Bangladesh J. Zool. **50**(1): 23-35, 2022 ISSN: 0304-9027
eISSN: 2408-8455

FISH DIVERSITY OF THE MEGHNA RIVER ADJACENT TO SONARGAON UPAZILA OF NARAYANGANJ DISTRICT

Tonima Mustafa*, Shah Jalal Muhammad Jesan, Mst. Hasina Begum, Ami Akter and Md. Masud Rana

Department of Zoology, Jagannath University, Dhaka-1100, Bangladesh

Abstract: The study was conducted to assess the diversity of fish fauna in the Meghna River close to Sonargaon upazila, Narayanganj district between December 2017 and November 2018. Some water quality parameters (temperature, pH and transparency) were measured in two selected sites (Boidyerbazar ghat and Uddamganj) of the river. In this study, a total of 58 fish species were identified, which belong to nine orders, 26 families and 41 genera. Cypriniformes was the most dominant order contributing about 34.48% of the fish species diversity. A total of 30 species were considered as of Least Concern (LC) while ten species were Near Threatened (NT), seven species were Endangered (EN), six species were Vulnerable (VU), only one species *Bagarius bagarius* ranked as Critically Endangered (CE) and four species were not listed according to IUCN (2015). The highest number of fish species was observed in the rainy season while the lowest was in the summer. The ranges of water temperature, pH and turbidity values in the river were 21-32 °C, 6.5-8.5 and 23-42 NTU, respectively. This study indicates that the fish species diversity of the Meghna River is likely declined gradually when compared with previous studies.

Key words: Bangladesh, Cypriniformes, Fish fauna, Fish Conservation, Meghna River, water quality

INTRODUCTION

Bangladesh is a riverine country that extensively enriched with fisheries resources and biodiversity (Mohsin and Haque 2009). Fisheries sector contributes a significant role in national economy and nutrition as it contributes about 1.39% of the total export earning, 3.52% to GDP and 26.37% to agricultural sector (BES 2020 and FRSS 2020). Currently, the inland fisheries production of our country has ranked third position in the world (DoF 2020). Inland water and its fisheries resources take part an important aspect in the food, economy and livelihood security of the country by providing the major supplementations of nutritious animal food including protein, fatty acids, ammino acids, vitamin and minerals; notably, these are recognized numerous health benefits (Funge-Smith and Bennett 2019).

*Author for correspondence: <tonimamustafa@yahoo.com>
 DOI: https://doi.org/10.3329/bjz.v50i1.60089

Freshwater ecosystems are the most endangered in the world which affecting both species diversity and their abundance (Sala *et al.* 2000). Rapid and unplanned urbanization, commercial development along with population pressure are substantial driver for the declining of freshwater fish biodiversity. Several research data stated that the major rivers of our country are seriously affected by industrialization and urbanization (Uddin and Jeong 2021).

The Meghna River is one of the most important rivers in Bangladesh. In the Sonargaon upazila of Narayanganj district, the Meghna River plays a vital part in facilitating the fisheries resources with rich diversity to the region and also to Dhaka city (NDS 2018). As this region is near to Dhaka city, the city people can get easily the fresh riverine fishes. But recently, urbanization and industrialization near the river bank has created pollution problem which may cause threat in fish diversity (Uddin and Jeong 2021).

Meghna River is at risk due to pollution, multiple human stressors, industrialization, brick fields and land development projects for urbanization (Akter *et al.* 2021; Bhuyan *et al.* 2016). The continuous study of biodiversity is important as there may be the negative impact of above factors on biodiversity. Moreover, biodiversity in freshwater ecosystems is more threatened and declining more rapidly than biodiversity in terrestrial and marine ecosystem in Bangladesh. However, the Meghna River is one of the important rivers of the country, the study of biodiversity assessment of the river is essential for the fisheries sector. Thus, the present study was aimed to provide information about the fish diversity of Meghna River in different seasons adjacent to Sonargaon upazila, Narayanganj district.

MATERIAL AND METHODS

Study area and duration of sample collection: The study was carried out in the Meghna River at Boidyer Bazar of Sonargaon upazila, Narayanganj district. The study area located between Latitude 23° 41′26.31″ N and Longitude 90°37′13.50″ E (Fig 1). The investigation was carried through in the Meghna River for a year, from December 2017 to November 2018. The sample collection was done once in every two weeks between 5:00 a.m. to 7:00 a.m.

Sample collection: Fish samples were collected from the Boidyer Bazar landing area on the bank of the Meghna River at Sonargaon upazila, Narayanganj district. Around one hundred fishermen carry their catch from the Meghna River of the surrounding Narayanganj district to Boidyer Bazar. Fishermen bring the fishes in the landing area at early morning (5:00 a.m. to 6:30 a.m.) and afternoon (12:00 p.m. to 1:30 p.m.). About ten to fifteen samples for each species were collected from the fishermen just after caught and kept in a chill

box then immediately transported to the fisheries laboratory, Department of Zoology, Jagannath University for identification.

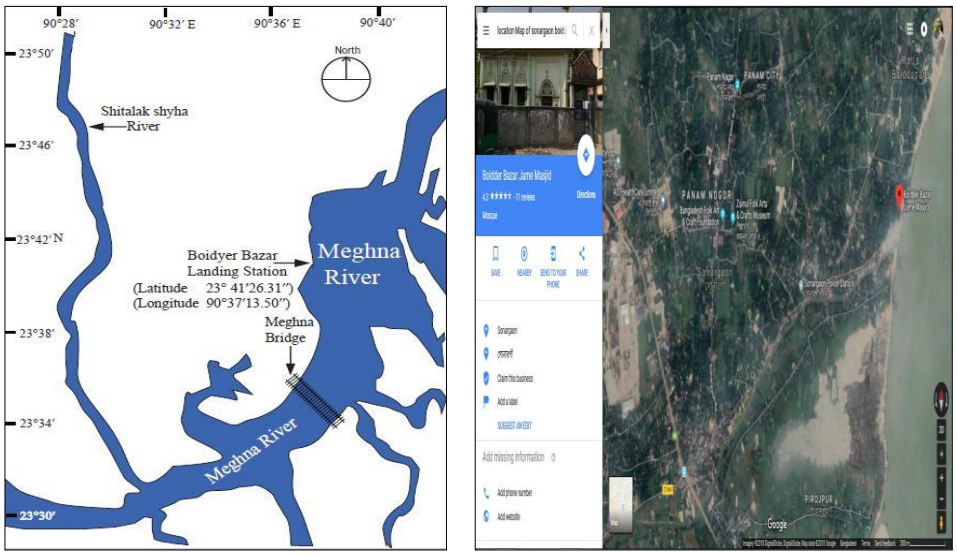

Fig. 1. Map of the study area (Left) with satellite image (Right) of Boidyer Bazar

Identification of the collected fish samples: The collected fish samples were identified by analyzing the morphometric and meristic characteristics following Shafi and Quddus (1982), Rahman (2005), Talwar and Jhingran (1991) and Roy *et al.* (2007). The systematic classification of the identified fish species was made following scientific names and authorities according to Fish base (2021), ITIS (2021), Rahman (2005) and Winterbottom (2006).

Physicochemical parameters: Some physiological parameters were measured within 7:00 a.m. The pH, transparency and temperature of the river water at two spots (Spot 1: Boidyerbazar ghat and Spot 2: Uddamganj) adjacent to the Boidyer Bazar area were determined using a pH meter (s327535, Hanna Instruments), a Sacchi disc (20 diameter) and a thermometer in centigrade, respectively.

Statistical analysis: The data of fish diversity and physicochemical parameters around the year were presented in four different seasons (1. Summer during March-May, 2. Rainy-season during June-September, 3. Autumn during October-November and 4. Winter during December-February) of the country according to Aquastat (2011). Statistical analysis was performed using SPSS version 25 for Windows. Student's t-test was used to determine the

differences between the water parameters of two spots in this study. Level of significance was tested at α level of 5% ($p < 0.05$).

RESULTS AND DISCUSSION

Fish diversity: A total of 58 fish species were identified in the study period that were included in nine orders, 26 families and 41 genera (Table 1). Cypriniformes was the most dominant order contributing about 34.48% of the fish species diversity (20 species, 12 genera and four families), followed by Siluriformes (14 species, 11 genera and eight families), Perciformes (13 species, 10 genera and eight families), Channiformes (four species, one genera and one family), Clupeiformes (two species, two genera and one family) and Osteoglossiformes (Two species, two genera and one family); these were comprised of 24.14%, 22.41%, 6.90%, 3.45% and 3.45% of total fish biodiversity, respectively (Fig. 2). The least number of species was counted for the order Synbranchiformes, Beloniformes and Tetraodontiformes, each of those comprised only one species accounting for about 2% of total species diversity. Those fish species were *Monopterus cuchia, Xenentodon Cancila, Leiodon cutcutia* belonging to the family Synbranchidae, Belonidae and Tetraodontidae, respectively. Similarly, Cypriniformes, Siluriformes, Perciformes and Clupeiformes were dominant order in the different rivers in Bangladesh (Ali *et al.*, 2020; Rahman *et al.*, 2012; Easmin *et al.*, 2018; Baki *et al.*, 2017). Among 58 fish species the majority (18) were recorded under cyprinidae family followed by Bagridae (5), Channidae (4), Osphronemidae (3), Mastacembelidae (3), Danionidae (2), Cobitidae (2), Siluridae (2), Ambassidae (2), Ailiidae (1), Pangasiidae (1), Sisoridae (1), Heteropneustidae (1), Loricariidae (1), Sciaenidae (1), Nandidae (1), Cichlidae (1), Gobiidae (1), Anabantidae (1), Synbranchidae (1), Belonidae (1) and Tetradontidae (1).

The fish species diversity in the present study was concur with the previous studies in the same river which flows in different districts (Bhuiyan *et al.* 2016, Hossain *et al.* 2012 and Rahman *et al.* 2019). For examples, Bhuiyan *et al.* (2016) recorded 69 fish species in the Meghna River close to Narsingdi district, Rahman *et al.* (2019) observed 60 fish species in the same river near to Chandpur district, and Hossain *et al.* (2012) identified 53 fish species in the Meghna river estuary. However, Mia *et al.* (2015) and Mondal *et al.* (2013) recorded only 20 species from the Meghna River at Ashugonj upazila and 16 species in the Meghna River at Ramgoti upazila which were far less than the present findings. In comparison with the fish diversity of other rivers in this country, Habib *et al.* (2016) found 82 species in the Padma River near to

Table 1. Fish diversity of the Meghna river with their conservation status from December 2017 to November 2018 (EN: Endangered; LC: Least Concern; NT: Near Threatened, VU: Vulnerable; CR: Critically Endangered; (–): no data available in the red list of IUCN, 2015).

Order	Family	Scientific Name	English Name	Local name	IUCN status
Cypriniformes (20)	Cyprinidae (16)	*Puntius chola* (Hamilton, 1822)	Swamp Barb Chola Barb	Chala punti, Punti	LC
		Osteobrama cotio (Hamilton, 1822)	Cotio	Keti, Dhela, Dhipali	NT
		Puntius terio (Hamilton, 1822)	One Spot Barb	Teri Punti	LC
		Puntius sarana (Hamilton, 1822)	Olive Berb	Sar Punti	NT
		Puntius sophore (Hamilton, 1822)	Spotfin Swamp Barb	Punti, Jat Punti	LC
		Hypophthalmichthys molitrix (Valenciennes, 1844)	Silver Carp	Silver Carp	-
		Labeo calbasu (Hamilton, 1822)	Orangefin labeo	Kalibaus, Baus, Kalia	LC
		Gibelion catla (Hamilton, 1822)	Catla	Catla, Katla	LC
		Labeo rohita (Hamilton, 1822)	Rohu Carp	Rui, Rohit	LC
		Labeo gonius (Hamilton, 1822)	Kuria Labeo	Ghannya, Goni	NT
		Labeo bata (Hamilton, 1822)	Bata Labeo	Bata, Bhangan Bata	LC
		Cirrhinus reba (Hamilton, 1822)	Reba carp	Bhagana, Tatkini, Bata	NT
		Cyprinus carpio (Linnaeus, 1758)	Common Carp	Carpu	-
		Barbonymus gonionotus (Bleeker, 1849)	Java Berb	Tai Sarpunti, Rajpunti	-
		Labeo boggut (Sykes, 1839)	Boggut Labeo	Ghania, Gohria	VU
		Cirrhinus cirrhosis (Bloch, 1795)	Mrigal Carp	Mrigal, Mirka	NT
	Danionidae (2)	*Amblypharyngodon mola* (Hamilton, 1822)	Mola Carpet	Mola, Moa	LC
		Rasbora daniconius (Hamilton, 1822)	Common Rashbora	Darkina	NT
	Cobitidae (2)	*Botia Dario* (Hamilton, 1822)	Queen Loach, Bengal Loach	Rani	EN
		Lepidocephalichthys guntea (Hamilton, 1822)	Guntea Loach	Gutum	LC
Siluriformes (14)	Bagridae (5)	*Mystus bleekeri* (Day, 1877)	Day's Mystus	Bajari Tengra Bujri	LC
		Mystus tengara (Hamilton, 1822)	Tengara catfish	Tengra, Gulsha Tengra	LC
		Mystus cavasius (Hamilton, 1822)	Gangetic Mystus	Kabashi Tengra, Gulsha	NT
		Mystus vittatus (Bloch, 1794)	Stripped Dwarf Catfish	Tengra	LC
		Spearata aor (Hamilton, 1822)	Long Whiskered catfish	Ayre	VU
	Siluridae (2)	*Wallago attu* (Bloch & Schneider, 1801)	Boal	Boal, Boali	VU
		Ompok pabda (Hamilton, 1822)	Pabda	Pabda	EN
	Ailiidae (1)	*Ailia coila* (Hamilton, 1822)	Gangetic Ailia	Kajuli, Bashpata	LC
	Schilbeidae (2)	*Clupisoma garua* (Hamilton, 1822)	Garua Bacha, Gagra	Gharua, Bacha	EN
		Eutropiichthys vacha (Hamilton, 1822)	Batchwa vacha, Bacha	Bacha, Garua Bacha	LC
	Pangasiidae (1)	*Pangasius pangasius* (Hamilton, 1822)	Pangas catfish	Pangas	EN
	Sisoridae (1)	*Bagarius bagarius* (Hamilton, 1822)	Gangetic Goonch	Baghair	CR
	Heteropneustide (1)	*Heteropneustes fossilis* (Bloch, 1794)	Stinging Catfish	Shing, jiol	LC
	Loricariidae (1)	*Hypostomus plecostomus* (Linnaeus, 1758)	Plecostomus, Suckermouth Catfish	Choshok Machh	LC
Perciformes (13)	Ambassidae (2)	*Parambassis baculis* (Hamilton, 1822)	Himalayan glassy perchlet	Kata Chanda. Phopa Chanda	NT
		Parambassis lala (Hamilton, 1822)	Highfin Glassy Perchlet	Lal Chanda	LC
	Sciaenidae (1)	*Otolithoides pama* (Hamilton, 1822)	Pama Croaker	Poa, Poma	LC
	Nandidae (1)	*Nandus nandus* (Hamilton, 1822)	Gangetic leaffish	Bheda, Meni	NT
	Cichlidae (1)	*Oreochromis mossambicus* (Peters, 1852)	Mozambique tilapia	Tilapia	-
	Gobiidae (1)	*Glossogobius giuris* (Hamilton, 1822)	Tank Goby	Bele, Ballia	LC
	Anabantidae (1)	*Anabas testudineus* (Bloch, 1792)	The Climbing Perch	Koi, Kai	LC
	Osphronemidae (3)	*Trichogaster fasciata* (Bloch & Schneider, 1801)	Banded gourami	Khalisha Cheli	LC
		Trichogaster lalius (Hamilton, 1822)	Dwarf gourami	Lal Khalisha	LC

Order	Family	Scientific Name	English Name	Local name	IUCN status
Channiformes (4)	Mastacembelidae (3)	*Ctenops nobilis* (McClelland, 1845)	Indian Paradise fish, Frail Gourami	Naftani, Napit Khailsha	LC
		Macrognathus pancalus (Hamilton, 1822)	*Barred spiny eel*	Guchi Baim	LC
		Macrognathus aculeatus (Bloch, 1786)	Lesser Spiny Eel	Tara Baim	NT
		Mastacembelus armatus (Lacepède, 1800)	Zig-zag eel	Sal Baim, Boro Baim	EN
	Channidae (4)	*Channa punctate* (Bloch, 1793)	Spotted Snakehead	Taki, Lata, Lati	LC
		Channa striatus (Bloch, 1793)	Striped Snakehead	Shol	LC
		Channa orientalis (Bloch & Schneider, 1801)	Asiatic Snakehead Walking Snakehead	Gachua, Cheng	LC
		Channa marulius (Hamilton, 1822)	Great snakehead	Gajar, Gajari	EN
Clupeiformes(2)	Clupeidae(2)	*Tenualosa ilisha* (Hamilton, 1822)	River Shad, Hilsa shad	Ilish, Ilsha	LC
		Gudusia chapra (Hamilton, 1822)	Indian River Shad	Chapila	VU
Osteoglossifores	Notopteridae (2)	*Chitala chitala* (Hamilton, 1822)	Humped Featherback	Chital, Chetol	EN
		Notopterus notopterus (Pallas, 1769)	Grey Featherback	Foli, Fholui	VU
Synbranchiformes	Synbranchidae (1)	*Monopterus cuchia* (Hamilton, 1822)	Cuchia	Kuchia, Kuicha	VU
Beloniformes	Belonidae (1)	*Xenentodon Cancila* (Hamilton, 1822)	Freshwater Garfish, Needle Fish	Kankila, Kakila	LC
Tetradontiforms	Tetradontidae (1)	*Leiodon cutcutia* (Hamilton, 1822)	Ocellated puffer Fish	Tepa, Potka	LC

Rajshahi city. Also, Easmin *et al.* (2018) recorded 77 fish species in the Jamuna river of Pabna district. Galib *et al.* (2013) reported 63 species of the Choto Jamuna River. Besides, Baki *et al.* (2017) observed 56 fish species in the Buriganga River. Furthermore, Chowdhury *et al.* (2019) recorded 51 fish species in the Shurma River at Sylhet sador. Therefore, based on the current findings as well as previous records on fish biodiversity in some rivers in this country, it is likely that fish diversity in different rivers may have jeopardized and gradually declined. The declining of riverine fish species diversity in this country probably due to the climate change, water pollution and habitat destruction. These adverse conditions have significant relation to anthropogenic activities causing pollution, climate change impact include erosion, siltation, salinity intrusion, and over exploitation and illegal fishing gears uses (Akter *et al.* 2021; Bhuyan *et al.* 2016; Uddin and Jeong 2021).

In the present study, exotic fish species i.e., Tilapia, *Oreochromis mossambicus* and Silver carp*, Hypophthalmichthys molitrix* and Common carp, *Cyprinus carpio* were found in almost all seasons during the study. This may happen due to accidental escape from the culture pond during heavy flood. The early maturation, higher fecundity and growth rate of these introduced species may exert predation and out competition to our native fish fauna and reduce

species diversity (Sarker *et al.,* 2021). Similarly, Baki *et al.* (2017), Bhuiyan *et al.* (2016), and Easmin *et al.* (2018) have been recorded two exotic fish species from the Buriganga River, six exotic fish species from the Meghna River, four exotic fish species from the Jamuna River respectively.

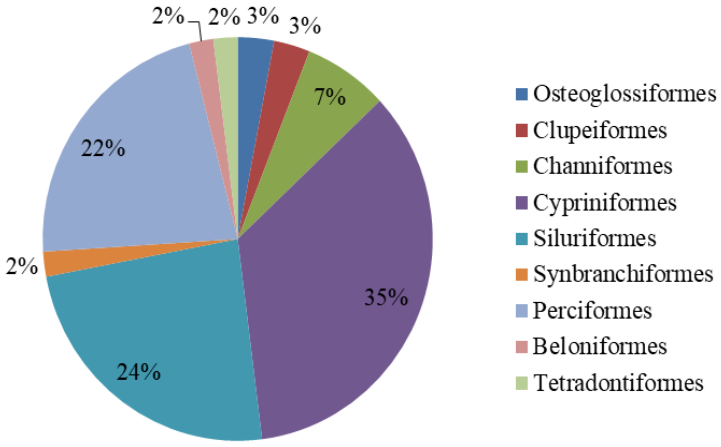

Fig. 2. Order wise percentage of fish species compositions in the Meghna River

Fish species diversity with different seasons: The number of fish species varied in different months and seasons (Fig. 3 and Fig. 4). The highest number (52) of fish species was recorded in October and lowest was in March (18). The number of fish species in different months were 38 (January), 26 (February), 18 (March), 26 (April), 21 (May), 28 (June), 37 (July), 42 (August), 45 (September), 52 (October), 50 (November) and 41 (December). According to the season wise, the highest average number of fish species was observed in the rainy season while the lowest was in summer. The average number of fish species was found in the pattern as summer (32) < winter (48) < autumn (53) < Rainy-season (58). Similar fish diversity variation in different seasons was also observed in the Buriganga River, the maximum species diversity has found in the rainy-season while most of the fish species has recorded in June to November (Baki *et al.*, 2017).

Conservation status of the fish species: Out of the 58 identified fish species, 30 species were considered as of Least Concern while ten specie were Near Threatened (NT), seven species were Endangered (EN), six species were Vulnerable (VU), Only one species *Bagarius bagarius* ranked as Critically Endangered and four species were not listed (IUCN 2015).

Physico-chemical parameters of water of Meghna River: Physico-chemical factors of river-water influence the occurrence, diversity, abundance and distribution of riverine fishes. For that, temperature, pH and turbidity of the water have been estimated during the study that is shown in the Table 2.

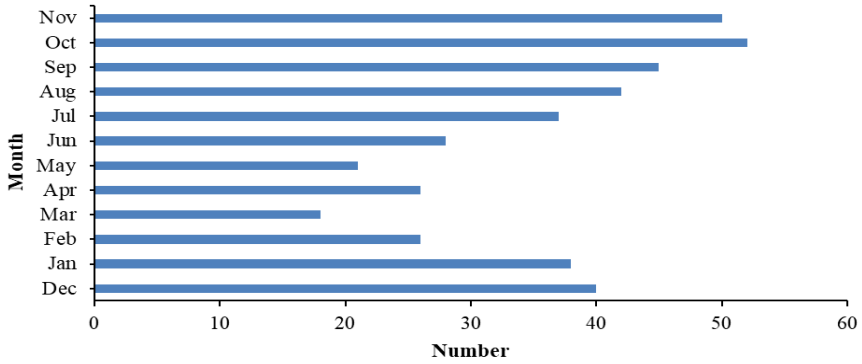

Fig. 3. Total number of fish species found in different month during study period from the Meghna River

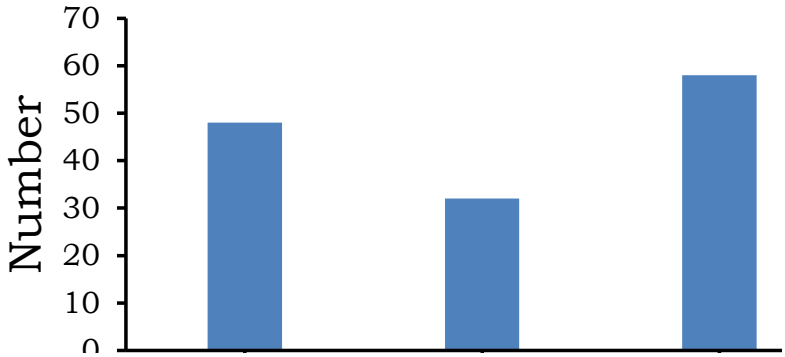

Fig. 4. Average number of fish species found in different seasons from the Meghna River

In this study, the monthly water temperature, pH and turbidity values did not differ ($p > 0.05$) significantly between Boidyerbazar ghat and Uddamganj in the Meghna River (Table 2 and Fig. 4). The highest temperature (32°C) was measured in rainy season while the lowest value was (21°C) in winter. The temperature of riverine water usually varies with ambient temperature, geographic location and time of sampling (Ahipathy and Puttaiah 2006). Moreover, the overall water temperature of this river was considered as favorable for fishery in Bangladesh (EQS 1997). The range of pH value over the year was from 6.7 to 7.8 which were within the optimum pH level for fishery (ECR 1997).

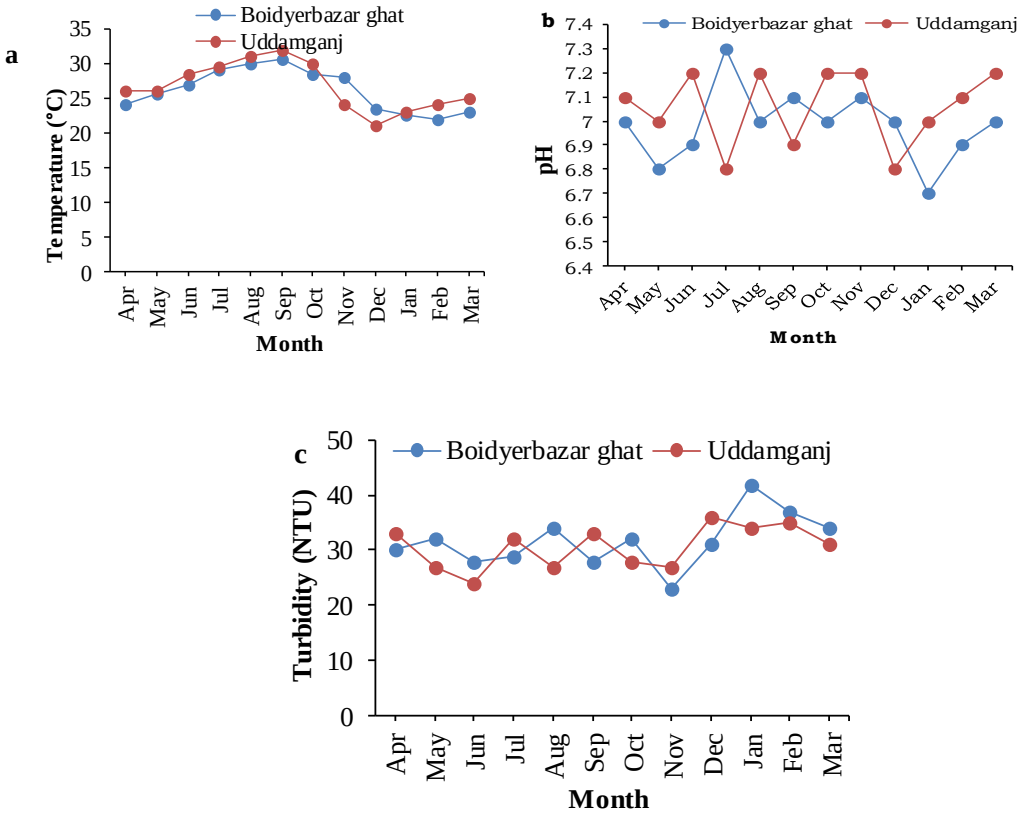

Fig. 5. Monthly variation of temperature (a), pH (b) and turbidity (c) at Boidyerbazar ghat and Uddamganj in the Meghna River.

Turbidity of the riverine water sample was measured in various seasonal condition. In this study, the range of turbidity was 23 to 42 NTU, these values have exceeded the acceptable value at 10 NTU (DPHE 2019). However, the turbidity range in this study was much higher than the acceptable value thus these higher concentrations of turbidity includes suspended solids; which may exert light blockage for photosynthesis, spawning bed degradation and interferes the gill function of the fish fauna. Therefore, the water quality degradation in this river is likely due to the turbidity which may have sabbatical relationships to improper anthropogenic activities (NDS 2018). In this study, only few water quality parameters include temperature, pH and turbidity were measured in the two sites that was near the bank of the river, however, this study was not assayed the overall water quality scenario of the Meghna river. Therefore, the detail study should be warranted to focus the water quality parameters and

their relations to the aquatic biota include plankton, bathos, fishes etc. to understand the actual scenario of that riverine ecosystem.

Table 2. Some water quality parameters of Meghna river water in different seasons at the Boidyerbazar ghat (S1) and Uddamganj (S2)

Parameter	Station	Year round (Mean ± SE)	Seasons				Standard for fisheries
			Winter	Summer	Rainy-season	Autumn	
Temp. (°C)	S1	26.12 ± 0.88[a]	22-23.50	23-25.50	27-30.50	28-29	20-30°C (EQS, 1997)
	S2	27.50 ± 1.26[a]	21-24	25-26	28.50-32	25-30	
pH	S1	6.98 ± 0.04[a]	6.7-7.10	6.8-7.0	6.9-7.30	7.0-7.10	6.5-8.5 (ECR,1997)
	S2	7.05 ± 0.04[a]	6.8-7.10	7.10	7.8-7.20	7.20	
Turbidity (NTU)	S1	31.67 ± 0.39[a]	31-42	30-34	28-34	23-32	10 (DPHE, 2019)
	S2	30.58 ± 1.12[a]	34-35	27-33	24-33	27-28	

Notes: S1: Spot1-Boidyerbazar ghat; S2: Spot2-Uddamganj; EQS: Environmental Quality Standard; ECR: Environmental Conservation Rules; DPHE: Department of Public Health Engineering; NTU: Nephelometric Turbidity Unit. Superscript similar letter in same column for each parameter did not differ ($p > 0.05$) significantly.

CONCLUSION

The present study was focused on fish species diversity and some water quality parameters in different months and seasons from the Meghna River adjacent to Sonargaon upazila of Narayanganj district. Based on the current findings and other similar studies of recent time, it can be concluded that the fish species diversity of the Meghna River is declined gradually. Moreover, the fish diversity was varied among the seasons that might be due to the environmental, physical and biological factors. The study site's water temperature and pH were within the acceptable limit while the turbidity was exceeded the limit. Continuous and detail study is recommended to promote a sustainable environment monitoring system along the riverside area and a healthier life includes their aesthetic values for the inhabitants.

Acknowledgements: The authors are grateful to Jagannath University research grant and R and D research project, National Science and Technology, Ministry of Science and Technology, Bangladesh for financial support. They are also grateful to Department of Zoology, Jagannath University, Dhaka for laboratory support.

LITERATURE CITED

AKTER, A., HOSEN, A., HOSSAIN, M.A., KHALIL, F. and MUSTAFA, T. 2021. Heavy metal concentrations and human health risk assessment of selected wild and cultured fishes of

Bangladesh. *Bangladesh J. Zool.* **49(2)**: 189-203. DOI: https://doi.org/10.3329/bjz.v49i2.56257

AHIPATHY, M.V. and PUTTAIAH, E.T. 2006. Ecological characteristics of Vrishabhavathy River in Bangalore (India). *Environmental Earth Sciences*. **49**(8): 1217-1222.

ALI, M.M., ALI, M.L., RAHMAN, M.J. and WAHAB, M.A. 2020. Fish diversity in the Andharmanik river sanctuary in Bangladesh. *Croatian Journal of Fisheries*. **78**: 21-32

AQUASTAT, 2011. Survey report on Ganges-Brahmaputra-Meghna River basin. FAO.

BAKI, M.A., HOSSAIN, M.M., BHOUIYAN, N.A. and ASADUZZAMAN, M. 2017. Fish species diversity, fishing gears and crafts from the Buriganga River, Dhaka. *Bangladesh J. Zool.* **45**(1): 11-26.

BES (Bangladesh Economic Survey) 2020. A Report prepared under the programme, Independent review of Bangladesh Development (IBRD), CPD, Released on 2020.

BHUYAN, M.S., BAKAR, M.A., AKHTAR, A. and ISLAM, M.S. 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.

BHUYAN, M.S., SHARIF, A.S.M., AKHTER, A. and ISLAM, M.S. 2016. Diversity status of fishes of the Meghna River adjacent to Narsingdi district, Bangladesh. *J. Bio. & Env. Sci.* **9**(6): 46-53.

CHOVANEC, A., HOFER, R. and SCHIEMER, F. 2003. Fish as bioindicators. In Trace metals and other contaminants in the environment. *Elsevier*. **6:** 639-676.

CHOWDHURY, M.A., KARIM, M.A., RAHMAN, M.T., TALUKDER, S.H., RAHMAN, S.A. and HOSSAIN, M. A. 2019. Biodiversity Assessment of Indigenous Fish Species in the Surma River of Sylhet Sadar, Bangladesh. *Punjab University Journal of Zoology*. **34**(1): 73-77.

DoF (Department of Fisheries) 2020. Yearbook of Fisheries Statistics of Bangladesh, 2019-20. Pp. 2.

DPHE (Department of Public Health Engineering) 2019. Water quality parameters Bangladesh standards, Government of the People's Republic of Bangladesh.

EASMIN, M.N., HABIB, AHM. S., AKTER, S. and MAJUMDER, K. 2018. Status and diversity of ichthyofauna of Jamuna River, Bangladesh. *Jagannath University Journal of Life and Earth Sciences*. **4**(1): 12-24.

ECR (Environmental Conservation Rules). 1997. Reported by Department of Environment. Ministry of Environment and Forest. Government of the People's Republic of Bangladesh.

EQS (Environmental Quality Standard). 1997. Reported by Department of Environment. Ministry of Environment and Forest. Government of the People's Republic of Bangladesh.

FISHBASE. 2021 A global information system on fishes. http://www.fishbase.org/.

FROESE, R. and PAULY, D. 2015. List of Freshwater Fishes reported from Bangladesh.

FRSS (Fisheries Resources Survey System) 2020. Fisheries Statistical Report of Bangladesh. Department of Fisheries, Bangladesh: Ministry of Fisheries and Livestock. **37:** 141.

FUNGE-SMITH, S. and BENNETT, A. 2019. A fresh look at inland fisheries and their role in food security and livelihoods. *Fish and Fisheries*. **20**(6): 1176-1195.

GALIB, M., NASER, S.A., MOHSIN, A.B.M., CHAKI, N. and FAHAD, F.H. 2013. Fish diversity of the River Choto Jamuna, Bangladesh: Present status and conservation needs. *International Journal of Biodiversity and Conservation.* **5**(6): 389-395.

HABIB, F., TASNIN, S. and BHUIYAN, S.A.M.I.N. 2016. A checklist of fishes and fisheries of the Padda (Padma) River near Rajshahi city. *International Journal of Pure & Applied Bioscience.* **4**(2): 53-57.

HOSSAIN, M.S., DAS, N.G., SARKER, S. and RAHAMAN, M.Z. 2012. Fish diversity and habitat relationship with environmental variables at Meghna river estuary, Bangladesh. *Egyptian Journal of Aquatic Research.* **38:** 213-226.

ITIS (Integrated Taxonomic Information System). 2021. http://www.itis.gov.CC0

MCERLEAN, A.J., O'CONNOR, S.G., MIHURSKY, J.A. and GIBSON, C.I. 1973. Abundance, diversity and seasonal patterns of estuarine fish populations. *Estuarine and Coastal Marine Science*. **1**(1): 19-36.

MIA, Y.F., NESA, N.U., KAFI, M.F.H., MIAH, M.I. and HAQ, M.S. 2015. Assessment and monitoring fish biodiversity of Meghna River in Bangladesh. *International Journal of Natural and Social Sciences*. **2**(3): 13-20.

MOHSIN, A.B.M. and HAQUE, E. 2009. Diversity of fishes of Mahananda River at Chapai Nawabganj district. *Research Journal of Biological Sciences.* **4**(7): 828-831.

MONDAL, M., ASADUJJAMAN, M.D. and ANWARUL, A.M.D. 2013. Analyses of catch composition and fish marketing of the Meghna River at Ramgati upazilla under Lakshmipur district in Bangladesh. *Middle-East Journal of Scientific Research.* **16**(11): 1452-1461. https://doi.org/10.5829/idosi.mejsr.2013.16.11.75172

NDS (Narayanganj District Statistics). 2018. Reported by the Bangladesh Bureau of Statistics (BBS), Statistics and Informatics Division (SID), Ministry of Planning, Government for the People's Republic of Bangladesh.

QUDDUS, M.M.A. and SHAFI, M. 1983. *Bangapasagarer Matsya Sampad* (The Fisheries Resources of the Bay of Bengal). *Bangla. Bangla Academy, Dhaka, Bangladesh.*

RAHAMAN, M.J., EMA, N.S., HOSSAIN, M.S., RAHMAN, M.M. and HOSSAIN, Z. 2019. Effects of climate change on fisheries biodiversity of the Meghna, Laukhati and Galachipa River in Bangladesh. *Eurasia J Biosci.* **13:** 1705-1717.

RAHMAN, A.K.A. 2005. Freshwater fishes of Bangladesh, 2nd edition, Zoological Society of Bangladesh, Department of Zoology, University of Dhaka, Dhaka-1000. pp. 263.

RAHMAN, M.M., HOSSAIN, M.Y., AHAMED, F., RAJ, F.B.R., SUBBA, ABDULLAH, E.M. and OHTOMI, J. 2012. Biodiversity in the Padma Distributary of the Ganges River, Northwestern Bangladesh: Recommendations for Conservation. *World Journal of Zoology* **7** (4): 328-337.

ROY, B.J, DEY, M.P, ALAM, M.F. and SINGHA, N.K. 2007. Present status of shark fishing in the Marine water of Bangladesh, Presented in the Convention on the Conservation of Migratory

Species (CMS) 1st Meeting in Seychelles. December, 2007.Link: www.UNEP/CMS/MS/ Inf/10.4p.

SALA, O. E., CHAPIN, F.S., ARMESTO, J.J., BERLOW, E., BLOOMFIELD, J., DIRZO, R., HUBERSANWALD, E., HUENNEKE, L.F., JACKSON, R.B., KINZIG, A., LEEMANS, R., LODGE, D.M., MOONEY, H.A., OESTERHELD, M., POFF, N.L., SYKES, M.T., WALKER, B.H., WALKER, M. and WALL, D.H. 2000. Global biodiversity scenarios for the year 2100. *Science*. **287**(5459): 1770-1774.

SHAFI, M. AND QUDDUS, M.M.A. 1982. *Bangladesher Matshya Shampad* (in Bengali). 1st ed. Bangla Academy, Dhaka. pp 2-14.

TALWAR, P. K. and JHINGRANJ, A. G. 1991. Inland fishes of India and adjacent countries. CRC Press. Vol **2**

UDDIN, M. J. and JEONG, Y.K. 2021. Urban river pollution in Bangladesh during last 40 years: potential public health and ecological risk, present policy, and future prospects toward smart water management. *Heliyon*. **7**:1-23

WINTERBOTTOM, R. 2006. Review of "Fishes of the World" by Joseph S. Nelson. Reviews in *Fish Biology and Fisheries*. **16**(2): 227.

(Manuscript received on 25 February 2022 revised on 30 April, 2022)