Effect of Sewage Pollution on zooplankton community of Sirsiya river at Raxaul, India

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Abstract : A large number of plankton populations occur in any river, pond and lake ecosystem, which determine their productivity. The zooplankton are animals floating in water and are used as food sources for fishes and other aquatic forms. Most of them are protozoa, cladocera, rotifera and copepoda etc, which serve as indicators of heath of any aquatic body. A change in the water quality leads to change in the tolerance, abundance and diversity of plankton. Therefore, the present work was performed considering the effect of domestic sewage on zooplankton population in river sirsiya at Raxaul, East Champaran Bihar, India. During the study period 18 types of zooplankton were observed as Protozoa-2 sps, Ostracoda-1 sps, Rotifera-4 sps, Cladocera-6 sps & Copepoda-5 sps. Rotifera were found to be the most abundant.

Key words :- **Zooplankton, Rotifera, Cladocera, Protozoa, Ostracoda etc.**

I. INTRODUCTION

Our country India is very rich in water bodies as ponds, lakes & rivers etc. A bunch of 10 river system & their tributaries cover about 27000 km. North Bihar is bestowed with many river such as Koshi, Bharmputra, Sone, Gandak etc.

The river Sirsiya (sariswa) a tributary of Burhi Gandak originates from pathlahia hill of the dense Ramban forests in Nepal. Its course roaming through Bara and Parsa districts in Nepal & Raxaul in Bihar (India), flows 15 km in Nepal and then enters India at Raxaul. From here, the river flows about 20 km in India and joins Burhi Gandak (Sikarhana) near Sugauli in East Champaran District. The water of river maintains its valuable contents upto parwanipur (Nepal). But after that untreated wastes of about 100 factories and domestic sewage at Birgunj (Nepal) are being dumped which make this river contaminated. The colour of the river turned black besides, emanating foul smells has made the life of the people a nightmare.

Domestic human waste includes human excreta, urine and associated sludge (Black water) and waste water generated through bathing and kitchen (grey water).

Water pollution affects plants and organisms of the water bodies. Zooplankton that are heterotrophic animals floating in water constitute an important food source for many species of aquatic organisms. Zooplankton are globally recognised as organisms that indicate pollution in aquatic environment. The knowledge of plankton composition and distribution with respect to time and space in a water body are of great value. The study of zooplankton is necessary from fishery point of view. Zooplankton biomass, abundance and diversity are used to determine the condition of the water bodies. The continuous monitoring of river's water quality is very essential to determine the state of pollution in our rivers. Therefore, an attempt to evaluate the effect of domestic sewage on zooplankton population in River Sirsiya at Raxaul, Bihar, India has been undertaken in present work.

II. Material and Methods

For the collection of sample the chhath ghat near koriya-tola, Raxaul was selected. The samples were collected by filtering 30 litres of water through standard plankton counting net. Plankton were counted with the help of Sedgwick rafter slide in the laboratory of P.G. Department of zoology every month from January to December, 2014. The plankton were identified using the keys. Abundance of zooplankton was estimated as organism/litre, using the equation-

$$N(\text{Number of zooplankton})/\text{Litre} = \frac{A \times 1000 \times C}{L}$$

Where,

A = No. of zooplankton/cc

C = Volume of concentrated sample taken for counting

L = Volume of water in litre for collecting of sample.

1000= Area of counting chambers.

Methods for analysis of Abiolic Parameters:-

Physico-chemical analysis was carried out using the methods given by APHA[01] & Trivedi and Goel[08]. pH by measured using pH-meter and temperature was measured by Celsius thermometer, Nitrate, Phosphate & Sulphate pest kits were used to perform the analysis.

III. Results and Discussion

During the analysis of abiotic parameter of Sirsiya river in year 2014, it was found that June was hottest (38.5°c)and January was coldest (11.5°C). The pH of the water was slightly alkaline that is 7.1 to 7.8 . DO of the water was in the range of 3.7 (July) to 5.2 (Jan). The FCO_2 was found to be 35.8 to 47.8. The total hardness was also found to be varying from 321 mg/l to 371 mg/l. The other parameter were also Table (1)

TABLE- 1
ABIOTIC PARAMETERS OF SIRSIYA RIVER
YEAR 2014

Month	JAN	FEB	MAR	APR	MAY	JUN	JULY	AUG	SEP	OCT	NOV	DEC
Temperture (0^0C)	11.5	16.6	20.9	32.5	36.8	33.2	40.4	36.2	33.5	26.3	21.5	11.8
pH	7.3	7.5	7.4	7.5	7.4	7.8	7.4	7.3	7.4	7.6	7.8	7.2
DO (mg/l)	5.1	4.9	4.8	4.6	4	3.8	3.7	3.9	4.1	4.2	4.5	4.9
FCO_2 (mg/l)	48.1	49.2	44.1	42.2	40.5	40	41.4	44.5	45.6	47	47.5	47.8
TOTAL HARDNESS (mg/l)	350	356	368	370	390	391	380	365	364	360	356	355
CALCIUM HARDNESS (mg/l)	50	52	57	60	67	68	60	45	42	38	41	43
CARBONATE (mg/l) ALKALINITY	4.2	4.7	4.9	5	5.5	5.7	5.4	5.3	5	4.8	4.6	4.3
BICARBONATE ALKALINITY (mg/l)	407	427	395	390	387	384	392	397	398	388	387	401
PHOSPHATE (mg/l)	2.2	2.3	2.5	3.1	3.2	3.5	3.3	2.9	2.7	2.5	2.4	2.3

NITRATE (mg/l)	2.1	2.3	2.4	2.5	2.7	3	2.9	2.6	2.4	2.3	2.2	2
SULPHATE (mg/l)	3.5	3.4	3.6	3.7	2.9	2.7	2.4	2.8	3.9	4.4	4.2	3.9
CHLORIDE (mg/l)	13.2	15.6	16.8	19.1	22.1	25.5	24.9	22.9	21.9	19.2	16.2	15.2
CALCIUM (mg/l)	156	160	161	164	170	173	175	178	179	181	174	162
MAGNESIUM (mg/l)	21.8	22	23.6	29.4	29.5	27.5	27.8	30.3	24.4	22.3	21.9	21.5
ORGANIC CONTENTS (mg/l)	1.9	2	2.15	4.1	5.9	6.1	4.9	3.1	2.2	2.1	1.5	1.9
BOD (mg/l)	2.4	2.5	3	3.6	4.1	4.5	4.6	4.9	4.5	3.9	3.7	2.9
COD (mg/l)	3.4	3.6	3.8	4	4.4	4.5	4.7	4.6	3.9	3.7	3.4	3.5
SILICA (mg/l)	26	28	31	30	28	29	25	24	23	22	21	22

The number of zooplankton (units/Lit) in the year 2014 from January to December are presented in table-2, 18 species were observed belonging to Copepoda, Cladocera, Rotifera, Protozoa & Ostrocoda.

TABLE-02

MONTHLY VARIATION IN ZOOPLANKTON POPULATION OF SIRSIYA RIVER ORGANISMS/LITRE OF WATER

YEAR-2014

MONTH	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	TOTAL
COPEPODA													
1. Cyclops	11	10	12	13	7	5	4	6	10	14	13	12	117
2. Mesocyclops	12	11	13	12	8	6	4	9	9	11	12	13	120
3. Nauplius	13	10	9	8	6	5	7	8	9	10	11	12	108
4. Neo-Diaptomus	9	8	7	8	8	6	6	9	5	7	9	10	92
5. Diaptomus	11	10	7	6	1	1	0	3	6	4	5	10	64
CLADOCERA													
1. Daphnia	9	8	5	5	5	7	6	6	7	6	12	10	86
2. Moina	7	8	9	6	6	4	3	7	6	7	8	9	80
3.Simocephalus	8	9	6	5	7	5	4	6	6	5	9	9	79
4. Bosmina	3	5	6	3	4	2	1	2	4	3	2	5	40
5. Ceriodaphnia	14	12	8	8	7	5	3	4	6	11	13	14	105
6. Alona	5	10	9	3	2	2	2	1	3	4	9	7	57
ROTIFERA													
1. Platyias	9	10	7	8	5	6	6	7	8	9	8	9	92
2. Brachionus	22	21	20	19	18	16	15	13	14	16	22	24	220
3. Asplanchna	12	11	10	12	9	10	9	8	12	11	11	10	125

4. Monostyla	8	8	6	7	7	6	6	9	7	8	6	7	85
PROTOZOA													
1.Paramoecium	20	21	20	18	12	6	10	11	11	12	18	20	179
2. Euglypha	5	8	6	5	4	4	2	3	5	4	4	7	57
OSTRACODA													
1. Stenocypris	22	24	27	32	25	24	21	20	18	30	29	25	297

Copepoda:-

Of the 5 genera of copepod, Cyclops were dominant. In winter season all sps were found more in number where as in rainy season they were minimum. The other Genera were Mesocyclops, Nauplius, Neo-diaptomus and Diaptomus etc.

Cladocera:-

The group was represented by 6 genera. Simocephalus were at the top and Bosmina was found less in number. In winter season they were more numerous.

Rotifera:-

This group was represented by 4 genera as platyias sps, Brachionus sps, Asplanchna sps & monostyla sps, of them Brachionus were more in number.

Protozoa:-

The protozoa was represented by only 2 genera Paramecium sps and Euglypha sps. Paramecium were more in number in all seasons.

Ostracoda:-

This group was represented by only one genius Stenocypris. They were more abundant in winter season.

IV. Discussion

The population of zooplankton was low at Raxaul, (Bihar) as the river water becomes heavily loaded with domestic sewage and Industrial effluents in Nepal itself. The lowering of zooplankton population might be due to change in the physio-chemical parameters of the water due to the presence of organic and inorganic matter of sewage as evidenced by many workers[Kumari Kajal & Singh N.P], Factors like dissolved oxygen, transparency, depth, salinity, pH, temperature and nutrients influence the occurrence, abundance and distribution from year to year due to dynamic nature of aquatic system. Zooplankton represents a sensitive indicator of pollution. The predominance of rotifers over other groups of zooplanktons has also been reported by other workers.[Ref.2,3,4,5,6,7], It is also know that, in any aquatic community certain species are more susceptible than other in water problems. These species have the potential to be indicators of pollution or "Bioindicators". Some of the well known bioindicators are Corssastrea gigas, Acartia tousa, Ecoli, copepods, (Hawkins et al, 1994)

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