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STUDIES ON FISH FAUNA AT DURGAPUR BARRAGE AND ITS ADJACENT WETLAND AREAS WITH AN EYE TO THE PHYSICO-CHEMICAL CONDITIONS OF DAMODAR RIVER FROM DURGAPUR, WEST BENGAL, INDIA

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Abstract: The present study deals with the survey of fish fauna of Durgapur barrage and its adjacent wetland areas with an eye to the physico-chemical conditions. The Durgapur barrage is constructed on river Damodar. This river receives effluents of a huge number of factories, agricultural run off, sewage disposal as well as products of washing of cloths and animals and other activities. Present survey revealed the richness of the Durgapur barrage area in its fish faunal diversity where 36 fish species belonging to 14 families were identified within a span of six months study (December 2010 to May 2011). Study of physico-chemical conditions revealed that fish species thriving at Durgapur barrage and adjacent region are under potential stress from pollution and anthropogenic pressure. Proper environmental management policy is essential for saving this biome and immediate conservation measures should be taken to ensure habitat protection in the Damodar River and its adjacent wetland ecosystem.

Keywords: Damodar River, Durgapur barrage, fish fauna, physico-chemical parameters, wetland ecosystem

INTRODUCTION

India is a mega biodiversity country that holds ninth position in terms of freshwater biodiversity [1]. A total of 2,500 species of fishes have been recorded from the Indian subcontinent of which 930 are categorized as freshwater species [2] and the remaining 1570 are marine in nature [3]. Reverine fisheries of India comprises of five major river systems [4]. Physico-chemical parameters of riverine water and their impact on aquatic biota from around the world are well on record [5-7].

River Damodar is one of the most important rivers in South Bengal, India. Durgapur barrage (total length 692 m) was constructed over this river in the year 1955 for the purpose of flood

control, irrigation and drinking water supply for the inhabitants of Durgapur city. A good number of fishermen also depend on this barrage for their earnings but due to anthropogenic pollution, fish productions and diversity of ichthyofauna are decreasing incessantly.

Though Damodar is one of the most polluted rivers in India; this river is still a good source of number of fish species. The present study was undertaken to explore the ichthyofaunal diversity of Durgapur barrage on River Damodar and its adjacent wetland areas for the duration of 6 months (December 2010 to May 2011) with an eye to the physico-chemical conditions that they are thriving in.

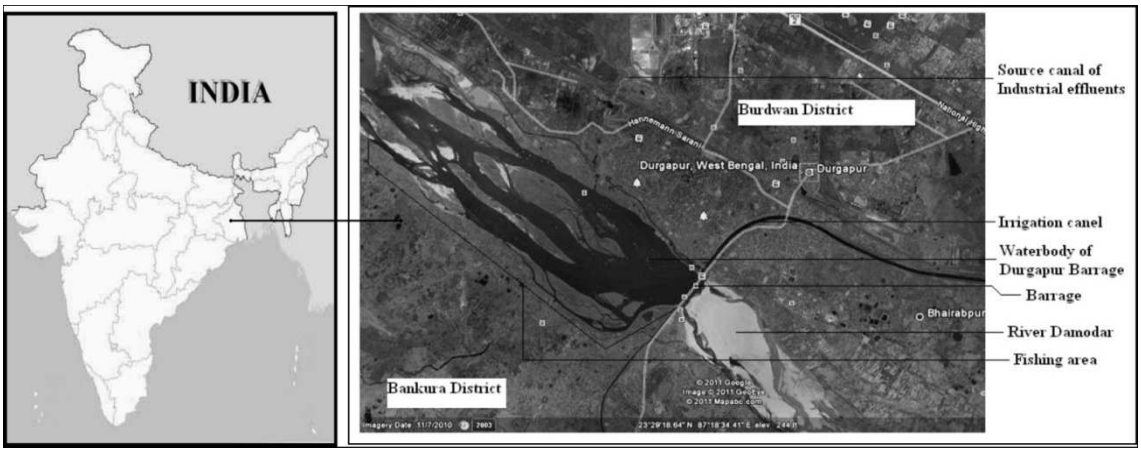

Fig. 1: Map showing the location of Damodar River in India and the present study site at Durgapur barrage and adjacent wetland areas.

MATERIALS AND METHODS

Fishes and much other valuable information were collected from local fishermen and residents adjacent to the Durgapur barrage area (Figure 1). After obtaining fish; body colour pattern, body spots, fin colour pattern and all other necessary information were noted down. Next, the fins of the collected fishes were spread by concentrated formaldehyde (for fin-rays count purpose) and then fishes were preserved in 8% formalin. The collected fishes were stocked in jars with appropriate labeling. Different established literatures were consulted for species identification [8-10]. Water samples were collected regularly and water chemistry of samples for Dissolved oxygen (DO), total alkalinity, total hardness, phosphate and nitrate was analyzed on site using Emerck (Germany) Merckquant and Aquamerck field-testing kits. Primary productivity was measured by employing light-dark bottle technique and conversion of Oxygen values to calorific values were calculated following Eaton *et al*., [11].

RESULTS AND DISCUSSION

During the present study the physico-chemical parameters of Damodar River at Durgapur barrage and adjacent wetland area varied greatly and have been depicted in Table 1. So far as ichthyofaunal diversity is concerned a total of 36 fish species belonging to 22 genera representing 14 families were recorded during the present investigation that has been depicted in Table 2.

Table 1: Physico-chemical parameters of water collected from the study site (Durgapur barrage) during the present investigation, December 2010 – May 2011 (SD: Standard Deviation).

Parameters	Months						Mean±SD
	Dec 10	Jan 11	Feb 11	Mar 11	Apr 11	May 11	
Solar Radiation (x 100 Lux) (Kcal m^{-2} d^{-1})	511	252	265	589	605	735	492±195
Air Temperature (°C)	22.3	21.9	33.5	39.3	34.3	37.5	31.47±7.56
Water Temperature (°C)	20.6	18.4	30.5	31.5	30.5	33.2	27.45±6.28
pH	6.00	8.35	8.58	7.57	7.06	8.01	7.60±0.95
Conductivity (μΩ)	0.34	0.28	0.31	0.38	0.30	0.30	0.32±0.03
Total Dissolved Solids (g L^{-1})	0.14	0.12	0.13	0.16	0.13	0.14	0.14±0.01
Dissolved oxygen (mg L^{-1})	3.7	3.6	3.5	3.1	3.8	3.9	3.60±0.28
Total Alkalinity(mmol L^{-1})	1.9	2.3	1.8	1.7	1.6	1.9	1.87±0.24
Total Hardness(mmol L^{-1})	0.8	0.9	0.7	0.5	0.6	0.3	0.63±0.22
Phosphate (mg L^{-1})	3.5	3.2	3.4	3.6	3.9	3.7	3.55±0.24
Nitrate (mg L^{-1})	0.5	0.5	1.0	1.5	1.5	2.7	1.28±0.83
Net Primary Productivity (mg $Cm^{-2}d^{-1}$)	2785	2858	2438	1963	1736	1568	2224.67± 547.55
Gross Primary Productivity (mg $Cm^{-2}d^{-1}$)	3662	3891	3259	2849	2673	2396	3121.67± 583.94

Table 2: Fish fauna recorded from Durgapur barrage is represented in the following table. (IUCN status; LC: Least Concerned; NT: Near Threatened; NA: This taxon has not yet been assessed for the IUCN Red List; C: This taxon is in the Catalogue of Life; NC: This taxon is not in the Catalogue of Life) (Population trend; D: Decreasing; U: Unknown; S: Stable).

Family	Local name	Scientific name	English name	IUCN status	Population trend
Clupeidae	Khaira	*Gudusia chapra*	Indian River Shad	LC	D
Notopteridae	Folui	*Notopterus notopterus*	Bronze Featherback	LC	D
	Chital	*Notopterus chitala*	Spotted Featherback	NA/C	U
Cyprinidae	Rui	*Labeo rohita*	Rohu Fish	LC	U
	Bata	*Labeo bata*	Bata Fish	LC	U
	Mrigel	*Cirrhinus mrigala*	Mrigal Fish	LC	S
	Katla	*Catla catla*	Catla Fish	NA/C	U
	Chela	*Salmophasia bacaila*	Large Razor-belly Minnow	LC	S
	Techokha	*Danio rerio*	Zebra fish	LC	D
	Techokha	*Danio aequipinnatus*	Zebra fish	LC	S
	Mourola	*Amblypharyngodon mola*	Pale Carplet	LC	S
	Punti	*Puntius ticto*	Firefin Barb	LC	U
	Punti	*Puntius sophore*	Spotfin Swamp Barb	LC	U

	Punti	*Puntius sarana*	Olive Barb	LC	U
	Punti	*Puntius conchonius*	Rosy Barb	LC	U
Siluridae	Boal	*Wallago attu*	Freshwater Shark	NT	D
	Rita	*Rita rita*	Goonch	LC	D
	Tangra	*Mystus vittatus*	Striped Dwarf Catfish	LC	D
Bagridae	Tangra	*Mystus seenghala*	Giant River Catfish	NA/C	U
	Tangra	*Mystus cavasius*	Gangetic Mystus	LC	D
	Aard	*Mystus aor*	Long-whiskered Catfish	LC	S
Clariidae	Magur	*Clarias batrachus*	Walking Catfish	LC	U
Saccobranchidae	Singi	*Heteropneustes fossilis*	Stinging Catfish	LC	S
Schilbeidae	Pangus	*Pangasius pangasius*	Bocourts Catfish	LC	D
Sisoridae	Garua	*Bagarius bagarius*	Gangetic Goonch	NT	D
	Lata	*Channa punctatus*	Spotted Snake Head	NA/NC	U
	Sal	*Channa marulius*	Giant Snake Head	LC	U
Channidae	Sol	*Channa striatus*	Striped Snake Head/ Banded Snake Head	NA/C	U
	Chang / Gurui	*Channa gachua*	Smooth Brassed Snake Head	LC	U
Anabantidae	Kholse	*Trichogaster colisa*	Honey Gourami	NA/NC	U
Ambassidae	Chanda	*Ambassis nama*	Elongate Glass Perchlet	NA/C	U
	Chanda	*Ambassis ranga*	Dwarf Glass Perchlet	NA/C	U
Gobiidae	Bele	*Glossogobius giuris*	Tank Goby/ Bar-eyed Goby	NA/C	U
	Ban / Turd	*Mastacembelus armatus*	Zigzag Eel/ Spiny Eel	LC	U
Mastocembelidae	Pankal	*Mastacembelus pancalus*	Striped Spiny Eel	NA/C	U
	Ban / Turd	*Macrognathus aculeatum*	Lesser Spiny Eel	NA/C	U

Ecosystem stabilization intrinsically depends on biodiversity which essentially protects the overall environmental quality for understanding the fundamental value of all species on earth [12]. Diversity indices of fishes have been used extensively over the years in environmental impact

assessment and as measure of ecosystem stability where low fish diversity and abundance have often been found to be associated with stressful aquatic conditions [13].

Fish species are genetically triggered to exploit diverse set of physicochemical conditions which altogether determines their diversity and distribution [14]. Water temperature is considered as one of the most important ecological factor which controls the physiological behavior of the aquatic system and thereby distribution of diverse aquatic life forms. The present investigation revealed a suitable water temperature (27.45±6.28 °C) for fish species colonization from the current study location. The pH of water which is considered as a measure of environmental suitability is directly related to the presence of carbonate and bicarbonate ions and a range of 7.0 to 8.5 is considered to support rich fish diversity and other biota [15]. During the present investigation mostly alkaline ranges of pH (mean value recorded as 7.60±0.95) were observed, which can be correlated with a presence of carbonate and bicarbonate alkalinity in Damodar River water. Total alkalinity again is very closely related with aquatic productivity and more than 200 mg/L is considered good for the biological productivity [16]. Lower water temperatures have been reported to encourage higher photosynthesis in tropical waters [17], it was also evidenced in the present study where colder months (Dec - Feb) were recorded for higher gross and net primary productivity over the comparatively hotter months (Mar - May). Dissolved oxygen (DO) is considered as one of the most important parameter in assessing water quality. Permissible limits of DO in potable water is >5.00 mg/L [18]. During the present investigation mean DO value was recorded as 3.60±0.28 mg/L which is much lower than the permissible limit and hence is not suitable for drinking without prior proper treatment. Moreover, the values recorded for phosphate and nitrate during the present study were also on the higher side indicative of water pollution.

So far as the ichthyofaunal diversity is concerned during the present study 36 species of fishes belonging to 22 genera and 14 families were recorded from the Durgapur barrage and the adjacent wetland areas. When these findings were compared with previous studies made by Sarkar and Banerjee [19] a decrease in overall fish diversity was noticed. Fishermen and local residents also reported that the variety and quantity of fishes are declining incessantly from the present study location. Habitat destruction and fragmentation by developing dams and reservoirs has been found to exert serious consequences in terms of alternative life history strategies. Restriction in migration for most fish species in the dammed-off area converts them to resident forms. Moreover, the consequences like change in flow regimes, substrate, depth, changes in sediment and nutrition transport altogether exerts negative impact on fish diversity. Researchers have pointed out the adverse effects of dams on Damodar River regarding the overall fish species diversity and how to minimize these effects [20]. Other important factors found perturbing the fish diversity during the present study were low dissolved-oxygen levels, increased agricultural and industrial activities, water pollution by amplified anthropogenic activities, increased water withdrawal and over exploitation. The present investigation recorded one near threatened fish species *Bagarius bagarius* which according to IUCN Red list of threatened species [21] is facing decline in population due to habitat fragmentation and over exploitation.

CONCLUSIONS

Fish diversity of Durgapur barrage region constitutes a valuable natural resource in economic, aesthetic, scientific and educational terms and its conservation and management are critical to the interests of humankind itself. To this, all concerned, conservationists, government and nongovernmental agencies have a major role to play in creating public awareness and support for the conservation mechanisms for the fish species. Moreover, this is our responsibility that we all protect not only our river system like Damodar but also every natural resources from its improper or unscientific uses and in these regard we should have to adapt our time-old concept of sustainable development, 'live and let live'.

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