**, 27-31.

Shahjahan M, Miah MI, Haque MM. 2001. Present Status of Fisheries in Jamuna River. Pakistan Journal of Biological Sciences **4**, 1173-1176.

Shannon CE, Weaver W. 1949. The Mathematical Theory of Communication. Urbana, IL: University of Illinois Press.

Shinde SE, Pathan TS, Bhandare RY, Sonawane SL. 2009. Ichthyofaunal Diversity of Harsool Savangi Dam, District Aurangabad, (M.S.) India. World Journal of Fish and Marine Sciences **1**, 141-143.

Talwar PK, Jhingran AG. 1991. Inland fishes of India and adjacent countries, Vol. 1 and 2. Oxford & IBH Publishing Company Pvt. Ltd, New Delhi, India 1158.

Thompson P, Das Ak, Deppert DL, Choudhury SN. 2007. Changes in biodiversity with wetland restoration and fish reintroduction, MACH technical paper 5, Winrock International: Dhaka.

Zafar MS, Amin MN, Iqbal MJ. 2007. Biodiversity of fisheries organisms in the Pagla river of Bangladesh. Bangladesh Journal of Fisheries (Special Issue) **30**, 165-175.