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Ostracods as indicators of pollution in the lakes of Mysore

B. Padmanabha* and S.L.Belagali

Department of Studies in Environmental Science, Manasagangothri University of Mysore, Mysore-570 006, India

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Abstract: *Ostracods are small crustaceans found in aquatic habitats and the present paper deals with the role of water quality index on their population diversity and seasonal fluctuations in the four lakes of Mysore city. The present investigation was carried out from July 2004 to June 2005. The study revealed highest water quality index and population density of ostracods during summer and least during winter. Dalvoi lake recorded higher water quality index (125.04), population density (60 l^{-1}) but lower species diversity (2 species) of ostracods, whereas Kamana lake recorded lowest water quality index (63.49), population density (40 l^{-1}) and highest species diversity (6 species) of ostracods. Increase in the water quality index indicates increase in the pollution load. As water quality index (WQI) increases, population density of ostracods increases but species diversity decreases*

Key words: *Mysore lakes, Water quality index, Ostracods, Pollution, Population diversity*
PDF of full length paper is available with author ***(*padmanabhavb@yahoo.co.in)***

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. The diversity, abundance and seasonal fluctuations of ostracods have direct link with water quality. The water quality index (WQI) is computed to reduce large amount of water quality data to single numerical value reflecting composite influence of different hydrographical parameters (Tiwari and Mishra, 1985). Comparative study of seasonal variations of zooplankton communities of fresh water perennial ponds were made during November 2002 to October 2003. The zooplankton belonging to rotifers, copepods, cadocerans and ostracods and protozoans were recorded in both the ponds (Gausaghat and Gami ponds). The higher abundance of zooplanktonic fauna was recorded during summer, while lower value during rainy season. This fluctuation of zooplankton is mainly due to environmental changes (Sunkad, 2004; Sheeba and Ramanujan, 2005; Manzeer *et al.,* 2005; Duran and Suicmez, 2007). In this paper an attempt is being made to assess the influence of WQI on the species diversity, abundance and seasonal fluctuations of Ostracods in the four lakes of the Mysore city.

Materials and Methods

The study area covers four lakes namely - Kamana, Kukkarahally, Karanji and Dalvoi lake in the Mysore city. The water samples were collected on monthly basis from July 2004 to June 2005 and analyzed as per methods described by APHA (2005) and Kodarkar *et al.* (1998). Nine water quality parameters were considered for calculation of water quality index (Harkins, 1974; Tiwari *et al.*, 1986; Tiwari and Manzoor, 1988; Mohanta and Patra, 2000; Kesharwani *et al*., 2004; Padmanabha and Belagali, 2005). Mean value of each parameter was calculated from three seasons data and compared with the ICMR recommended standards for water quality parameters to compute water quality index.

Water quality index (WQI) = $\sum q_i w_i$

Where q_i (water quality rating) = 100 X $(V_a - V_i) / (V_s - V_i)$,

When V_a = actual value present in the water sample

V_i = ideal value (0 for all parameters except pH and DO which are 7.0 and 14.6 mg l^{-1} respectively).

V_s = standard value.

If quality rating q_i =0 means complete absence of pollutants,

While $0 < q_i < 100$ implies that, the pollutants are within the prescribed standard.

When q_i >100 implies that, the pollutants are above the standards (Mohanty, 2004).

W_i (unit weight) = K / S_n

where K (constant) = $\frac{1}{1/Vs1 + 1/Vs2 + 1/Vs3 + 1/Vs4 - - - - - 1/Vsn}$

S_n = 'n' number of standard values.

According to Sinha *et al.* (2004), if, water quality index (WQI) is less than 50 such water is slightly polluted and fit for human consumption, WQI between 51 - 80 – moderately polluted, WQI between 50 - 100 – excessively polluted and WQI >100 – Severely polluted.

Table - 1: Seasonal mean values of water quality parameters in the lakes of Mysore city (July 2004 – June 2005)

Parameter	Kamana lake			Karanji lake			Kukkarahally lake			Dalvoi lake		
	Monsoon	Winter	Summer	Monsoon	Winter	Summer	Monsoon	Winter	Summer	Monsoon	Winter	Summer
pH	8.30	8.00	8.62	8.35	8.38	8.63	8.65	8.40	8.94	7.50	7.48	7.91
TDS	263	250	530	530	420	512.5	550	510.5	587.5	580	525	597.5
DO	4.6	4.8	4.45	3.5	4.0	4.8	4.4	4.4	5.2	2.0	3.2	1.10
BOD	0.4	0.3	1.0	3.10	2.4	4.6	4.2	4.0	4.6	8.0	7.0	10.2
Chloride	41.62	40.8	52.45	95.63	102.07	233.25	245.5	230.8	251.4	290	255	292.5
Alkalinity	185	180	212.5	240	227.5	288.25	305	260.5	316.7	325	297.5	337.5
Hardness	146.75	124.5	163	240	222.5	230	232.5	225	247.5	457.5	412.5	465
Ca^{2+}	91.34	80.5	107.85	202.7	175.5	187.5	227.5	185.2	245	391.25	297.7	392.5
Mg^{2+}	20.2	19.2	21.37	31	28.17	32.36	42.52	30.5	44.64	59.68	48.04	68.34

Number of sample, n = 12, All parameters are expressed in mg l^{-1} except pH

Table - 2: WQI of four lakes in the Mysore city

Lake	Monsoon 2004	Winter 2004	Summer 2005
Kamana lake	62.30	57.50	70.68
Karanji lake	89.20	85.00	97.00
Kukkarahally lake	102.40	97.80	106.57
Dalvoi lake	27.80	107.50	139.81

<50 = Slight pollution, 51-80 = Moderately polluted, 81-100 = Excessively polluted, > 100 = Severely polluted

Ostracod samples were collected by towing plankton net (50 µm mesh size) horizontally at a depth of 40 cm for about 10 minutes and preserving the collection in 4% formaldehyde. The specimens were identified with the help of keys given by Edmondson (1959), Victor and Fernando (1979) and Begum and Altaff (2004). Abundance of ostracods was estimated by using Sedgwick rafter cell.

Results and Discussion

Water quality index is the most effective way to communicate water quality. WQI = 0 means complete absence of pollutants. When 0 < WQI <100, indicates the water is under consideration and fit for human use and WQI >100 reflects its unsuitability for human use (Bahera *et al*., 2004).

According to Table 2, four lakes recorded highest water quality index during summer and lowest during winter. In summer, Dalvoi lake documented highest WQI (139.81) followed by Kukkarahally (106.57), Karanji (97.00) and Kamana lake (70.68). During three seasons, Dalvoi lake recorded highest WQI and Kamana lake recorded lowest WQI. Increase in the WQI indicates, increase in the pollution load. So Dalvoi lake was more polluted as compared to other three lakes, whereas Kamana lake showed lowest pollution load. Mohanta and Patra (2000), Bahera *et al*. (2004), also reported highest WQI during summer and lowest in the winter season. Padmanabha and Belagali (2005) reported highest WQI in Dalvoi lake and lowest in the Kamana lake with seasonal fluctuations.

During summer, the water level in the lakes decreases and metabolic activities of biotic components increase significantly. So, due to the decreased water level, increased metabolic activities of the biotic components and inlet of corporate sewage in to the lakes, the water quality index or pollution load increases during summer. Dalvoi lake receives largest quantity of corporation sewage from the Mysore city. Kukkarahally lake and Karanji lake receives small quantity of domestic

Table - 3: List of ostracods found in the four lakes of Mysore

Ostracods	Kamana lake	Karanji lake	Kukkarahally lake	Dalvoi lake
Cypris protubera (Muller, 1776)	+	+	+	-
Cyprinotus nudus (Brady, 1885)	+	+	+	+
Stenocypris major (Sars, 1890)	+	+	+	-
Strandensia elongata (Stuhlmann, 1888)	+	+	-	-
Heterocypris dentatomarginatus (Strauss, 1821)	+	-	-	-
Indiacypris dispar (Fischer, 1851)	+	-	-	-
Hemicypris anomala (Furtos, 1933)	-	+	-	+
Total species (7)	6	5	3	2

- = Absent, + = Present

Table - 4: Seasonal variations in the ostracods density (No l^{-1}) during July 2004 - June 2005

Season	Month	Kamana lake	Karanji lake	Kukkarahally lake	Dalvoi lake
Monsoon	July 2004	06	08	10	11
	Aug. 2004	05	08	12	14
	Sept. 2004	06	09	14	15
	Oct. 2004	06	09	13	15
	Total	**23**	**34**	**49**	**55**
Winter	Nov. 2004	06	07	09	11
	Dec. 2004	03	05	09	08
	Jan. 2005	04	03	05	09
	Feb. 2005	02	04	06	10
	Total	**15**	**19**	**29**	**38**
Summer	Mar. 2005	08	10	12	14
	Apr. 2005	10	12	14	15
	May 2005	12	15	16	17
	June 2005	10	13	12	14
	Total	**40**	**50**	**54**	**60**
	Annual average	**26**	**34**	**44**	**51**

sewage from the city continuously. Kamana lake receives small quantity of sewage from the nearby village occasionally.

Seven species of ostracods were identified during the study period (Table 3). *Cypris protubera* (Muller, 1776), *Cyprinotus nudus* (Brady, 1885), *Stenocypris major* (Sars, 1890), *Strandensia elongata* (Stuhlmann, 1888), *Heterocypris dentatomarginatus* (Strauss, 1821) *Indiacypris dispar* (Fischer, 1851) and *Hemicypris anomala* (Furtos, 1933). The Kamana lake (6 species) recorded the highest number of species of ostracods. Karanji lake (5 species), Kukkarahally (3 species) and Dalvoi lake (2 species) recorded the lowest number of species.

According to Table 4, all the four lakes recorded highest abundance of ostracods during summer and lowest during winter (Table. 4). Dalvoi lake documented highest and Kamana lake recorded lowest abundance of ostracods during all the three seasons. In summer, Kamana lake recorded lowest population density (40 l^{-1}), followed by Karanji (50 l^{-1}), Kukkarahally (54 l^{-1}) and Dalvoi lake (60 l^{-1}). Analogus results were reported by Bedre and Pai (2004) and Jeelani *et al*. (2004) for rotifers. Sunkad (2004) and Manzer *et al*. (2005) also reported the seasonal fluctuation of ostracodan abundance in the fresh water lentic ecosystems.

During this study period, Dalvoi lake documented highest WQI (125.04) and population density (51l^{-1}) but lowest species diversity (2 species), whereas Kamana lake recorded lowest WQI (63.49) and population density (26 l^{-1}) but highest species diversity (6 species). Padmanabha and Belagali (2006) also published similar results for rotifers in the lakes of Mysore city. These observations indicates that, as water quality index increases, population density of ostracods increases but species diversity decreases. The WQI or pollution load fluctuates in different lakes and seasons due to several factors such as the volume of water, density of biota, the quantity and quality of domestic sewage access to the lakes. High pollution level changes the environment of the lakes, in which only a few species can tolerate and later flourish due to better adaptability and decreased competition from other species.

The concepts of the research may be extended into fishery biology public health, ecotoxicology, pollution monitor, pollution control *etc.*

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