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***Research Article** (Open Access)*

OSTRACODS AS INDICATORS OF WATER QUALITY IN JANNAPURA TANK, KARNATAKA

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ABSTRACT

Ostracods are sensitive to changes in the water quality and are regarded as valuable bio-indicators therefore they are used in investigation of water quality. To show the patterns of Ostracoda variety in the ecosystem Jannapura tank was examined during January to December 2016. This paper summarizes the diversity of six Ostracod species in the present water body. In the present study 06 species of Ostracods were recorded . The highest density of Ostracod was recorded during April (68 O/L) and minimum density was recorded in June (06 O/L).In the present study, water temperature ranged from 16^{o}C to 32^{o}C. pH of the water was alkaline. TDS level fluctuated from 295-650 mg/l. Total hardness deviated from 210-310 mg/l.Calcium and magnesium contents ranged from 52-102 and 11-45 mg/l respectively. Nonetheless, Carbonate and bicarbonate levels fluctuated from 120-520 and 150-530 mg/l respectively. Phosphate content between 0.45 mg/l and 1.1 mg/l. However, nitrate level varied from 0.12-0.18 mg/l.Their community structure not only allows estimating of the level of pollution, but also indicates the trend of general conditions over time. If changes in species diversity and population abundances result from either direct or indirect environmental stressors, then the changes in biota may be used to elucidate changes in the environment.

***Keywords**: Ostracoda, Water quality, WQI, Jannapura tank, One way ANOVA*

INTRODUCTION

Ostracods, constitute one of the important group of zooplanktons and are commonly known as ‘seed shrimps’. They have a laterally compressed body and a bivalved carapace enclosing the head along with trunk and limbs. These are found in a wide variety of aquatic habitats like lakes, pools, streams and especially shallow water bodies where weeds or algae are abundant. They play an important role in transferring the energy from producers to the consumers and they occupy an intermediate position in aquatic food web by being live food for fishes (Padmanabha and Belagali, 2008).

Only few researchers have conducted investigation on the composition and seasonal variation of freshwater Ostracods in various parts of India (Ganapati *et al.*, 1943; Vandysh, 2004, Padmanabha & Belagali,2008, Sontakke *et al.*, 2010; Ramulu *et al.*, 2011; Sontakke and Mokashe, 2014)

Zooplankton are sensitive to changes in the aquatic environment and any variation in their composition is often a reaction of significant alteration in ambient conditions within aquatic ecosystem. The factors regulating their abundance may be hydrological, chemical, physical and biotic (Ramesha and Sophia, 2013; Priyanka Malhotra and Ajay Kumar, 2014; Harish Kumar and Kiran, 2016). Therefore, the current investigation deals with variety of Ostracoda in relation to physico-chemical factors of sewage fed tank of Bhadravathi taluk , Karnataka.

MATERIALS AND METHODS

Study area

Jannapura tank is situated near Bhadravathi town in Shivamogga district of Karnataka (Figure 1) ($13^{o}48'37"$-$13^{o}52'30"$N & $75^{o}40'42"$-$75^{o}43'33"$E). This tank is perennial as it receives the water from Bhadra left bank channel and rain water. It has an area of 20 ha and depth of about 5-10mt. The water is utilized for irrigation and fisheries. The tank is also covered by aquatic flora and provide habitat for water birds.

Figure 1: Map showing location of Jannapura tank in Bhadravathi taluk of Shivamogga district *(Source : kssidc.in and https://ellakavi.files.wordpress.com/2007)*

Ostracod samples were collected by towing plankton net (50 µm mesh size) horizontally at a depth of 50 cm for about 10 minutes and preserving the collection in 5% formaldehyde. The ostracods were identified as per the key given by Edmondson (1959), Victor and Fernando (1979) and Begum and Altaff (2004). Abundance of ostracods was estimated by using Sedgwick rafter cell.

Water Quality Index (WQI)

WQI indicates the quality of water for any intended use. It is defined as a rating reflecting the composite influence of different water quality parameters were taken into consideration for the calculation of water Quality index (WQI) (Asit Kumar Batabyal and Surajit Chakraborty (2015).

$Wi = wi/\sum wi$ (i = 1 to n)

Wi= Relative weight, wi=Weight of each one parameter, 'n'= Number of parameter

$qi = (Ci / Si) \times 100$

qi= quality rating, Ci=Concentration of every chemical parameter , and Si=Guide line value/desirable limit as given in Indian drinking water standard (BIS, 2004).

For computation of WQI, the sub index (SI) is first determined for each chemical parameter, as given below:

$SIi = Wi \times qi$

$WQI = \sum SIi$ 1 - n

Where, SIi=sub-index & Wi=Relative weight of i^{th} parameters; qi= Rating based on concentration of i^{th} parameter, and 'n' - number of chemical parameters.

According to Sinha et al. (2004), Padmanabha & Belagali (2008), if, water quality index (WQI) is less than 50 water is slightly polluted and fit for human consumption, WQI between 51 - 80 – moderate pollution, WQI between 50 - 100 – excessive pollution and WQI >100 – Severe pollution (Table 2).

Statistical Analysis

One way ANOVA was carried out for physic-chemical parameters of water samples by using software's (www.statskingdom.com; goodcalculators.com).

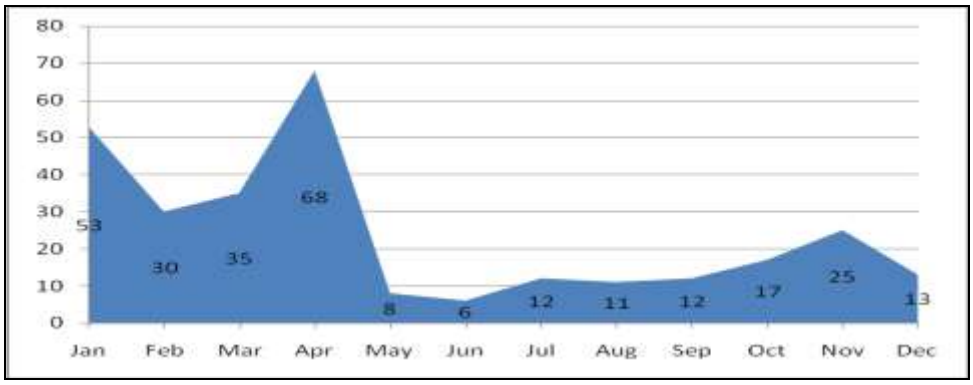

Figure 2: Abundance and Distribution of Ostracoda (O/L) in Jannapura tank during 2016

Table 1: One Way ANOVA data

Parameters	N	Mean	Std. Dev.	Std. Error
WT	12	25.5833	5.6159	1.6212
TDS	12	446.25	126.0253	36.3804
pH	12	8.8667	0.1923	0.0555
TH	12	255	26.7989	7.7362
Ca	12	78.5	15.7336	4.5419
Mg	12	27.9167	9.5008	2.7426
Co3	12	257.0833	151.1089	43.6214
HCO3	12	300	121.5244	35.0811
PO4	12	0.7125	0.228	0.0658
NO3	12	0.1467	0.0197	0.0057

Source	Degrees of Freedom DF	Sum of Squares SS	Mean Square MS	F-Stat
Between parameters	9	2782974.6505	309219.4056	56.6626
Within parameters	110	600292.8337	5457.2076	
Total:	119	3383267.4842		**P-value**
				0

Table 2: Occurrence of Ostracods in four sites of Jannapura tank,Karnataka

Ostracoda	Site I	Site II	Site III	Site IV
Cypris protubera (*Victor & Fernando*)	+	+	+	+
Cyprinotus nudus	+	+	+	+
Stenocypris fontinalis (Vavra,1895)	-	+	+	+
Hemicypris anomala	-	-	+	+
Eucypris bisponsa (*Victor &Michael,1975*)	+	-	+	-
Cyclocypris globosa (*Bars,1863*)	+	-	-	-

+= present - = Absent

Table 3: WQI in the four sites of Jannapura tank

Sites	Rainy	Winter	Summer
I	61.40	58.5	71.9
II	90.3	87.0	98.0
III	104.5	98.5	107.0
IV	28.9	108.8	140.6

<50=slight pollution; 51 - 80 – moderate pollution; 50 - 100 – excessive pollution; >100 – Severe pollution.

Table 4: CPCB and WHO Permissible limit of physico-chemical characteristics of water

Parameter	**Maximum permissible limit, CPCB (1995)**	**WHO (2004)**
pH	6.5-8.5	7.0-8.5
TDS (mg/l)	500	500
TSS (mg/l)	100	-
BOD (mg/l)	30	6
COD (mg/l)	250	-
Calcium(mg/l)	75	-
NO_3(mg/l)	45	10
Chloride(mg/l)	200	-
Sulphate(mg/l)	200	-
Total hardness(mg/l)	-	500
Alkalinity (mg/l)	30	120

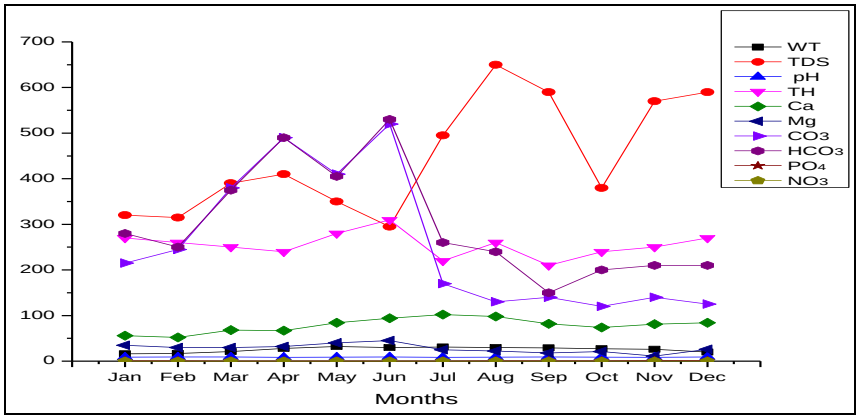

Figure 3: Monthly variations in physico-chemical parameters in the water samples of Jannapura tank

Bureau of Indian Standards (1991) Indian Standard Drinking Water-Specification. 1st rev. Bureau of Indian Standards: New Dehli, India

RESULTS AND DISCUSSION

In the present study 06 species of Ostracods were recorded (Table 2). The highest density of Ostracod was recorded during April (68 O/L) and minimum density was recorded in June (06 O/L) (Figure 2). Analogous observations are made by Padbhanabha and Belagali (2008) and Mirgane *et al.*, (2015) and they reported that highest abundance of ostracods during summer months. Sunkad (2004) and Manzer *et*

al., (2005) also reported the seasonal fluctuation of Ostracodan abundance in the fresh water lentic ecosystems.

Sakhre and Joshi (2006) reported 8 species of rotifers, 7 species each of cladocera and copepoda and 4 species of Ostracoda in Yeldari reservoir.

Padmanabha and Belagali (2006) also published work on rotifers in the lakes of Mysore city. Their observations indicates that, as water quality index increases, population density of Ostracods increases but species diversity decreases. The WQI fluctuates in seasons due to numerous factors such as the volume of water, density of aquatic life, the quantity and quality of sewage access to the tanks. Elevated pollution level changes the environment of the water body, in which only a few species can tolerate and later flourish due to better adaptability and decreased competition from other species.

Sontakke and Mokashe (2014) studied the population density of ostracoda in two freshwater lakes of Maharashtra,India. They identified a total of 8 species from Kagzipura lake and 4 species from Mombatta Lake. The population density of ostracod in Kagzipura lake is rich than the Mombatta lake . Their results indicate that the density of Ostracoda in both lakes increase in summer and decreases in monsoon season.

The current results shows that the pattern of density of ostracods observed to be increase in summer month (April) and decrease in rainy season (June). In summer season the growth of algae and aquatic plants is high due to anthropogenic activities, small scale industries and contamination of sewage. Hence, the abundance of ostracods, especially those of cosmopolitans, could be the indicator of pollution (Padmnabha & Belagali, 2008; Sontakke *et al.,* 2010). Pandit *et al.,* (2007) reported the poor number of Ostracods in Pravara river in Ahmedsagar, Maharashtra.

Physico-chemical characteristics of Water

In the present study, water temperature ranged from 16^{o}C to 32^{o}C. pH of the water was alkaline ranging from 8.6 (April, July) to 9.1(March, June). TDS level fluctuated from 295 mg/l in June to 650 mg/l in August. Total hardness deviated from 210 mg/l (September, November) to 310 mg/l in the month of June. Calcium and magnesium contents ranged from 52-102 in February-July and 11-45 mg/l in November-June respectively. Nevertheless, Carbonate and bicarbonate levels fluctuated from 120-520 mg/l (October-June) and 150-530 mg/l (September-June) respectively. Phosphate content between 0.45 mg/l in March and 1.1 mg/l in November. However, nitrate level varied from 0.12 mg/l (February-March) to 0.18 mg/l(June, November) (Figure 3).

One Way ANOVA test, using F distribution df(8,99) (right tailed)

H_0 hypothesis

Since p-value<α, H_0 is rejected.

Some of the groups' averages consider to be not equal.

In other words, the difference between the averages of some groups is big enough to be statistically significant.

P-value

p-value equals **0.00000**, [p(x ≤ F) = 1.000000]. This means that the chance of type1 error (rejecting a correct H_0) is small: 0.000 (0.0%)

The smaller the p-value the stronger it support H_1

The statistics

The test statistic F equals **56.6626**, is not in the 95% critical value accepted range: [-∞ : 2.0333]

Effect size

The observed effect size f is **large** (2.09). That indicates that the magnitude of the difference between the averages is large. The η^2 equals 0.81. It means that the group explains 81.3% of the variance from the average (similar to R^2 in the linear regression)

CONCLUSION

Conclusion of this study on physico-chemical parameters with zooplankton of a sewage fed pond are summarized below: In this tank water temperature is always less than air temperature. pH of the water is always alkaline. Maximum DO during some months might be due to increased photosynthetic activity while, lower values may be because of its utilization during decomposition of organic matter and respiration by microbes. Higher values of phosphate and nitrate during the study were due to sewage input into the tank. Interspecific and intraspecific factors influence the distribution and abundance of Ostracoda. The pollution load fluctuate in different months due to numerous factors such as the volume of water, density of biotic organisms, inflow of domestic sewage. The domestic activities must be banned to minimize the pollution load. Municipal establishment can have facilities there Creation Park with Ornamental plants, Fish Aquarium house, boating facility, swimming pool etc.

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