Diversity and Present Conservation Status of Fish Fauna in the Rupnarayan River at Kolaghat of Purba Medinipur District of West Bengal, India.

Dr. Mrinmay Ghorai

Assistant Professor
Centre for Fisheries Research,
Dept. of Zoology, Panskura Banamali College,
Purba Medinipur-721152, West Bengal, India.

***Abstract*: During the last century, riverine ecosystems have affected from intense human interference resulting in habitat loss and degradation and as a consequence, many fish species have become highly endangered, especially in rivers. In my present study three sampling stations were selected along the stretch of river Rupnarayan at Kolaghat. Moreover, Kolaghat thermal power station is located on the right pool of this river. Monthly sampling was collected at three sampling stations (S_1, S_2 & S_3) during July 2015-June 2016 by using gill nets and brought about to the laboratory and analyzed with the standard methods. Total 38 species of fishes belonging to twenty four sub- families and 9 orders were collected from the selected sampling stations. The Shannon- Weiner diversity index of three different sampling indicated a strong relationship with overall species richness, showed variation and ranged from 3.052 –3.278 . The highest fish diversity were recorded at station –I followed by station – III and II. The most abundant fish species was Ambly pharyngodonmola (8.3%) and Polynemus paradiseus (7.7%) were recorded. The order Siluriformes (29%) found to be dominant with 12 fish species followed by Perciformes (25%) with 11 species and Cypriniformes (21%) 5 species. Conservation status revealed that there are only four species that was under near threatened (NT) category. Apart from this remaining species represented least concerned (LC) and only few species are not evaluated (NE). In this study an attempt has been made to evaluate the fish-faunal diversity in the region and suggests mitigating measures.**

***Keywords*: Abundance, conservation status, fish-faunal diversity, species richness, near threatened.**

I. INTRODUCTION

Fish diversity of the riverine ecosystem has a great significance in terms of the livelihood and the socio-economic importance of the people living around the ecosystem. Fishes greatly influenced the nutritional security of human being especially the protein deficiency. Moreover, fishes exist at or near the top of the food chain and can serve as an indicator of a balanced aquatic ecosystem (O. T. Gorman and J. R. Karr, 1978). The connection between the biodiversity and human well-being is inter- linked and is being promote increasingly through the observation of ecosystem services provide by the species. Biodiversity is frequently used as a measure of the health of biological system. But habitat loss and environmental degradation causes rapid beg off in biological diversity which is a critical face up to for the modern era (Vyas et al., 2012). Today the fish diversity and associated habitats management is a great challenge and the ability to evaluate the effects of habitat change and other impacts on the fish population required extensive surveying of the fish population before and after the change occur (Lester et al., 1996; Dudgeon et al., 2006). The streams and rivers are facing number of environmental problems throughout the world largely associated with anthropogenic activities in their catchment areas.

In India, the Kolaghat Thermal Power Station (K.T.P.S) is situated 22^0 25'N, & 87^0 52'E on the right pool of the river Rupnarayan in Purba Medinipur district, West Bengal. It is a leading thermal power station in West Bengal. It is well connected with south-eastern Railway, NH- 6 and NH-41. This power plant was established during the sixth Five Years Plan period (1980-85). Presently its total power generating capacity is 1260MW, with six units, 210 MW each. KTPS generates around 7500-8000 metric tons of fly ash every day following the consumption of 18000 tons of coal (Source: KTPP office, 2009).

The fish diversity, community structure and species assemblages in the streams and rivers are interdependent on ecosystem. The biotic and abiotic factors determine the achievement or disintegrate of fish species assemblages in the rivers and streams within the range of spatial distribution limits (Minns, 1989). Different parameters such as ichthyofaunal diversity, abundance, species richness, distribution and its present conservation status have used in many studies to detail describe and assess fish community and diversity (Naik, A.S. Kumaret al., 2013; Negi, R. K. and S. Mamgain, 2013; Alam, M. S. et al., 2013; Laxmappa, B. et al., 2015; Smith, 1978; Hewitt et al., 2008; Friedlander and Parrish, 1998). In the present research, habitat ecology, fish species diversity, distribution and different indices of fish diversity management were considered in Rupnarayan river , a tributary of Dwarakeswar river , located in West Bengal , India to recommended conservation management measures.

II. MATERIALS AND METHODS

The Rupnarayan River is a river in India place at west Bengal state. This study was performed in the catchment area of the Rupnarayan river. It begins as the Dhaleswari (Dhalkisor) in the Chhota Nagpur plateau foothills northeast of the town of Purulia.

It then follows a twisting southeasterly course past the town of Bankura, where it is known as the Dwarakeswar river. Near the town of Ghatal it is finally connected by the Silai, where it takes the name Rupnarayan. Lastly, it joins the Hoogli River. It is located at latitude 22^0 25'N and longitude 87^0 52'E. This is famous for the Hilsa fish that live in it and are used in Bengali cuisine. It is also remarkable for the West Bengal Power Development Corporation Limited (WBPDCL), thermal power plant lacated at Kolaghat (**Fig. 1**).

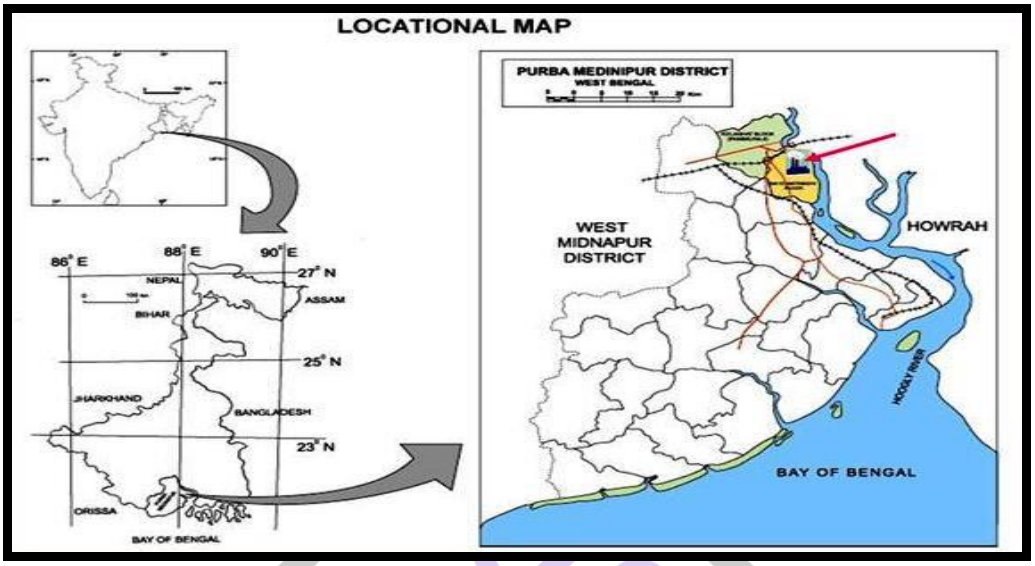

Figure 1 Location of the study area

Three study sites were selected along the entire stretch of river Rupnarayan. Monthly sampling was collected at three sampling stations (S_1, S_2 & S_3) during July, 2016-June, 2017 by using gill nets. Station I is situated near village at Naopala which 7 km.distance from Denan, Station II at 5 km. distance from the power plant and Station III at village Jamitta 5 km.from the Denan where latitude and longitude all of them are given in **Table-1 and Fig. 2**. The location of sampling stations was documented by using global positioning system (GPS). Water samples were collected each month and brought to the laboratory and analyzed with the standard method by APHA (1998).

Table 1 Details of the study Site

Sl. No.	**Name of the sampling station**	**Latitude and Longitude of the sampling site**	**Distance (Km.)**
Station I (S_1)	Naupala river bank (Fig.2)	22^0 27' 15.87" N 87^0 52' 29.14" E	7
Station II (S_2)	Denan canal river bank(Fig.2)	22^0 25' 42.65" N 87^0 53' 21.88" E	5
Station III (S_3)	Jamitta canal river bank(Fig.2)	22^0 24' 10.56" N 87^0 55' 48.42" E	5

Fish sampling was carried out at all the three stations on monthly basis at day time as well as at night time during the period of study. For sample collection at day time, different types of gears including the cast net (1-2 m diameter with mesh size of 0.05 cm), shore –seine net and gill net are used at all the study stations **(Fig. 2)**. During night time, fishing mosquito net was spread on the water ground. The net was placed close to the ground at one side and was lifted vaguely up at the other three sites so as to catch fishes. The represented fish samples were photographed and for identifying, collected specimens were preserved in 10% aqueous formaldehyde solution and were finally brought to the laboratory and identified with the help of standard reference books (Talwar and Jhingran, 1991; Jayaram, 1999). Secondary data were also collected through observation and interview with fishermen through questionnaires at the studied area.

Fig. 2 Satellite image of Rupnarayan river basin (with three sampling sites) at Purba Medinipur district of West Bengal (Station I Naupala, Station II Denan and Station III Jamitta).

III. RESULTS AND DISCUSSION

Species assemblages and distribution

As a result the Ichthyofaunal diversity is concerned during the present study period, a total of thirty eight (38) ichthyospecies belonging to 29 genera, 24 families and 10 orders have been recorded from the river of Rupnarayan of Purba Medinipur district of West Bengal, India. The list of fish species shows from **Table 2** and **Fig. 5** depicts the scientific name of the fish species encountered along with their family, order, and conservation status (IUCN).

On the basis of percentage composition, abundance and species richness, order Siluriformes was dominant (12 species) followed by Perciformes (10 species), Cypriniformes (4 species), Clupeiformes (3 species), Synbranchiformes and Mugiliformes (2 species), Polinemiformes, Pleuronectiformes , Anguilliformes and Beloniformes (1 species each). During the present investigation the order of dominance is as follows **(Fig. 3)**:

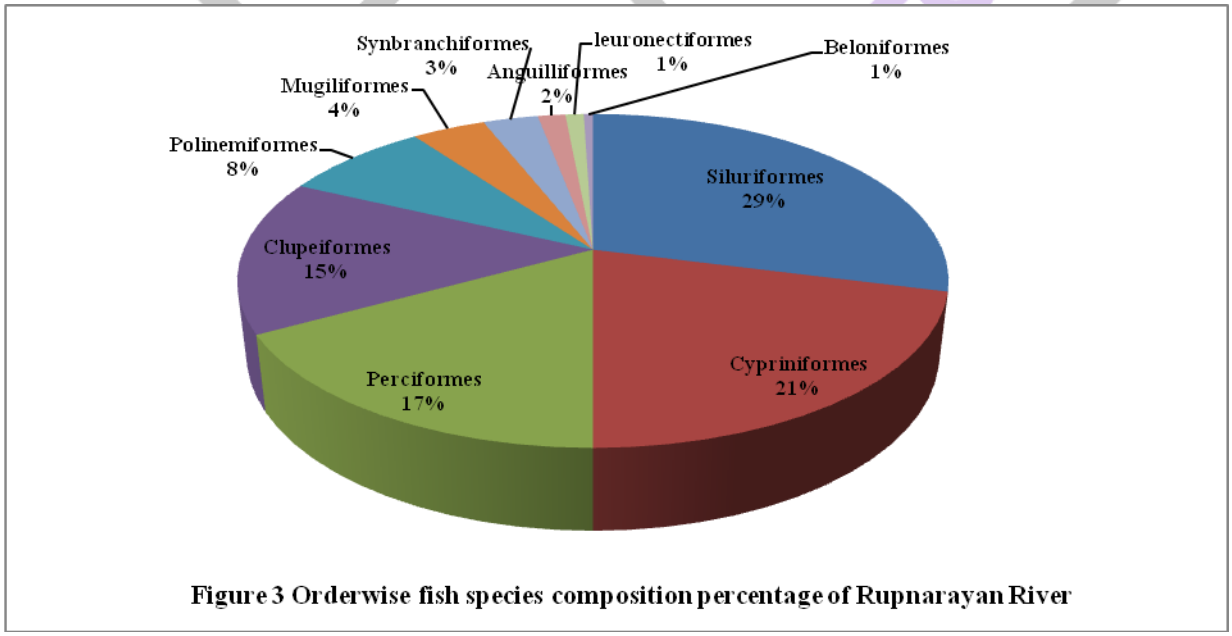

Figure 3 Orderwise fish species composition percentage of Rupnarayan River

Siluriformes (29%) > Perciformes (25%) > Cypriniformes (21%) > Clupeiformes(15%) > Mugiliformes (4%) > Synbranchiformes (3%) > Anguilliformes (1.5%) > Pleuronectiformes (1%) > Beloniformes (0.5%).

Out of 10 recorded orders, Perciformes contributed 8 families, followed by Siluriformes 6, Clupeiformes and Synbranchiformes each represent 2 family, Cypriniformes, Polinemiformes, Pleuronectiformes, Mugiliformes, Anguilliformes and Beloniformes each with 1 family. The ichthyofaunal diversity of Rupnarayan River comprises of 24 families. The sequence of dominance of encountered families is as follows **(Fig. 4)**:

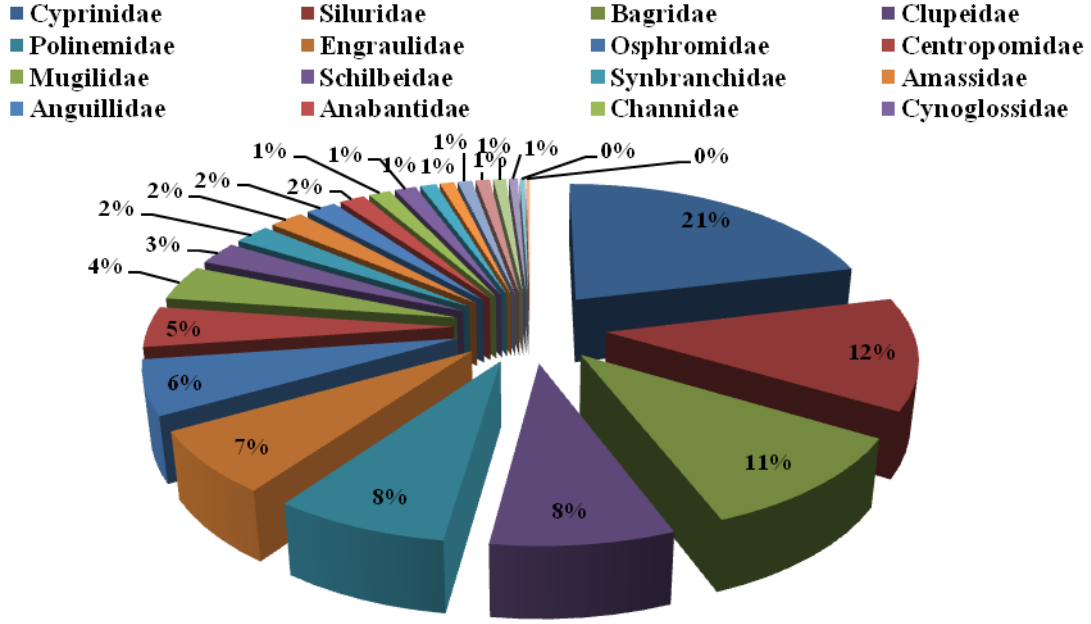

Figure 4: Familywise fish species composition percentage of Rupnarayan River

Cyprinidae (21.10%) > Siluridae (12.4%) > Bagridae (10.6%) > Clupeidae (8%) > Polinemidae (7.67%) > Engraulidae (6.88%) > Osphromidae (5.98%) > Centropomidae (4.51%) > Mugilidae (3.9%) > Schilbeidae (2.59%) > Synbranchidae (2.25%) > Amassidae (2.14%) > Anguillidae (1.9%) > Anabantidae (1.58%) > Channidae(1.35%) = Cynoglossidae (1.35%) > Pangasidae (1.01%) > Saccobrachidae (0.90%) = Sciaenidae (0.90%) = Gobiidae (0.90%) > Mastacembelidae (0.8%) > Clariidae (0.56%) > Cichlidae (0.33%) = Belonidae (0.22%).

Conservation status of fish species (IUCN)

Conservation status (IUCN) revealed that out of total 38 species there is no species under endangered (EN) category. But only 4 species namly Ompok bimaculatus, Ompok pabda, Wallago attu and Anguilla bengalensis were under near threatened (NT) category. The rest 20 recorded species were least concerned (LC) category and remaining 14 were recorded not evaluated (NE). Out of the species 4 near threatened (NT) (10.52%), 20 least concerned (LC) (52.63%), 14 not evaluated (NE) (36.84%) and not a single species is represent vulnerable (**Table- 2**).

Statistical estimation of species diversity

The species richness, abundance and biodiversity indices in all the three sites are shown in **Table – 3.** The Rupnarayan river shows Shannon-Weiner index (H) in station -1 (S_1) 3.052 is followed by station-2 (S_2) 3.278 and lowest in station-3 (S_3) 3.195. The Simpson's dominance index (1- Lamda) value shows high at station-2 0.955 and station-3 0.952 and low at station-1 0.942. With this index, 0 represents infinite diversity and 1, no diversity. That is, the larger the value of D, the poorer the diversity. The value of this index also ranges between 0 and 1, but now, the greater the value, the greater the sample diversity. The highest fish diversity was recorded at station- 1 followed by station– 3 and station- 2.The low fish diversity at station-2 may be due to assemblage of heavy thermal fly ash load from Kolaghat thermal power station as compared to the station -1 (upper stretch) and station-3 (lower stretch).Hence, it may be inferred that there is inverse relationship between fish diversity and fly ash pollution of the river.

The fish diversity has been studied by different researchers in the country. For example, there are 33 species in Gour river of Jabalpur district, Madhya Pradesh (Paunikar et al., 2012); 26 species in Godavari River at Mudgal Taluq of Pathri district (Rankhamb S.V., 2011). Few studies are available on diversity and conservation of freshwater fish fauna of Krishna River system (Kharat et al., 2012). Reported 57 fish species from Indrayani River (Dahanukar et al., 2012), a tributary of Bhima River (Vijajlaxmi et al., 2010), 45 freshwater fish fauna of Kangsabati river (Kar et al.,2016) and 51 fish species from Krishna River at Wai and Dhom reservoir in Maharashtra. These studies also support the present study. FAO (1985), Bayley and Li (1994) and Grando (2000) also documented that fish communities in riverine system typically follow a pattern of increasing species richness, diversity and abundance from upstream to downstream. These consequences ultimately create insecurity in the socio-economic sector of the study area in terms of increased poverty of local fishermen. It reveals that, a rapid decline in fish diversity at discharged zone which are polluted by effluents of KTPS of the Rupnarayan River.

Figure .5: Assemblage of Fish species in Study area of the Rupnarayan River.

Table 2 Fish species density, distribution and IUCN status of species reported during 2014-2015 in the Rupnarayan River

Sl. No.	**Fish species**	**Family/Orders**	**Sampling Station**			**IUCN Conservation status**
			S_1(Naupala)	S_2 (Denan)	S_3(Jamitta)	
I	**SILURIFORMES**					
1	Mystus seenghala	Bagridae	12	7	2	NE
2	Mystus vittatus	Bagridae	9	7	8	LC
3	Mystus tengara	Bagridae	19	10	12	LC
4	Mystus cavasius (Hamilton,1882)	Bagridae	5	0	3	LC
5	Ompok bimaculatus	Siluridae	6	7	5	NT
6	Ompok pabda	Siluridae	18	11	15	NT
7	Wallago attu	Siluridae	4	5	3	NT
8	Arius maculates	Siluridae	11	12	13	NE
9	Pangasius pangasius	Pangasidae	4	5	0	LC
10	Clarius batrachus	Claridae	2	3	0	NE
11	Heteropneutes fossilis	Saccobrachidae	3	3	2	LC
12	Silonia silondia	Schilbeidae	10	7	6	LC

II	**CYPRINIFORMES**					
13	Puntius ticto	Cyprinidae	12	10	9	LC
14	Puntius vittatus	Cyprinidae	7	8	10	LC
15	Chela cachius	Cyprinidae	6	4	8	LC
16	Puntius sarana	Cyprinidae	16	9	14	LC
17	Ambly pharyngodonmola	Cyprinidae	26	21	27	NE
III	**PERCIFORMES**					
18	Johnius coitor	Sciaenidae	5	0	3	LC
19	Oreochromis mossambicus	Cichlidae	2	1	0	LC
20	Latis calcarifer	Centropomidae	6	2	0	NE
21	Amphipnous sp	Centropomidae	13	8	11	NE
22	Colisa fasciata	Anabantidae	7	4	3	NE
23	Colisa chuna	Osphronemidae	18	15	20	NE
24	Chanda nama	Amassidae	10	2	7	LC
25	Chana striatus	Channidae	0	2	1	LC
26	Chana punctatus	Channidae	5	1	3	NE
27	Glossogobius giuris	Gobiidae	4	1	3	LC
IV	**CLUPEIFORMES**					
28	Setipinna phasa	Engraulidae	26	18	17	NE
29	Ptenualosa ilisha	Clupeidae	11	0	8	LC
30	Gudusia chapra	Clupeidae	23	12	17	LC
V	**SYNBRANCHIFORMES**					
31	Monopterus cuchia	Synbranchidae	5	6	9	LC
32	Mastacembelus pacalus	Mastacembelidae	3	4	0	NE
VI	**POLINEMIFORMES**					
33	Polynemus paradiseus	Polinemidae	31	19	18	NE
VII	**PLEURONECTIFORMES**					

34	Cynoglossus cynoglossus	Cynoglosidae	5	3	4	NE
VIII	**MUGILIFORMES**					
35	Mugil parsia	Mugilidae	13	7	9	NE
36	Mugil cephalus	Mugilidae	4	2	0	LC
IX	**ANGUILLIFORMES**					
37	Anguilla bengalensis	Anguillidae	6	7	4	NT
X	**BELONIFORMES**					
38	Xenentodon cancila	Belonidae	2	0	0	LC
	TOTAL		369	243	274	

Con. Status: Conservation status based on IUCN report (2010); NT: Near threatened; LC: Least concern; NE: Not evaluated.

Table 3 Fish species richness, abundance and biodiversity indices of Rupnarayan River

Sampling Station	**Species**	**Quantity(Kg)**	**Species Richness**	**Abundance**	**Shannon**	**Simpson**
	S	**N**	**D**	**N1**	**H' (loge)**	**1- Lambda'**
S1	369	6402	37	369	3.052	0.942
S2	243	6203	34	243	3.278	0.955
S3	274	10866	31	274	3.195	0.952

IV. CONCLUSION

In the present context of study, it is noticed that indiscriminate harvesting of fish species from their natural habitat is regularly done by the fisher-folk , which may lead to severe decline of fish population. About 52.63% of fish species availability was least concerned (LC) in the river. Through interviewing with the fisher-folk and according to IUCN (ver. 3.1) conservation status it is clear that some commercial and economically important fishes which are high market value are at present in very near threatened (NT) condition. It is sorry to say that the important riverine fishery of Indian Major Carps has either collapsed or it is at the threshold of collapse. Besides the above cause, overfishing, extensive killing of brood fishes, spawn, fry, fingerlings and juveniles violating Fishery Laws and Act, were assessed to be responsible for declining trend of fishery in the Rupnarayan River. Pesticides spreading from agricultural, mixing of thermal fly ash have also been created unfavorable environment for fish life in the river.
Therefore, the present study indicates that to keep this diversity, there is an urgent need for conservation of the fish habitant to conserve the productivity potential of the river through proliferation of fisheries legislation in future and also controlling the anthropogenic activities.Thus, some steps and awareness programme is needed to educate people about the importance of the river, its biodiversity and fish productivity.

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