Zooplanktonic Fauna in Relation to Physico-Chemical Properties in Ottu Reservoir, District Sirsa, Haryana, India

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Abstract

Aquatic ecosystems consist of physico-chemical and biotic components. Physico-chemical parameters are directly affecting to diversity of flora and fauna of water bodies. In fauna, zooplanktons are first line consumer and act as food for many higher animals. The present work aims to study the zooplanktonic fauna in relation to physico-chemical properties in Ottu reservoir were studied for the period of 15 months from April 2012 to June 2013. During the present study period mean value of physico-chemical parameters of water were analyzed such as pH (7.59), depth of visibility (31.95 cm.), electrical conductance (339.14 µs/cm), TDS (828.67 mg/l), chloride (27.56 mg/l), alkalinity (155.33 mg/l) , hardness (103.81 mg/l), dissolved oxygen (3.36 mg/l) while average nitrate and phosphate levels were (1.40 mg/l) and (1.59 mg/l). During the present study period, a total of 25 species of zooplankton were recorded out of which rotifera was represented by 9 species, cladocera by 6 species, where as copepoda and protozoa each represented by 4 and 5 species respectively, one species of Ostrachopoda. Rotifers were the dominant group among zooplankton community, with 9 species and 6 genera. Rotifera showed its presence throughout the study period and the recorded data clearly showed well-marked seasonal fluctuations in their population. Study indicated that the distribution of zooplankton species was influenced by physical and chemical factors of the freshwater reservoir environment.

Keywords: Zooplanktonic fauna, physico-chemical, dissolved oxygen, Ottu reservoir, Rotifera.

Introduction:

Aquatic ecosystem is the most diverse ecosystem in the world. The first life originated in the water and first organisms were also aquatic where water was the principal external as well as internal medium for organism. The interrelationship between the physico-chemical parameters and plankton production of reservoir water and its relation with fluctuation of zooplankton are of great importance and basically essential fish culture. Zooplankton are dependent on physicochemical parameters. Any changes of these parameters may affect the growth, development and maturity of zooplankton. Different casual influences, which determine the quality of water, show a characteristic change from season to season. Zooplankton constitute important food item of many fauna. The larvae of carps feed mostly on zooplankton. Zooplankton also play an important role in food chain as they are second in tropic level as primary consumers and also as contributes to next tropic level. Many researcher have worked on physico-chemical condition and seasonal variation of zooplankton[1-5]. The present study was made on zooplanktonic fauna in relation to physico-chemical properties in Ottu reservoir.

Material and Methods:

Study area:

Ottu reservoir, a man made reservoir has been set up on the river of Ghaggar at Sirsa, Haryana, India. Ottu reservoir is a water body of the Ghaggar river and the river water is blocked at weir, as such the river does not have any water downstream. All river water was diverted to canal in Haryana. The Ottu reservoir is situated in the mid south of Sirsa between 29.29'21" North latitudes and 74.53' 38" East longitudes. Water bodies is situated about 14 km. from centre east-west of Sirsa city. For experimentation, water samples were taken from three stations of reservoir. Water sampling were done between 9:00 to 11:00 hrs in morning for a period of fifteen months from April 2012 to June-2013. The reservoir Water is already used for irrigations and fishery so the aim of present study observe informative data to understand Zooplanktonic fauna in relation to physic-chemical progress of Ottu reservoir.

Water sample collection and Analysis:

Water samples from Ottu reservoir were collected from the pre decided location during last week of each month in clean plastic air tight bottles. During the monitoring, physico-chemical parameter like atmospheric and water temperature was measured using Mercury thermometer, pH was determined using pH meter and transparency by using Secchi disc at the sampling spot. The conductivity of water was measured using conductivity meter . The dissolved oxygen was measured using modified Winkler's method (1981). Free CO_2, alkalinity, chloride and hardness, COD and BOD was estimated using APHA-AWWA-WPCF (1981). Phosphate, sulphate and nitrate were were recorded in the laboratory following the standard methods of Trivedi and Goel (1986) and APHA (1981 and 1998) and compared with standard values[6-9].

Zooplankton collection, Preservation and Identification:

Qualitative and quantitative Zooplankton analysis of the reservoir was done for the same period. From sampling spot 10 litre of water samples was filtered through plankton net of bolting silk No. 25 (mesh size 55 micrometer). Collected sample was fixed and preserved in 4% formaldehyde. Fixed sample was transferred to duly labeled polythene bottle of 20 ml and brought to the laboratory. Supernatant plankton free water was removed and sedimentary zooplankton was counted by plankton counting chamber. Identification of zooplankton was done under abinocular research microscope using keys and monographs of the help of experts of Limnology[10-11].

Correlation analysis:

The Pearson Correlation matrix(r) between physic-chemical parameter and zooplankton vailability has been done using Microsoft Excel (2010) to correlate among them.

Results and Discussion:

The relationship between the physico–chemical parameters (Table–4) and zooplankton production in reservoir water influence the trophic status. The study revealed that the total number of zooplankton was low in rainy season (July – October) and high in summer(March – June) followed by winter (November – February). Highest number of zooplankton were also reported in Summer in lower Manair Reservoir by[13]. A total number of 25 zooplankton species belonged to five groups namely Rotifera (9 species), Cladocera (6 species), Copepoda (4 species), Protozoa(5 species) and Ostracoda (1 species).

Rotifera:

Rotifera was the dominant group out of total zooplankton population and represented by 9 species belonging to 6 genera. The occurrence of rotifera was highest i.e. 430 Ind./l in April, 2013 and lowest i.e. 40 Ind./l in September, 2012 (table-1). The commonly occurring rotifers were *Keratella sp., Brachionus sp.* which were found all over the year. Rotifer population was positively correlated with D.O. (r = 0.4057), transparency (r = 0.0971), etc. Many researcher showed that the transparency, DO were favour for rotifer population[12,14]. On the contrary, this population were negatively correlated with water turbidity (r = - 0.2351) and BOD(r = - 0.4099), etc. Similar observation were also registered in Loktak Lake, Manipur[15].

Cladocera:

In the present study, Cladocera group were occupied by 6 species. The population was maximum in number i.e. 240 Ind./l in the month of January but minimum in the month of May ie. 20 Ind./l (table– 1). This group was dominated by *Diphonosoma excisum, Ceriodaphnia reticulate, Daphnia magna, Moina micrura, ,Bosmina longirostris, Macrothrix rosea*. Cladocerans showed markedly positive correlation with DO and transparency, etc. and negative correlation with water temperature, BOD, phosphate, etc (table-2). Negative correlation with phosphate had also been reported[16-17].

Copepoda:

Diaptomus sp., Cyclops leuckarti, Naupilus larvae, Mesocyclops leuckartii were the dominant genera under the group copepod. This group was represented by 4 species. The occurrence of copepods were highest i.e. 240 Ind./l in the month of March, 2013 whereas lowest i.e. 10 Ind./L in the month February, 2013 (table-1). Copepods made positive correlation with water PH (r = 0.2300), temp. (r = 0.4418), etc.while made negative correlation with trancperency(- 0.2155) in (table-2). Positive correlation with water pH and negative correlation with transparency coincides with the investigation of Tulsi Reservoir, Maharastra[16].

Protozoa:

The members of the Protozoa were *Euglena sociabilis, Amoeba proteus, Arcella discoid, Difflugia limnetica, Paramecium caudatum.* The occurrence of *Paramecium and Arcella sp.* are very remarkable event. It is to be mentioned that *Paramecium and Arcella sp.* are very sensitive to physico–chemical parameters. The highest density i.e. 150 Ind./l was found in the month of May, 2013 and lowest i.e. 30 Ind./l in the month of February, 2013 (table–1). This group set up strongly positive correlation with temperature, phosphate, BOD[17], etc and negative correlation with DO and transperancy (table–2). Positive correlation with temperature and chloride were also suggested for Rishi Lake[18].

Ostracoda:

Cypris pelluotella spp. were the representative of ostracoda group which was found numerous in number i.e. 150 Ind./l in the month of February and very poor i.e. 0 Ind./l in the month of October and June. This group demonstrate positive correlation strongly with Trancperency, Total hardness, chloride and negative correlation with water temperature, BOD, sulphate, phosphate etc (table–2). This group was mostly abundant in winter season and built also negative correlation with alkalinity which was also found in Wular Lake[19].

Correlation between Total zooplankton fauna and physico–chemical parameters:

To assess the overall impact of different parameters (Table-4) on zooplankton abundance, correlation were made between total zooplankton population and water parameters (table-3). Zooplankton population showed notable positive correlation with D.O. (r = 0.3676),Trancperency (r = 0.0958) and Total hardness(r = 0.3786) etc. On the contrary, negative correlation were made with water Turbidity (r = -0.1522), E.C. (r = -0.0279), COD(r = - 0.2079), BOD(r = - 0.3982), Sulphate(r = - 0.2593), etc (table– 3). Some research also reported the positive correlation with Trancperency,Hardness and DO and negative correlation with water COD, BOD, etc. Such findings corroborate our results[20-21].

Conclusion:

The maximum number of zooplankton during summer followed by winter and rainy season indicates favourable physico-chemical condition in relation to zooplankton population. Transparency, dissolved oxygen, PH was observed high in winter months and these provide plentiful environment for thegrowth of plankton[22-25]. In OttuReservoir, zooplankton density was greatly concerned at consumer level of reservoir ecosystem. In this reservoir chiefly contributed group were rotifera peak in April, cladocera peak in January,copepoda peak in March, protozoa peak in May, ostracoda peak in February during the study period. A huge number of zooplankton availability was due to the richness of dissolved oxygen, pH, transparency. The availability of zooplankton were rich by rotifera>copepoda>cladocera>protozoa>ostracod respectively in relation to water quality. In total during study period the zooplanktons ranges from 270(December) to 1040(March) Ind./l .

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Table–1: Zooplanktons (Individuals/l) of Ottu reservoir during the study period from April, 2012 to June, 2013

S.No.	Months	Availability of Zooplanktonic Groups (Ind./l)					Total
		Rotifera	Cladocera	Copepoda	Protozoa	Ostracoda	
1.	April	230	90	100	120	10	**550**
2.	May	200	20	90	130	20	**460**
3.	June	260	80	170	70	10	**590**
4.	July	120	80	90	70	70	**430**
5.	August	60	60	20	60	30	**230**
6.	September	40	40	140	40	20	**280**
7.	October	70	30	110	70	0	**280**
8.	November	90	80	120	50	20	**360**
9.	December	150	30	20	40	30	**270**
10.	January	260	240	40	70	90	**700**
11.	February	330	230	10	30	150	**750**
12.	March	420	150	240	90	140	**1040**
13.	April	430	130	140	110	60	**870**
14.	May	320	100	120	150	10	**700**
15.	June	220	130	130	100	0	**580**
Total		**3200**	**1490**	**1540**	**1200**	**660**	**8090**

Table–2: Correlation between physico – chemical parameters and different groups of Zooplankton of Ottu reservoir during study period from April, 2012 to June, 2013

S.No.	Parameters	Zooplanktonic Groups				
		Rotifera	Cladocera	Copepoda	Protozoa	Ostracoda
1.	Atmo.Temp.(^{0}C.)	+0.1463	-0.3073	+0.4355	+0.6300	-0.4257
2.	Water Tem.(^{0}C.)	+0.0805	-0.3450	+0.4418	+0.5996	-0.4399
3.	pH	+0.5391	+0.2679	+0.2300	+0.4909	-0.1107
4.	Turbidity(NTU)	-0.2351	-0.1915	+0.1313	+0.1161	-0.1343
5.	Trancperency (cm.)	+0.0971	+0.3230	-0.2155	-0.3779	+0.3298
6.	E.C. (µs/cm)	-0.0006	-0.3879	+0.4075	+0.516	-0.5260
7.	Total alkinity (mg/l)	+0.2495	-0.1589	+0.3106	+0.7789	-0.3429
8.	TDS(mg/l)	+0.4996	+0.1971	+0.3860	+0.6685	+0.0272
9.	Total hardness (mg/l)	+0.3899	+0.0694	+0.2474	+0.5376	+0.0618
10.	Free CO2 (mg/l)	+0.3849	-0.1744	+0.4383	+0.7942	-0.3096
11.	DO (mg/l)	+0.4057	+0.5380	-0.2931	-0.2978	+0.6222
12.	COD (mg/l)	-0.2628	-0.1975	+0.1785	+0.7078	-0.3793
13.	BOD (mg/l)	-0.4099	-0.0448	+0.1445	+0.6209	-0.0441
14.	Chloride (mg/l)	+0.6559	+0.2772	+0.3636	+0.6935	+0.0700
15.	Nitrate (mg/l)	+0.2306	-0.0978	+0.3867	+0.5320	-0.3893
16.	Sulphate (mg/l)	-0.1817	-0.5038	+0.0373	+0.5684	-0.5836
17.	Phosphate (mg/l)	-0.2650	-0.6175	+0.3725	+0.3597	-0.6274

Table–3: Total zooplankton basis correlation of Ottu reservoir during study period from April, 2012 to June, 2013

S.No.	Parameters	Correlation coefficient (r)
1	Atmo.Temp.(^{0}C.)	+0.1103
2	Water Tem.(^{0}C.)	+0.0596
3	pH	+0.4658
4	Turbidity(NTU)	-0.1522
5	Trancperency (cm.)	+0.0958
6	E.C. (µs/cm)	-0.0279
7	Total alkinity (mg/l)	+0.2121
8	TDS(mg/l)	+0.5197
9	Total hardness (mg/l)	+0.3786
10	Free CO2 (mg/l)	+0.3203
11	DO (mg/l)	+0.3676
12	COD (mg/l)	-0.2079
13	BOD (mg/l)	-0.3982
14	Chloride (mg/l)	+0.6301
15	Nitrate (mg/l)	+0.1931
16	Sulphate (mg/l)	-0.2593
17	Phosphate (mg/l)	-0.2878

Table –4: Minima,maxima and average values of physico–chemical parameters of Ottu Reservoir during April 2012-June 2013

S.R.	Parameters	Minima	Month	Maxima	Month	Average
1.	Atmo.Temp.(^{0}C.)	20.15	January	44.10	June	33.99
2.	Water Temp.(^{0}C.)	18.90	January	36.09	June	28.25
3.	pH	7.02	October	8.12	June	7.59
4.	Turbidity(NTU)	13.78	Dec.	24.13	July	18.2
5.	Trancperency (cm.)	22.15	August	43.42	Dec.	31.95
6.	E.C. (µs/cm)	281.7	January	397.2	June	339.14
7.	Total alkinity (mg/l)	128	Dec.	192	May	155.33
8.	TDS(mg/l)	540	Dec.	992	July	828.67
9.	Total hardness (mg/l)	63.50	Nov.	120.28	April	103.81
10.	Free CO2 (mg/l)	1.45	January	7.12	April	4.38
11.	DO (mg/l)	2.70	June	4.50	Dec.	3.36
12.	COD (mg/l)	11.21	Dec.	21.52	June	16.74
13.	BOD (mg/l)	5.23	Nov.	12.23	June	9.47
14.	Chloride (mg/l)	11.85	Sep.	39.50	June	27.56
15.	Nitrate (mg/l)	1.16	Dec.	1.80	June	1.40
16.	Sulphate (mg/l)	4.12	Nov.	8.86	May	5.84
17.	Phosphate (mg/l)	0.93	January	2.12	June	1.59

EC=Electric conductivity, DO = Dissolved oxygen,Temp. = Temperature, TDS = Total Dissolved Solids, COD= Chemical oxygen demand, BOD = Biological oxygen demand

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