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Impact of Pollutional Load on Ichthyo Faunal Diversity of Mathabhannga River At-Chuadanga District in Bangladesh

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Abstract

Mathabhanga is the main river of the southwestern part of Bangladesh which plays big role in the supply of fresh water. The river has a great contribution in sociological, economical and environmental aspects. Most of the urban developments are established on the bank of the river and the inhabitants of the riverside areas are largely depending on the productivity of the river. But unfortunately river ecosystem is seriously degraded by anthropogenic activities over the past two or three decades. Large amount of domestic and agricultural wastes, industrial waste were deposited in the river basin, resulting the deterioration of water quality affected directly the productivity of the river ecosystem. Excess use of fertilizer and pesticides in agricultural field in order to cope up the crop yield mainly in irrigation and vegetable cultivation ultimately find its destination in natural water like rivers and lakes increase the nutrient concentration and heavy metal infestation in in aquatic environment. Excessive nutrients in water causes the overgrowth of plankton and aquatic plants causes the depletion of oxygen in water responsible for fish kills. Attempts were made to deal with the availability of fishes and to assess the negative impact of pollutants on riverine ecosystem.

Keywords: Fish diversity, Mathabhanga river, water quality, pollution, Chuadanga.

Introduction

The ecosystem of the river plays an important role in reservoir, water recycling, agriculture, fish and other biodiversity maintenance, livestock harvesting, pollution abatement and soil fertility etc!. Mathabhanga is an important river in Chuadanga and originated from the large Ganga Padma river system. So Mathabhanga is an important tributary in Ganga anf falls into the Bay of Bengal as Ichamoti river. Rivers provide natural habitat of fish in the earth and fish is the principal source of protein in the rural mass. In addition fish supplies sufficient amount of vitamins and minerals which helps to eradicate mail nutrition of the nation. It has a great contribution in the national economy (GDP) as well as foreign exchange earning[2].

Chuadanga is a district situated in south western part of Bangladesh and adjacent to Nadia district in west Bengal, India. The district is well communicated by roads, railways and rivers. The density of the population is very high so that the demand for per capita fresh water is increasing day by day. Withdrawal of water by building dam, reservoir in upstream areas, excessive use of water for irrigation, rapid urbanization, unplanned developments, industrialization, climate change, changes of rainfall pattern are responsible for shortage of fresh water resources. In addition to this, the water of the river is contaminated by large numbers of domestic and agricultural wastes, heavy metals, pesticides, heavy siltation due to encroachment and municipal and industrial wastes[3-5]. As a result, fish and other aquatic animals face different degrees of environmental stress. Water quality termed as physical, chemical and biological factors which is governed by some variables[6,7,8]. The deterioration of water quality causes the depletion of biodiversity and shrinkage of genetic equilibrium[9,10]. Life of an aquatic ecosystem depends on the potentiality of the water criteria[11]. The physicochemical factors have a great contribution in maintaining water quality and the parameters like pH, temperature. Dissolved oxygen etc are vital for determining the health of water[12,13].

A The objectives of the paper deals with the present fish diversity in the river Mathabhanga and impact of different degree of pollution on aquatic organism especially for fish.

Material and Methods

Selection of sampling sites: Five sampling sites were selected for investigation during the period from July 2012 to June 2013 along the bank of the river. These are Chuadanga (station–i), Alamdanga (station–ii), Darsana(station–iii), Xero point (station-iv) and Halderpara BSF capm (station –V).

Collection of sample: Samples were collected every fifteen days interval during the study period at 9am to 11am. Samples were preserved in BOD sampler bottle and immediately transferred to the laboratory for investigation.

Water quality analysis: Some parameters like temperature, pH and dissolved oxygen were measured on the spot. Temperature of water was measured with the help of Mercury thermometer in centigrade scale, pH of water was measured with the help of

Hanna device (HANNA-PHEP), dissolved oxygen of water was measured by using Wrinklers method, BOD was measured according to Trivedi and Goel[14]. Rest of the parameters was measured according to standard methods described by APHA[15].

Figure-1
Mathabhanga River

Figure-2
Fish catch during survey for identification

Figure-3
Fish catch by traditional way

Figure-4
Fish catch by using traditional net

Identification of fishes: Fishes were collected from the river with the help of fishermen by using various crafts and gears and local people. .Besides these, local fish market visit, consult with age old inhabitants were taken during the study period..Common fishes were identified on the spot and living fishes were release to the environments.. Those fishes which were difficult to identify brought to the laboratory, preserved in formalin, labeled with date of collection and location. Identification of fishes was done with the help of different books[16,17,18].

Result and Discussion

The major sources of pollution were identified during the survey listed in table-1.

Table-1
The major sources of pollutants were identified during the survey through the stretch of the river

Serial no	Sources of pollution	Nature of pollutants
01	Municipal wastes of Jhenidah sadar	Solid
02	Domestic wastes	Soap, detergent, washing of cattle, cowdung, washing of fertilizerbag and pesticides container.
03	Pharmaceuticals and other industries	Chemicals.
04	Agricultural wastes	Pesticides and fertilizer runoff.
05	Ashes from burning ghats	Ashes
06	Wastes from rituals	Organic wastes and chemicals
07	Jute retting	Oeganic wastes
08	Brick fields	Fly ash
09	Silt	Clay

Table-2
The result obtain from the investigation through the study period (July/2012 to June/2013) was depicted

parameter	July	Aug.	Sept.	October	Nov.	Dec.	Jan.	Feb.	March	April	May	June
Temperature Celsius	30±.62	34±1.20	28±0.50	28±0.12	26±0.53	20±1.11	16±0.87	18±0.95	29±0.79	32±1.30	35±0.99	29±0.73
pH	6.6±0.07	6.5±0.12	7.5±0.23	7,4±0.13	7.9±0.31	7.7±0.32	8.01±0.33	8,2±0.12	7.1±0.67	6.9±0.51	4.7±0.23	6.7±0.21
DO mg/l	5.97±0.17	5.6±0.19	5.3±0.21	5.4±0.13	6.1±0.42	6,9±0.10	7.1±0.73	7.4±0.59	6.3±0.48	5.4±0.32	4.01±0.23	4.8±30
BOD mg/l	5.06±0.33	5.07±0.30	4.8±0.17	3.5±0.07	3.0±0.20	2.7±0.19	2.5±0.33	1.59±0.23	0.98±0.53	1.99±0.44	9.13±0.51	3.5±0.18
Alkalinity mg/l	188±7.90	174±6.97	159±5.32	166±3.97	177±11.90	196±9.06	201±17.56	217±15.83	239±20.12	267±18.04	268±11.76	195±13.84
Hardness mg/l	283±11.92	231±13.31	211±9.49	198±13.07	181±19.78	172±14.49	176±7.88	186±9.32	199±8.82	226±13.11	256±14.10	265±8.59
TDS mg/l	207±7.76	197±5.59	179±13.08	182±6.97	176±7.07	167±8.76	159±14.13	178±5.90	223±21.03	232±8.97	242±14.81	234±21,02
Nitrate mg/l	1.92±0.13	1.45±0.09	1.77±0.08	2.,04±0,015.	1.98±0.010	2,01±0.07	2.02±0.01	2.001±0.03	2.02±0.011	2.13±0.02	2.25±0.07	1.88±0.02
Phosphate mg/l	0.49±0.03	0.47±0.02	0.46±0.06	0.0.38±0.085	0.43±0.05	0.45±0.02	0.54±0.03	0.51±0.01	0.54±0.022	0.63±0.04	0.75±0.07	0.46±0.021
COD mg/l	513±29.63	578±20.31	602±50.23	571±32.91	487±27.10	453±22.30	411±23.32	432±35.91	483±21.30	560±22.40	569±39.71	479±41.34

The temperature is the most vital among all parameters which has a great role in growth, reproduction and distribution of animals[19]. The highest temperature was recorded in the month of May due to hot weather and lowest in January due to cold weather. Temperature, DO and pH are the critical parameters of water quality. The range of temperature 20-35^{o}C is suitable for fish production. The obtain result is similar with the finding of Bhaumik etal and others[20,21]. The range of pH was 6.6 in August and 8.2 in February. The measured pH values indicate that the water was acidic and alkaline in nature. The minimum value of pH was due to rainfall in monsoon. DO is the most significant parameter which is essential for survival of aquatic animals[13]. The concentration of DO depends on factors like temperature, water volume, friction of water and air, organic and domestic wastes etc. Maximum DO was observed in winter (December, January and February) because of less degradation and least value of DO was found in May4.5mg/l. lower concentration of DO was also observed in July and August due to high degradation and traditional jute retting practices by the farmers in the river. The cause for oxygen depletion was excessive microbes present in water as a result then water was having no dissolved oxygen. At that time mass mortality of fishes locally called "Gaba" was also occurred.

The maximum alkalinity in May and lowest value was observed in the month of October. The results of low alkalinity were attributed to rain water[22]. The minimum value of Hardness was measured in December as 172mg/l and maximum was observed in June as 272 mg/l. The value of Hardness 50mg/l is suitable for fish culture The TDS concentration was higher in summer and lower in January. The rich content of Nitrate was found in October 2.04mg/l and least content was found in August1.45mg/l. The concentration of phosphate was higher in the month of May and lower concentration in the month of November. The river water was enriched with nutrients (phosphate and nitrate) because there is a large agricultural practice by the side of the river. Excessive nutrients were responsible for plankton bloom resulting the killing of aquatic species. The excessive use of agrochemicals in the field, use of different kinds of detergents are the main sources of nutrients in the river[23,24]

The maximum COD value was 602 mg/l in September and the minimum was 411mg/l in January, The value of BOD and COD determined the pollution status of the river. This is for dumping of different domestic and organic wastes and high COD is the result of industrial pollution. The two parameters affect the other parameters altered the physiological process of the fishes.

The health of the water body was reflected by the measurement of DO and BOD also to express the pollution status[25,26]. Generally the range of DO 5.5 mg/l or above is most favorable for fish cultivation. High BOD value shows inverse relationship with DO The main sources of pollution for decreasing DO and

increasing BOD which include domestic and non domestic sewage, industrial effluents, decaying vegetation etc. The demand for excessive dissolved oxygen is for rapid biodegradation or chemical oxidation process which is greater than available oxygen in river. Lowest level DO observed in the month of May4.01mg/l and highest 7.4mg/l in winter season. The obvious reason for decreasing DO was due to low flow of water and huge abstraction of water for agricultural purposes and less volume of water in the river. Discharge of effluents from Darsana sugar mills in winter damage the ecology and fishery resources[27].

260 species of fresh water fishes were available in fresh water bodies of Bangladesh in the past. But only 57 species were identified during the investigation and some of them are rarely found and some of them are on the verge of extinction. This is probably due to industrial and agricultural pollution, change of flow pattern, habitat degradation and overexploitation. Similar causes of degradation of diversity of species in fresh water ecosystem were also identified. Gosh and Konar also studied the diversity of Churni river in Nadia district and identified the causes of declining fish species due to anthropogenic activities[28]. The diversity in different water bodies varies due to the topography of the basin, flow modification, building obstacles in the upper stream areas and different pollution load , overfishing and introduction of exotic species. The identified fishes were illustrated in the table 2. Available fishes were treated as most common, some are treated as rare and some are very rare. The fishes which were very rarely found includes *Labeo bata, Puntius sarena,Rajbora rajbora, Macrognathus pancalus, Salmostoma phulo, Schistura savona, Mastacembelus eculeatus,Chela lauboca, Aila coila* and *Nandus nandus.*Most common fishes were carps and catfishes.

Table-3
Identified fishes were listed during the experimental period.

No.	Local name	Scientific name	Occarance
01	Ruhu	*Labeo rohita*	+++
02	Catla	*Catla catla*	++
03	Calibasu	*Labeo calibasu*	++
04	Mrigal	*Cirrhina mrigala*	+++
05	Bata	*Labeo bata*	+
06	Singhi	*Heteropneustus fossilis*	+++
07	Magur	*Clarius batrachus*	+++
08	Tit puti	*Puntius ticto*	+++
09	Jat puti	*Puntius sarena*	+
10	Foli	*Notopterus notopterus*	+++
11	Bele	*Glossogobius giuris*	+++
12	Tengra	*Mystus tangra*	+++
13	Tangra	*Mystus vitatus*	++
14	Air	*Sperata aor*	++
15	Kakila	*Xenotodon cancilla*	++
16	Shol	*Channa striatus*	+++
17	Pabda	*Ompok pabda*	++
18	Baim	*Mustacembelus armatus*	++
19	Pankal	*Macrognathus pancalus*	+
20	Chela	*Salmostoma phulo*	+
21	Chapila	*Gudusiachapra*	++
22	Baghair	*Bagarius bagarius*	+
23	Shavon	*Schistura savona*	+
24	Kholisha	*Colisa fasciatus*	++
25	Lal kholisha	*Colisa lalia*	+++
26	Chanda	*Chanda nema*	++
27	Potka	*Tetraodon cutcutia*	++
28	taki	*Channa punctatus*	+++
29	Gozar	*Channa marulius*	+++
30	Boal	*Wallago attu*	+++
31	Kuche	*Pisodonophis cancrivorus*	++
32	Tara baim	*Mustacembelus eculeatus*	+
33	Chitala	*Chitala chitala*	++
34	Chep chela	*Salmostoma bacaila*	++
35	koi	*Anabus testidineus*	+
37	Chela	*Chela lauboca*	+
38	Darkina	*Rajbora rajbora*	++
39	khorsula	*Rhinomugil corsula*	++
40	Saran puti	*Puntius sarana*	++
41	Tangra	*Mystus bleekeri*	++
42	Garua	*Clupisoma garua*	++
43	Tepa	*Tetraodon Patoka*	+
44	Ranga chanda	*Chanda ranga*	++
45	Kata chanda	*Chanda sp.*	+++
56	Silong	*Silonia silondia*	++
47	Gatum	*Lepidocephalichthys guntea*	++
48	Darkina	*Esomus danricus*	++
49	Aila/Kajuli	*Aila coila*	+
50	Kharki bata	*Cirrhinus reba*	++
51	khorka	*Corica saborna*	++
52	Silver carp	*Hypophthalmichthys molitrix*	++
53	Common carp	*Cyprinus caprio*	+++
54	Chela	*Salmostoma bacaila*	++
55	Veda	*Nandus nandus*	+
56	Vacha	*Eutropichthys vacha*	++
57	Mola	*Amblypharyngnodon mola*	++

Note: +++ Most common, ++ rare and + very rare.

From the study, it may be said that the water quality of the river Mathabhanga is facing environmental problems and diversity of

fishes are declining day by day. The river side areas should be protected by tree plantation, social or community forestry should be set up. Play ground and other recreational facilities should be to boost up rivers productivity[29]. The fishery sector should come forward immediately in order to save the valuable natural resources, conservation of fishery act should strictly followed and sources of pollution should be monitored continuously, impose restriction not to fishing during spawning period. It is urgent to create awareness among people, civil societies and government to implement laws and sustainable protection practices of rivers and other aquatic bodies.

Conclusion

The diversity of Ichthyofauna was depleted and the production of fishes yield is relatively very low due to anthropogenic activities[30]. The cost of local fish is comparatively high so that the people below the poverty level have no access to consuming fish protein in order to achieve millennium developmental goal, Government, donor agencies, civil societies will come forward to adapt appropriate steps for successful sustainable management of the river ecosystem.

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