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The study of correlation between physico-chemical parameters and ichthyofaunal diversity at raidak river flowing through the Coochbehar district of west Bengal, india

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Abstract:
The present investigation was carried out on the Raidak-I river flowing through the Tufanganj subdivision of Coochbehar district from January, 2017 to July, 2018 at three stations to access the seasonal variation of physico-chemical parameters with Ichthyofaunal diversity. The constituents monitored included water temperature, turbidity, pH, total dissolved solid, total suspended solid, total solid, conductivity, dissolved oxygen, biological oxygen demand, free carbon dioxide, chloride, total alkalinity, hardness, nitrate, phosphate, total coliform. Throughout the entire study period the hardness of water were high and a significant variation of the rest of the parameters were observed. In respect of Ichthyofaunal diversity, a total of 43 species belonging to 5 orders and 12 families were recorded. Among them 19 species were considered as food, another 19 belong to ornamental as well as food and only 5 were recorded to be considered exclusively as ornamental. The species *Cyprinion semiplotum* marked as vulnerable (A2acde + 3cde) by IUCN was recorded from station-1. In this lotic system the diversity and distribution of fishes were uneven, this might be due to varied physico-chemical parameters of the water, soil quality of the substratum, and indiscriminate fish capture practice of the locals. The increase in species richness at down streams i.e. at S3 might be due to the large growth of submerged macrophytes. Ichthyofaunal density and diversity was recorded lowest at station-2 at which the physico-chemical parameters records also indicated as most polluted compare to other two spots.

Keywords: Ichthyofauna diversity, physico-chemical properties, Raidak river.

Introduction:

Northern part of West Bengal, popularly known as North Bengal is gifted with numerous torrent fresh water rivers; the river "Raidak" is one of the popular among them. There are six major river systems longitudinally cut the Coochbehar district flowing in a south-easterly direction. From the west to east these are the Tista, Jaldhaka, Torsa, Kaljani, Raidak and Gangadhar (Sonkosh) system. Some notable tributary rivers are Dharla, Jaldhaka, Raidak–II , Dudua, Kaljani, Sankosh, Gadadhar, Mansai, Ghargharia Jorai etc. (Majumdar, S. C. 1942). The name Raidak came in this part of Bengal as because

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of several floods during monsoon season along with the changes of its course (Choudhuri, 1903). The rivers flow in a slanting course from north - west to south – east and merged with the river Brahmaputra in Bangladesh. There are several rives abbreviated with Raidak are present in the Alipurduar and Cooch Behar districts of West Bengal i.e. Raidal-I, Raidak-II, Mora Raidak, Bura Raidak, Ghora Raidak, Buri Raidak etc (NIC, Cooch Behar and NIC, Alipurduar). The river Raidak originates from the ice field of the Jomolhari (7270m, the highest peak in Bhutan), Kungphu (6894m), and Takaphu (6493m) peak of the Great Himalaya in Bhutan. Within the Bhutanese territory the lead stream of the Raidak is known as Wong Chu (Barman *et al*. 2014). It receives two major tributary the Paro Chu and the Ha Chu. The catchment area covers an area of 5505.2 sq. km out of which 4813 sq. km lies in Bhutan. 692 sq. km within sub-Himalayan North Bengal and only 450 sq. km is situated within the area of Alipurduar district (Rudra, 2008).

Our present study is on the three spots of the river Raidak-I, that's flows beside the Tufanganj town of district Cooch Behar of West Bengal, India. The main stream of this river flows down from Bhutan and traverse through Tufanganj-I and Tufanganj block-II of Coochbehar district. The total catchments area of the river is 807 square km, most of which is covered by arable land. The basin of this river sustains life and livelihoods of farmers, fishermen and slum-dwellers. Farmers consume the water resource for cultivation and drain off the utilized excess water which carries varieties of pesticides and fertilizers to that river (Ray, 1932 and Rudra, 2015). The fishermen utilize the downstream of this river in Tufanganj block-I for fishing (Willcocks, 1930). Slum-dwellers exploit the water resource for bathing, washing of cloths etc. Sewage from municipality, garbage from market directly discharges to this river. As a consequence the physical, chemical and biological characteristics of the river water are gradually changing and producing the harmful effect on aquatic biota and thereby human beings due to biomagnification. A quantity of physico-chemical variables of the water along with the density and the diversity of the Ichthyofauna were studied to get an adequate knowledge (as suggested by Barat *et al*., 2015) of their oscillating rhythmic phenomena, and to throw a close insight into the environment of the system.

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Fig.I: Location of three survey spots under Tufanganj sub-divisions of Cooch Behar district of West Bengal (Courtesy: Google earth surfed on November 15, 2018 at 8.00 pm)

A considerable quantity of research has been carried out on the physicochemical parameters of riverine water and their impact on aquatic biota in India (Adebisi, 1980; Barat and Jha, 2002; Dhanapakiam, 1999; Pande *et al.*, 1988 and Dey *et al.*, 2015). However, this type of study has not been carried out in respect in Raidak-I river of West Bengal. The objectives of this study is to investigate physical and chemical properties of this river water in different seasons of the year and to examine the density and diversity of captured fin-fish resources from the river so as to find the relation in between the fish population with hydrological parameters to get a picture of the effect of pollution if any.

Materials and methods:

Three different stations (Fig-1) were selected in Raidak-I river to collect water samples and to record the captured fishes with the help of expert local fishermen, one is 5 km ahead before it enters into the Tufanganj town area; one adjacent to the town area and third one is 10 km away after crossing the Tufanganj town. Its latitude, longitude, and elevation along with the administrative parameters is presented in the Table-I. The station-II is located adjacent to the main town of Tufanganj Subdivision i.e. Tufanganj town and the survey spot is located behind the hospital and the market popularly known as Ranirhut (Table-I).. The station-III is selected at the Kerochhar (Sarkar para) near Balabhut where the river meets with the river Torsa before it enters into the Bangladesh.

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Table-1: Administrative Parameters of the Surveyed Spots

Spot No.	Name of the spot / Mouza	GPS readings	Location of Survey spot	
			Block	GP / Municipality
S1	Bansraja	26°21'07"N & 89°40'29"E	Tufanganj-II	**Salbari-I**
S2	Ranirhut	26°18'39"N & 89°40'14"E	Tufanganj Sadar	**Tufanganj Municipality**
S3	**Kerochhar (Sarkar para)**	**26°13'09"N & 89°41'37"E**	**Tufanganj-I**	**Balabhut**

Sixteen physico-chemical parameters of the collected water were considered for detailed study of the water quality for better understanding its effect on wild fish population. Fortnightly the water samples were collected at the depth of 8" - 1 ft from the surface within 6.30 am to 8.30 am. Water samples were collected in duplicate in two glass DO (Dissolved Oxygen) bottles with a capacity of 150 ml each and one large PVC (1 litter capacity) bottle. Water of one bottle were fixed with manganus sulfate on the spots for the estimation of DO and all samples were transferred to the laboratory immediately for all physico-chemical experiments except the air, water temperature, pH, conductivity and total dissolved solid (TDS). The water temperature was measured with a mercury thermometer by placing it inside the water at the depth of 1 ft. on all sampling stations. Other physico- chemical parameters were analyzed in the laboratory in the same day within 2-3.5 hours except BOD. Digital meter were used to record the turbidity, pH, conductivity and TDS (Model-171 of Electronics India). The total suspended solid (TSS) was measured by evaporation method. The dissolved oxygen, free carbon dioxide, BOD, chloride, hardness and total alkalinity, nitrate and phosphate were measured in the laboratory in recommended by APHA (1995).

The fishes were captured in three stations by cast net (mesh size 6mm. X 6 mm.) or by vessel net or khara jal (with a mesh size of 6 mm. X 6 mm.) and gill net (variable mesh sizes) as recommended by Das (2015) and Paul and Das (2016). After capture the color, color patterns, spots etc. were noted and their picture was taken by a DSLR camera. The fishes were narcotized by using 10% formalin solution containing one part commercial formalin (37-40% HCHO) + nine part glass distilled water and 7 gm Borax/liter (Jayaram, 1981). All the fishes were kept in this buffer formalin solution for 4-5 hours for proper fixation. The fishes were identified by studying their morphometric and meristic characters and by considering the literature of Talwar and Jhingran, 1991 and Jayaram, 1999 and 2006 and confirmed by surfing the fishbase website. The threat status and endemism of fishes were assayed following Barman (2007) and the website of IUCN. The Shannon and Weaver (1949) and Pielou (1975) diversity and evenness indices were calculated by using the software PAST (Hammer, 2001). The study was carried out from January, 2017 to July, 2018. The statistical observations along with the graphical figures were interpolated by using the software SPSS, PAST, Excel etc. to comprehend the physico-chemical factors with the fish population.

Results and discussion:

The results of physico-chemical study, correlation coefficient values and list of the recorded fishes are presented in Table-1, 2 and 3. Health of an aquatic system depends on the physico-chemical properties as well as sustainable biota. Physico-chemical factors of a lotic water body not only affect the distribution patterns and species abundances, they also play a vital role in species diversity. The physiological activities and distribution of biota is controlled by the temperature, an important physico-chemical parameter. The river water temperature changes seasonally and daily in a very normal way and a few lotic body show vertical temperature gradients. The water temperature varied in between 16.5-30°C at S1, 19-30°C at S2 and 19 to 28.7 at S3. It is observed that on any sampling day, the temperature of S2 and S3 did not fluctuate too mach but between S1 and S2 and S1 and S3 data

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showed a significant wide range of variation. In the entire period of monsoon at S1 the average water temperature was 27.5°C, at S2 28°C and at S3 27°C. Turbidity is a measure of the degree to which the water loses its transparency due to the presence of suspended particulates as well as mix up the additional colour due to excess decomposition of biota or by the discharge of sewage. Turbidity is considered as a good parameter for measuring the quality of water as it controls the penetration of light therefore have an inverse effect on the population of macrophytes of the water body. Large amounts of silt, unusual microorganisms, plant fibers, sawdust, wood ashes, chemicals and coal dust increases the turbidity. Excessive plankton and soil erosion from logging, mining may increase turbidity. Our study recorded that at monsoon maximum turbidity range into the studied spots but during pre and post monsoon turbidity recorded in low range. Station-3 showed highest turbidity than other two sampling sites. This might due to soil erosion which plays a vital role. The recorded mean pH on S2 and S3 during pre and post monsoon was acidic. During the period of early monsoon it was neutral to alkaline. The S2 which is situated beside Tufanganj town showed acidic pH during pre and post monsoon time. High organic load and decomposition is indicated by the acidic pH. The rain water can accelerate the neutralization and leads to alkaline. The changeability of pH in this lotic environment may be due to the ability of buffering capacity. The solid substances present in the water body are either in smaller dissolved or lighter suspended forms. The TDS values of water ranged from 0.03 to 0.06 ppt at S1, 0.04 to 0.09 ppt at S2 and 0.03 to 0.08 ppt at S3. Comparatively S2 station showed maximum TDS concentration. The TSS values of water ranged from 0.05-0.14 ppt at S1, 0.09- 0.25 ppt at S2 and 0.03-.22 ppt at S3. The TDS and TSS parameter were irreversibly related due to addition of solids from excess water as corroborated with the findings of Patra, *et al*., 2011.

Table1. Physico-chemical Parameters of water and fish population at three different stations of Raidak River

Spots studied:	S1 (Mean value)			S2 (Mean value)			S3 (Mean value)		
Parameter recorded	Pre-monsoon	Monsoon	Post-monsoon	Pre-monsoon	Monsoon	Post-monsoon	Pre-monsoon	Monsoon	Post-monsoon
Water temperature (°C)	30	27.5	16.5	30	28	19	28.7	27	19
Turbidity(NTU)	19.64	32.9	8.6	19.1	47.9	8.6	24.1	54.8	10.2
Total dissolved solid (ppt)	0.05	0.03	0.06	0.09	0.04	0.07	0.08	0.03	0.04
Total suspended solid (ppt)	0.06	0.14	0.05	0.096	0.25	0.06	0.12	0.22	0.03
pH	6.8	7.2	6.9	6.3	7.0	6.4	6.5	7.0	6.5
Conductivity (µs/cm)	39.1	31.1	34.9	79.6	65.6	68.4	51.6	43.9	46.4
Dissolved oxygen (ppm)	5.845	7.01	4.42	5.35	5.42	3.21	5.6	5.42	3.21
Free CO2 (ppm)	6.45	5.99	6.57	7.05	5.1	6.1	6.9	4.9	6.05
BOD (ppm)	1.325	0.335	1.02	2.29	0.97	1.9	2.3	0.97	1.86
Nitrate (ppm)	0.465	0.22	0.195	0.6	0.18	0.29	0.56	0.17	0.27

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Phosphate (ppm)	0.185	0.1	0.075	0.3	0.1	0.12	0.29	0.075	0.11
Chloride (ppm)	3.7	5.45	6.3	14.53	7.4	8.7	13.7	7.3	8.2
Total alkalinity (ppm)	31.5	29.4	30	32.5	32	33	32.7	31.5	31.9
Sulphate (ppm)	4.8	5	4.1	4.75	5	4.3	4.5	4.7	4.2
Hardness(Total)	75.5	68	50.5	77.5	66.5	52	75	67.5	48
Total Coliform/100 ml	2300	2175	2095	80000	75584	72332	23564	19765	15300
Fish density (mean catch)	103	134	116	90	98	93	351	374	382
Fish diversity (Shannon-H)	3.098	3.334	3.33	2.945	2.549	2.809	3.401	3.432	3.439

Electrical conductivity (EC) is mostly affected by concentration of ions and nutrients and variation of dissolved solids present in water body. The EC values of water samples ranged from 31.1 to 39.1(µs/cm) at S1, 65.6 to 79.6 (µs/cm) at S2 and 43.9 to 51.6(µs/cm) at S3. Comparatively S2 showed maximum EC. This might be due to the dilution of water during monsoon which lowers the EC value of water. EC recorded positive correlation with TDS. The variation of conductivity value indicates the irregular incidence of un-ionized chemical substances and due to lack of proper irrigation supervision, addition of minerals from rain water overflow and other illogical discharges (Chakraborty, 1998).

Table-2: Correlation coefficient values among Mean physico-chemical parameters and fish population of Raidak river.

	WT	TB	TDS	TSS	PH	CD	DO	FCO_2	BOD	NO^{3-}	$PO4^{3-}$	Cl^-	TAlk	HD	TColi	FD	FD(H)
WT	1.00																
TB	0.57	1.00															
TDS	0.05	-0.54	1.00														
TSS	0.36	0.92	-0.57	1.00													
PH	0.13	0.61	-0.80	0.67	1.00												
CD	0.18	-0.04	0.61	-0.10	-0.67	1.00											
DO	0.79	0.57	-0.22	0.43	0.59	-0.30	1.00										
FCO_2	0.00	-0.75	0.80	-0.81	-0.60	0.13	-0.03	1.00									
BOD	0.09	0.56	-0.22	0.41	0.08	0.02	-0.03	-0.51	1.00								
NO^{3-}	0.14	-0.30	0.06	-0.34	0.07	-0.36	0.17	0.34	-0.35	1.00							
$PO4^{3-}$	0.37	0.60	-0.11	0.38	0.06	0.03	0.20	-0.36	0.94	-0.17	1.00						
Cl^-	0.21	-0.13	0.77	-0.23	-0.72	0.68	-0.12	0.48	0.14	-0.47	0.20	1.00					
TAlk	0.14	-0.11	0.57	-0.11	-0.79	0.79	-0.46	0.13	0.17	-0.17	0.18	0.63	1.00				
HD	0.97	0.45	0.23	0.23	0.04	0.18	0.79	0.19	0.07	0.23	0.38	0.29	0.13	1.00			

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TColi	0.14	0.08	0.46	0.07	-0.48	0.97	-0.26	-0.05	0.00	-0.43	-0.03	0.55	0.68	0.11	1.00		
FD	-0.06	0.21	-0.24	0.18	-0.08	-0.26	-0.16	-0.21	0.60	-0.33	0.53	0.21	0.16	-0.11	-0.37	1.00	
FD(H)	-0.17	-0.10	-0.21	-0.18	0.13	-0.70	0.08	0.16	0.33	0.03	0.33	-0.05	-0.41	-0.11	-0.81	0.70	1.00

Note: WT- water temperature; TB- turbidity; TDS- total dissolved solid; TSS- total suspended solids; CD- conductivity; DO- dissolved oxygen; FC_O2- free carbondioxide; BOD- biological oxygen demand; NO^{3-} nitrate; $PO4^{3-}$- phosphate; Cl^{-}-Chloride; Talk- total alkalinity; HD- hardness; TColi- total coliform; FD- fish density; FD(H)- fish diversity (Shannon-H).

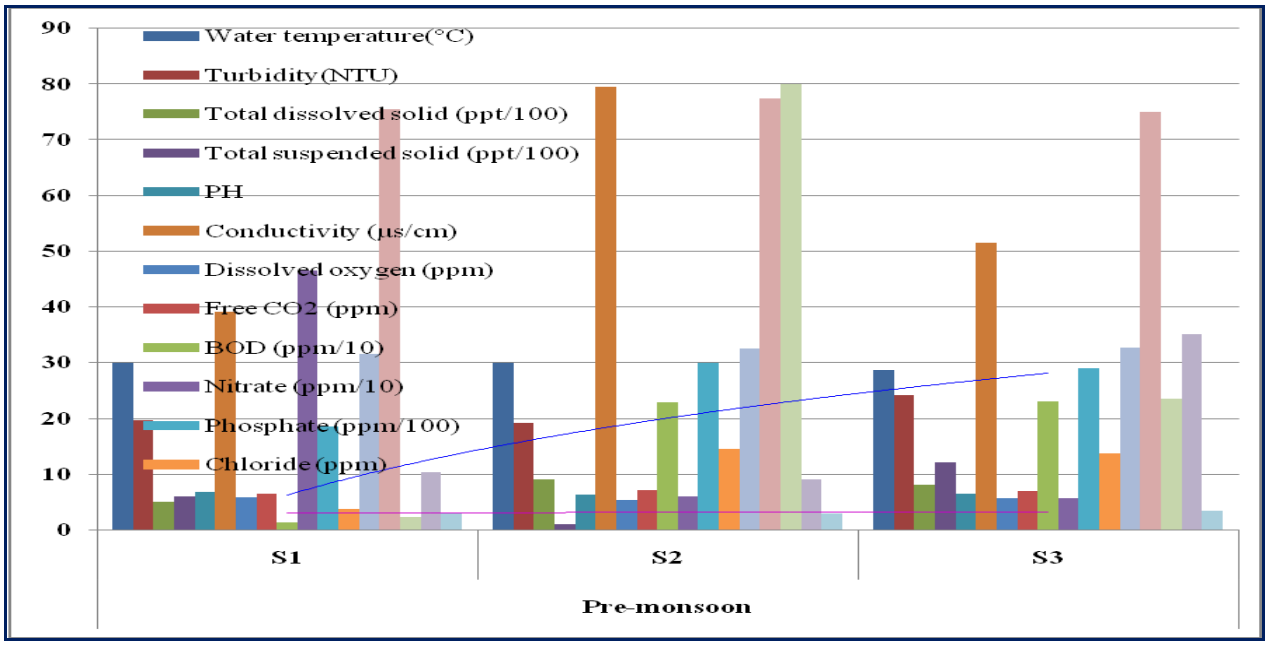

Fig.2: Graphical presentation of the Physico-chemical data along with the fish density and diversity of three stations during pre-monsoon season (blue trend line indicates fish density and pink trend line indicates fish diversity).

Dissolved oxygen is an important factor which is necessary for the metabolism of all aquatic aerobically respired biota and also an indicator of water quality and diversity of living organisms. The value ranged from 4.42 to 7.01ppm at S1, 3.21-5.42 ppm at S2 and 3.21-5.6 ppm at S3. The highest values of DO were recorded from the post monsoon to monsoon at all the spots. In our study it indicates DO has a positive correlation with temperature and pH. This may be due to Turbulence and oxygenation resulting from rain falls and adding up of gleaming aerated water. Accumulation of different biodegradable pollutants from garbage near to market and hospital, domestic sewage, municipality's wastes, etc. induce the growth of microorganisms which reduce the dissolved oxygen. So the concentration of DO gradually decreases (Ray and David, 1966).

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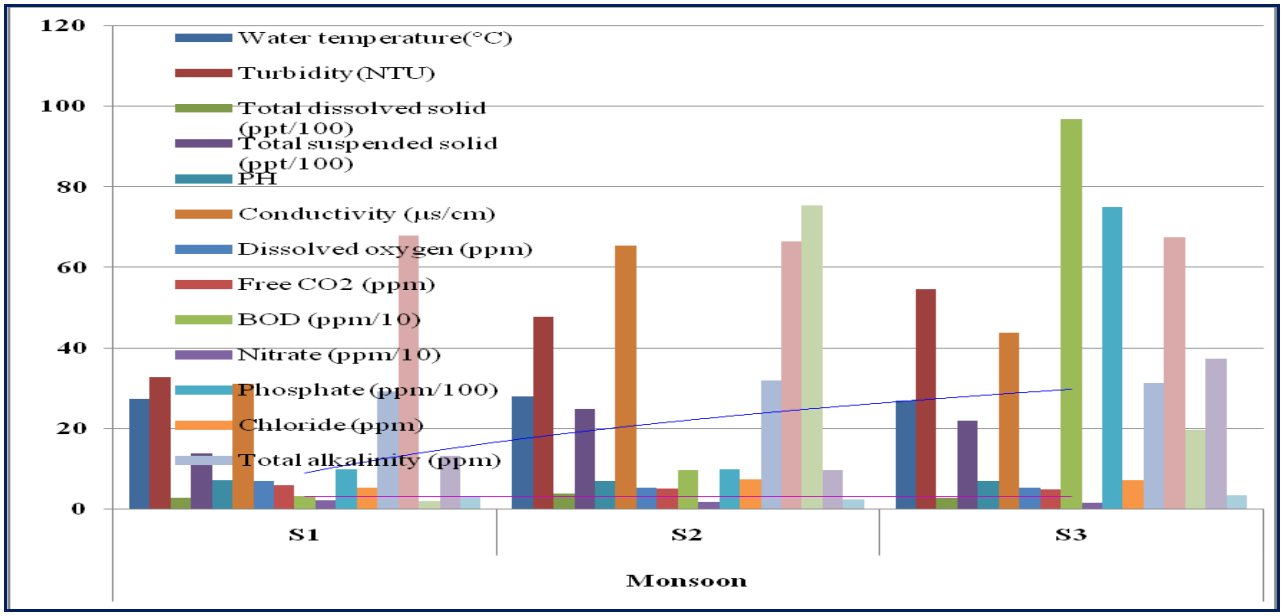

Fig.3: Graphical presentation of the Physico-chemical data along with the fish density and diversity of three stations during monsoon season (blue trend line indicates fish density and pink trend line indicates fish diversity).

The quantity of biodegradable organic matter present in an aquatic system which is subjected to aerobic decomposition by microorganisms is indicated by the biological oxygen demand (BOD) value which provides a direct measurement of the status of aquatic pollution. The value of BOD recorded from 0.335 to 1.325 ppm at S1, 0.97 to 2.29 at S2 and 0.97-2.3 at S3. At all the stations, the BOD values were highest during the period of pre-monsoon and minimum during the period of monsoon. This hydro chemical factor was irreversibly correlated with DO at all three stations and corroborated to the observations of Ray and David, 1966. The BOD level clearly indicates that S2 is highest polluted compare to other two spots.

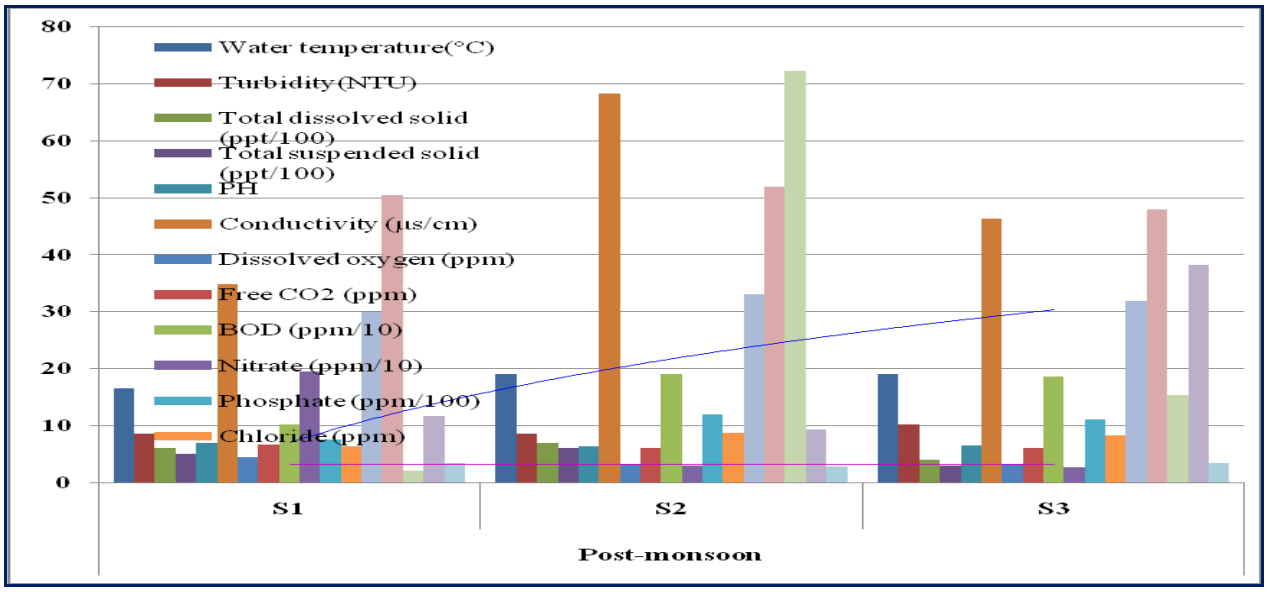

Fig.4: Graphical presentation of the Physico-chemical data along with the fish density and diversity of three stations during post-monsoon season (blue trend line indicates fish density).

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During the respiration of biota free CO_2 is produced in an aquatic system. Aquatic macrophytes and phytoplankton absorb the carbon dioxide for photosynthesis and produce oxygen and carbon-rich foods. These free CO_2 has a tendency to combine quickly with water to form weak carbonic acid. The presence of carbonic acid in river water may be good or bad depending on the pH of the water. Carbonic acid will neutralize alkaline water but if the water is quite acidic the carbonic acid will stay un-dissociated. In present study, the free carbon dioxide concentration ranged from 5.99-6.57 ppm at S1, 5.1-7.05 ppm at S2 and 4.9-6.9 ppm at S3 respectively. It is inversely correlated with pH at all the stations. The value of carbon dioxide clearly indicates high organic load in two downstream stations.

Alkalinity is an indicator of a solutions power to react with acid and "buffer" its pH. Alkalinity is significant for fish and entire aquatic life because it protects or buffers against the changes of pH. In present study, total alkalinity (TA) represents to bicarbonate alkalinity only. Average TA values were observed high during the pre-monsoon and low during monsoon at all the stations. There is an interrelation in between pH, dissolved CO_2 and TA. TA with CO_2 showed positive correlation but with pH showed negative correlation. Decomposition of discharged organic matters from different sources might be the reason behind the observation.

Chloride concentration inter-related with the concentration of salinity. In present observation, the average chloride concentration showed an increase from S1 (6.3 ppm) to S2 (14.53 ppm) and thereafter decreased at S3 (13.7 ppm) during post-monsoon. Minimum concentrations were evaluated during monsoon time and maximum were observed during pre-monsoon period at all the stations. The observation is supported by the data reported by Munawar (1970). This observation might be related with the fact that sewage contamination with high organic load increases the value of chloride concentration at station-2.

Total reactive phosphorus is the ionized form of orthophosphoric acid. The higher the pH, the more PO_4^{3-} will form the deprotonation of HPO_4^{2-}. Phosphates are less soluble and less volatile. It can form salts with calcium and magnesium and precipitated out of solution and settled as sediment. Plants, bacteria and all living biota consume phosphate as it is an essential nutrient. Inorganic phosphate can promote dense growth of macrophytes in water body, ranged from 0.07-0.185 ppm at S1, 0.1-0.3 ppm at S2 and 0.07-0.29 ppm at S3. The value shows maximum during pre-monsoon period and lowest during rainy season. This nutrient indicates positive correlation with nitrate. This may be due to the domestic discharge and agricultural overspill where phosphate containing fertilizers are widely used.

To access the water quality of Raidak-I river, three major nutrient parameters were chosen. Among them Nitrate (NO_3^-) is one of the vital in any water body. Nitrite (NO^{2-}) is oxidized to nitrate after entering in an aerobic system. At the same time plants and microorganisms reduce nitrate into nitrite but nitrite ion is quickly oxidized back to nitrate once it re-enters the aquatic system. Natural sources of nitrate are plant decay and animal waste including fish, wild animals and bird, discharges from car exhausts. Nitrate provokes the growth of plankton and water weeds that contribute food for fish which may increase their population. But if algal growth is excessive, the dissolved oxygen levels will be decrease during early morning and fishes will die due to shortage of DO. In the present study, the nitrate concentration ranged from 0.19 to 0.46 ppm at S1, 0.18 to 0.6 ppm at S2 and 0.17to 0.56 ppm at S3. Maximum concentration was estimated during pre- monsoon at all the stations. The contamination of nitrogenous fertilizer from agricultural field, sewage, rottenning of jute etc. lowers the mean value of the above parameter at S1 in comparison to S2 and S3.

Total colifrom test is one of the most significant biological parameter in drinking water quality. The microbial quality of river water is controlled by the activities of human. In urban areas fecal

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microorganisms are mostly brought to aquatic environments through the discharge of domestic waste, few industrial wastes and agricultural field runoff (Lewin, 1961). According to WHO, the number of coliform in 100 ml of water should be zero. In our study the values of total coliform/100 ml varied between minimum 2175 at site S1, 72332 at S2 and 15300 at site S2 which marked water as inferior in quality for domestic use. The domestic or municipality sewage contamination of water in area located near town area (i.e. S2) to the river system might be the reason of higher values of coliform at that spot. The little bit greater coliform counts in the water body at S3 might be as a result of contributions from the rural domestic sewage runoff (Singh, *et al.*, 2010).

TABLE 3: Check list of Ichthyofauna recorded from river Raidak-1 flowing through the Cooch Behar District of WB

Scientific name	Common / Local name	Abundance CPUE			Economic importance	IUCN Status (ver 3.1, 2018)
		S1	S2	S3		
CLASS: PISCES						
ORDER: CYPRINIFORMES						
FAMILY: CYPRINIDAE						
SUB FAMILY: Cyprininae						
Osteobrama cotio cotio	Mowa / Mourla / Chanda	3	2	2	Fd	LC
Chagunius chagunio	Pithkanta	4	2	8	Fd	LC
Cyprinion semiplotum	Chepti	3			Fd	VU A2acde+3cde
SUB FAMILY: Cultrinae						
Securicula gora	Chela / Ghora Chela	7	25	12	Fd	LC
SUB FAMILY: Rasborinae						
Cabdio morar	Boroli / Bairali	8	6	25	Fd	LC
Barilius tileo	Bolla			2	Fd	LC
Raiamas bola	Ghol / Sikari / Boroli	3			Fd	LC
Barilius barila	Boroli / Bairali	7		5	Fd	LC
Barilius bendelisis	Kaksa / Darangi Ghakshi	5			Fd	LC
Barilius shacra	Ghakshi / Boroli	8	7	20	Fd	LC
SUB FAMILY: Danioninae						
Amblypharyngodon microlepis	Mourla	15	12	21	Fd/Or	LC
Rasbora daniconius	Darkina / Dadhika	3		6	Fd/Or	LC
SUB FAMILY: Labeoninae						
Labeo rohita	Ruhi / Rui/ Rohu	2		3	Fd	LC
Labeo gonius	Gharea / Kurchi / Goni	1	1	4	Fd	LC
Labeo bata	Bata	3	2	5	Fd	LC
Bangana ariza	Bhagna Bata	2		8	Fd	LC
SUB FAMILY: Barbinae						
Puntius sophore	Deshi Puthi / Jat Puthi	5	3	16	Fd/Or	LC
Puntius conchonius	Kanchan Puthi	1	8	3	Fd/Or	LC
Puntius terio	Teri-puthi	6		24	Fd/Or	LC

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Puntius ticto	Tita-puthi / Tit-puthi	4		5	Fd/Or	LC
Systomus sarana	Sar-puthi / Saral-puthi			6	Fd	LC
SUB FAMILY: Garrinae						
Crossocheilus latius latius	Kalagachi	5	7	22	Fd	LC
FAMILY: PSILORHYNCHIDAE						
Psilorhynchus sucatio	Nou-chata / Balitita		1	6	Fd/Or	LC
Psilorhynchus balitora	Baluchata / Titari			5	Fd/Or	LC
FAMILY: BALITIRIDAE						
SUB FAMILY: Nemacheilinae						
Acanthocobitis botia	Ghar-poia / Khorkey	3	4	8	Fd/Or	LC
FAMILY: COBITIDAE						
SUB FAMILY: Cobitinae						
Lepidocephalichthys guntea	Poia / Poa	2		6	Fd/Or	LC
Somileptes gongota	Guttum /Gongota Loach	3	3	4	Fd/Or	NA
Acanthocobitis botia	Poia	2		9	Fd/Or	LC
Schistura beavani	Poia	2	2	5	Fd/Or	LC
ORDER: SILURIFORMES						
FAMILY: BAGRIDAE						
Mystus vittatus	Tengra	5	3	4	Fd/Or	LC
Mystus bleekeri	Golsa Tengra			7	Fd	LC
Rita rita	Rita			1	Fd/Or	LC
Sperata seenghala	Aar	1		5	Fd	LC
FAMILY: SCHILBEIDAE						
SUB FAMILY: Schilbeinae						
Eutropiichthys vacha	Bacha			6	Fd	LC
FAMILY: SISORIDAE						
Laguvia shawi	Khat Khuta Tengra	2		6	Or	NA
Gogangra viridescens	Kaoua Tengra			22	Fd/Or	LC
Erethistes pusillus	Tarkanta / konakanta	1		4	Or	LC
ORDER: BELONIFORMES						
FAMILY: BELONIDAE						
Xenentodon cancila	Kankley / Kakley / Khata	3		8	Fd/Or	LC
ORDER: SYNBRANCHIFORMES						
FAMILY: MASTACEMBELIDAE						
Mastacembelus armatus	Bam /Bain				Fd/Or	LC
ORDER: PERCIFORMES						
FAMILY: AMBASSIDAE						
Chanda nama	Nama Chanda	2	5	14	Or	LC
Pseudambassis baculis	Chanda	4		8	Or	LC
FAMILY: GOBIIDAE						
SUB FAMILY: Gobiinae						

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Glossogobius giuris	Balia / Beley	3	4	11	Fd/Or	LC
FAMILY: OSPHRONEMIDAE						
SUB FAMILY: Luciocephalinae						
Trichogaster labiosa	Ranga-kholisha / Kholsa	5		6	Or	NA

Note: Economic importance: **Fd**=Food fish; **Or**=Ornamental fish; Ecological status: **LC**= least concern; **NA**: not assayed; **VU**= vulnerable; **CPUE=**Catch per unit effort (mean catch frequency with the help of a conventional net by a local expert fisherman.

A total of 43 species under 12 family and 5 order (as per systematic position) of fishes were recorded from three station during the period of study. Out of these, 19 sprcies were considered as food fish, another 19 were considered as food as well as ornamental fish and other 5 were exclusively considered as ornamental fishes as per their body size and colour texture and pattern. Regarding IUCN status and trend, majority of the recorded fishes belong to the status of 'Least concern' and a few belongs to 'Not assayed' category (Table 3). The recorded *Cyprinion semiplotum* belongs to the category 'Vulnarable' (A2acde + 3cde) as per IUCN. The mean catchment frequency of fishes from Station-1 is 134 individual per catch with 34 recorded species belongs to 27 genera, where as the Station-2 recorded 98 individuals per catch belongs to 19 species and 16 genera and Station-3 recorded a mean catchment of 342 individuals belongs to 39 species under 31 genus. It indicates that 4 species are there which are not recorded in the Station-3 though the spot recorded highest species diversity. PAST (Hammer, *et* al. 2001) analysis of Shannon-H recorded highest in S3 (H=3.44) and lowest in S2 (H=2.54) where as S1 recorded almost similar to S3, the value is H=3.33. The graphical presentation also indicates that the Station-2 recorded lowest fish density with least diversity and recorded physico-chemical parameters also correlated the recorded fish data.

Conclusion:

The fish represent one of the most important food, stable diet and supplement of proteins (Singh *et al.*, 2016) for many people of India. Fish constitute almost half of the total number of vertebrates of world. Out of 39,900 identified vertebrates, fish contains 54.44% of which 38.72% is fresh water species (Jayaram ans Singh, 1977). In the present Study, the spot S2, adjacent to Tufanganj town appears to be more polluted might be due to external influences compared to the S1 and S3 and the fish density and diversity also lesser than the other two spots. The S1 seems to be the lowest polluted. The domestic sewage, garbage from market, drainage materials from hospital, leaching of fertilizers and pesticides from agricultural land, use of Ichthyotoxic substances for illegal fish capture may directly mix up with that river water and are clearly manifested with the findings of the results. The data observed from the present investigation shall be supportive in future supervision of the river Raidak-I of Coochbehar District. . The S3 spot seems to be more inductive to the fish density and diversity might due to high food resources as it is located at the downstream with greater number of niches for the varieties of fish species. The records of the variety of fishes (as it is an environmental indicator species) are one of the preconditions for adopting the suitable conservation strategies of fish fauna. Till date the Raidak-I river of Tufanganj subdivision of Coochbehar district has not acknowledged any consideration from the ichthyological aspects. This study gains significance as the Raidak-I river has been described as one of the most important lifeline of the said locality.

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