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DIVERSITY OF ZOOPLANKTON IN MORNA LAKE, WESTERN GHATS, MAHARASHTRA

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ABSTRACT

Morna Lake is largest lake of ShiralaTahsil in Sangli District, Maharashtra. It is constructed over Morna River in the basin of Krishna. Present study was undertaken to investigate the physico – chemical characteristics and diversity of zooplankton of the Morna Lake. The presence of *Brachionuscalyciflorus, Brachionusrubense*. *Brachionusfalcatus* from rotifers, C*yclops, Mesocyclop* from copepods and, *Ceriodaphnia, Chydorus, Moina, Macrothrix* from cladocerans, pollution indicated species of zooplankton dominantly shows in station A (Shirala) and Station B(Padali) . These sites were infested not only by the influx of animal waste but also polluted due to domestic activities like bathing, washing, human activities and agricultural practices. The Lake was found to be moderately polluted and showed a trend of increasing eutrophication.

Figures : 14 References : 23 Tables : 04

KEY WORDS : Diversity, Eutrophication, Morna Lake ,Physico–chemical characteristics, Pollution, Zooplankton.

Introduction

Eutrophication is a global phenomenon associated with nutrient enrichment of aquatic ecosystem. In natural course it is slow process of lake ageing ultimately lead to succession. Lakes have a more complex and fragile ecosystem as they do not have a self-cleaning ability and therefore readily accumulate pollutants. The increasing anthropogenic influence in recent years in and around aquatic systems and their catchment area have contributed to a large extent to deterioration of water quality and dwindling of water bodies leading to their accelerated eutrophication.

Several lakes were made evergreen in ShiralaTahsil. They were famous for religious and cultural significance. Some of these lakes are already on the verge of disappearance due to eutrophication. These lakes therefore demand concerted attention towards a clear understanding of their ecosystem in order to mitigate further deterioration. Hence the purpose of this study was to investigate the present status of Morna Lake in term of its water quality and diversity of zooplankton.

Morna Lake is the largest lake of Shirala constructed over Morna River in Krishna basin, having a historical, ethno-cultural, religious and irrigation importance. It lies about 1 km West of Shirala. The Lake occupies an area of about 85.5km^2 and has an irregular octagonal outline. Actual length 1015 m. height 31.2 m and nature of Lake is shallow and deep.

The Lake is surrounded by farmland and there are a few flowering and thorny trees. There are several macrophytes inside and around the Lake for example: *Achyranthesaspera, Caesulia axillaries, Potamogetonnodusus, Spilanthuscalva,*

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Rotalarotundifolia, Hygrophilasclulli, Marseileasps. and*Saccharumspontaneum etc.* Among them *Hygrophilaschulli* was seen dominant in around the Lake.

Lake water being polluted is not used for drinking purpose. Local inhabitants use water for various purposes like bathing, washing swimming and cleaning cooking utensils. Inlets pouring water into lake carry chemical fertilizers and insecticides which further pollute the water.

Material and Methods

Physico–chemical and biological characteristics of the lake were studied seasonally *i.e.* during summer, rainy and winter seasons of the year 2009 to 2010. For these studies four different sites were selected on the basis of substratum structure, algal occurrence and human activities. Some of the physico-chemical characteristics of water including water temperature, depth, color, transparency, pH were determined using mercury thermometer, graduated string, visual Secchi disc, digital pH meter respectively. While dissolved oxygen, free carbon dioxide, total alkalinity, total hardness, chlorides were analyzed using titrimetric method at sampling stations. Other parameters including turbidity, electrical conductivity, total dissolved solids, nitrate-nitrogen, sulphates, potassium were analyzed in the laboratory within 6 to 8 hours following the standard methods[1,13].

Statistical analysis (correlation coefficient and standard deviation) was done on the basis of substantial availability of finding for the reality and significance of the result for plankton analysis. Two hundred liters water samples were filtered through the net no. 25 bolting silk. The samples collected were concentrated to 50 ml volume and preserved in 4% formalin. Each replicate of sample was identified under research microscope using suitable key, standard text 'Freshwater Biology[22] freshwater zooplankton[2] the Rotifer[6] and Cladocera[15]. Plankton species diversity was calculated by using Simpsons Index (D), Simpson

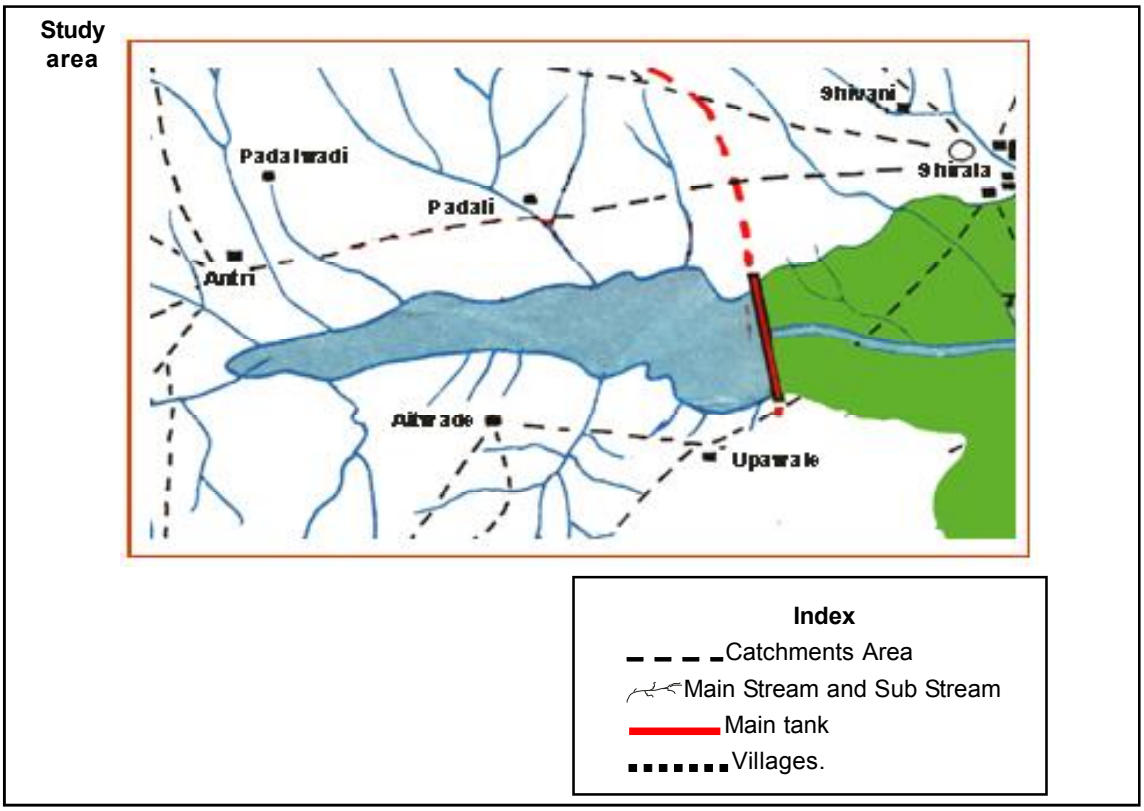

Fig.1 : Morna lake Dist. Sangli (M.S.) India

TABLE-1 : Physico–chemical characteristics of water of Morna Lake

Sr. No.	Parameters	Summer season	Rainy season	Winter season	Mean ± S.D
1.	Temperature (^{0}C)	26.74	25.13	13.94	21.93 ± 0.013
2.	Transparency (cm)	104.75	95.05	128.25	109.35 ± 4.08
3.	Total Solids (mg/l)	295.25	289.5	193.5	259.41 ± 5.53
4.	Conductivity (µs/cm)	297.75	293.75	194.75	262.08 ± 3.63
5.	pH	7.70	7.32	8.19	7.74 ± 0.069
6.	Alkalinity (mg/l)	188.5	150.05	178.25	172.26 ± 5.88
7.	Total Hardness (mg/l)	200	187.5	148.75	178.75 ± 7.98
8.	Dissolved Oxygen(mg/l)	5.35	4.77	9.86	6.66 ± 0.25
9.	B.O.D.(mg/l)	28.5	10.77	5.5	14.92 ± 2.06
10.	N-Nitrite (mg/l)	0.0157	0.020	0.032	0.023 ± 0.0014
11.	N- Ammonia (mg/l)	0.08	0.027	0.0005	0.035 ± 0.0044
12.	Orthophosphate (mg/l)	0.023	0.037	0.053	0.038 ± 0.0032

Diversity Index (1-D) , value was obtained using the following equation.

$$D = \frac{\Sigma\, n(n-1)}{N(N-1)}$$

Where n= the total number of zooplankton of a particular species.

N = the total number of zooplankton of all species.

Simpson's Index of Diversity = 1-D.

Morna , a small man made reservoir with 85.5 Sq. km^2 original catchments areas was built over a Morna River in the basin of Krishna River. The reservoir is located 1km South West of ShiralaTahsil in Maharashtra, India. Geographically it lies near 16^0 59' 2" (N) latitude and 74^0 6' 30" (E) longitudes (Fig.1). This reservoir is a multipurpose tank used for different activities like drinking water supply, irrigation, fisheries *etc.* Four sampling stations namely, station A (Shirala), B (Padali), C (Atiwade), D(Upawale) were selected for analysis of physico-chemical characteristics of water covering whole area of the reservoir.

Result and Discussion

Quality of an aquatic ecosystem is dependent on the physical and chemical qualities of water as also biological diversity of the system[20,21]. The analysis of biological materials along with chemical characteristics of water from a valid method of water quality assessment[4], hence, the physico- chemical characteristics and zooplankton composition during different seasons of a year observed in present study have been discussed below.

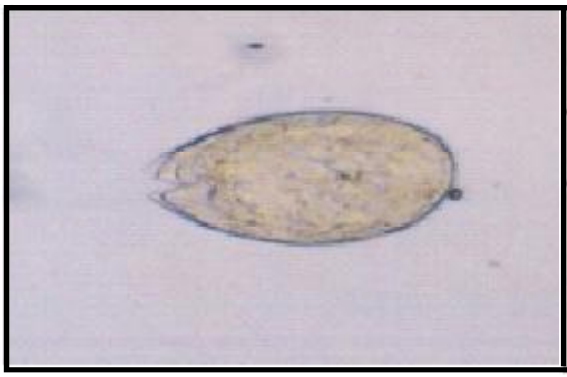

Fig. 2 : *Brachionusdurgae*

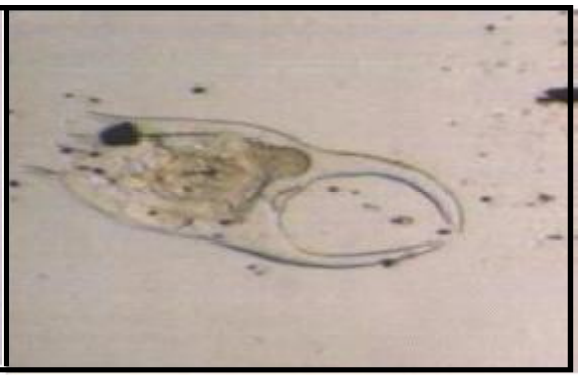

Fig. 3 : *Brachionusforficula*

Fig. 4 : *Keratellatropica*

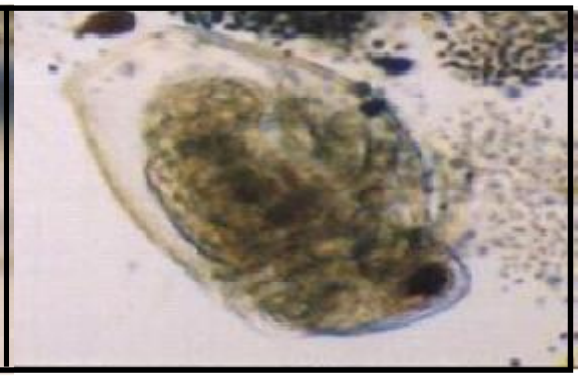

Fig.5 : *Simocephalusvetulus*

Fig. 6 : *Brachinusrubens*

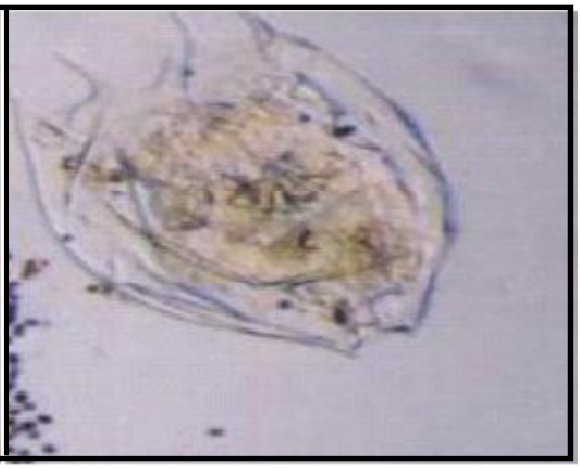

Fig. 7 : *Moina*

Physico- chemical characteristic of water of Morna lake is given in Table 1. The zooplankton composition of Morna lake is given in Table 2, Correlation coefficient (r) values between physico-chemical parameters & zooplankton of Morna Lake in Table 3. Similarly pollution indicator zooplankton is shown in Table 4.

Among zooplankton rotifers (55.40%)

TABLE-2 : Zooplankton composition of Morna Lake

Sr. No.	Zooplankton	Group	Summer season	Rainy season	Winter season
1	*Brachionusfalcatus*	Rotifer	33.43	19.12	16
2	*Brachionusrubens*	Rotifer	12.81	4.3	0
3	*Brachionuscalyciflorus*	Rotifer	24.5	21.56	5
4	*Brachionuscaudatus*	Rotifer	28.8	15.25	18
5	*Brachionusforficula*	Rotifer	8.5	9.6	0
6	*Brachionusangularis*	Rotifer	10.06	2.5	4.5
7	*Brachionuspatulus*	Rotifer	11.31	6.75	2.56
8	*Brachionusureceolaris*	Rotifer	11.16	2.93	0.87
9	*Brachionusquadridentatus*	Rotifer	3.5	11.93	10.83
10	*Camptocercusrectirostris*	Cladoceran	0	3.25	7.12
11	*Cereodaphniasps.*	Cladoceran	0	0	3.18
12	*Chydorussphaericus*	Cladoceran	22	36.25	20
13	*Cyclops sps.*	Copepods	23.56	9.5	12.75
14	*Diaptomusnauplius stage*	Copepods	21.81	0	20.33
15	*Filiniaopliensis*	Rotifer	10.12	7.58	4.25
16	*Keratellatropica*	Rotifer	22.75	23.18	6.33
17	*Keratellacochlearis*	Rotifer	20.37	14.87	2.87
18	*Lecane bulla*	Rotifer	11.25	18.87	0
19	*Mesocyclops*	Copepods	21.5	4.25	2.5
20	*Microthrixspinosa*	Cladoceran	0	4.5	8.31
21	*Moinabrachita*	Cladoceran	31.25	15.25	0
22	*Moinamicrura*	Cladoceran	28.33	7.5	5.25
23	*Simocephalusvetulus*	Cladoceran	31.44	13.37	0

TABLE-3 : Correlation coefficient (r) values between physico- chemical parameters & zooplankton of Morna Lake

Sr.No.	Parameters	Correlation coefficient (r) with		
		Rotifer	Caldoceran	Copepoda
1	Temperature (ºC)	0.567	0.629	0.328
2	Transparency (cm)	-0.341	-0.314	0.033
3	Total Solids (mg/l)	0.580	0.636	0.284
4	Conductivity (µs/cm)	0.579	0.598	0.277
5	pH	-0.330	-0.225	0.180
6	Alkalinity (mg/l)	0.016	0.351	0.618
7	Total Hardness (mg/l)	0.568	0.674	0.392
8	Dissolved Oxygen(mg/l)	-0.368	-0.445	0.037
9	B.O.D.(mg/l)	0.485	0.727	0.702
10	N-Nitrite (mg/l)	-0.410	-0.566	-0.347
11	N- Ammonia (mg/l)	0.542	0.782	0.672
12	Orthophosphate (mg/l)	-0.609	-0.756	-0.585

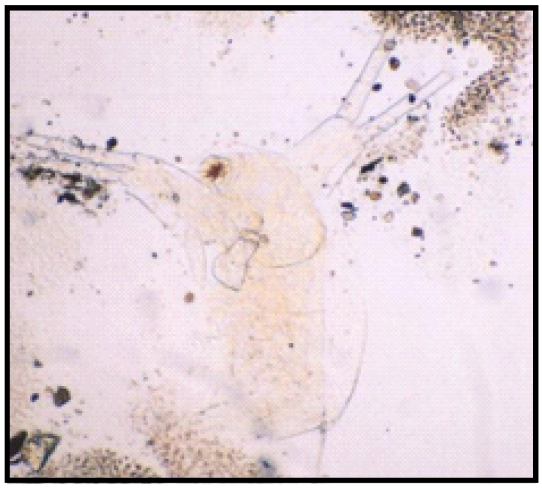

Fig. 8 : *Moinaflagellata*

dominated zooplankton followed by cladocerans (26.41%), copepods (15.96%) and ostracods (2.21%). During investigation 23 species were identified, they were abundant in summer. Rotifers represented 4 genera and 13 species. High temperature, less nutrients and low oxygen content of water favors the growth of rotifer. Higher rotifer population occurs during summer and winter might be dominant due to hypertrophical conditions of the pond at high temperature and low level of water[19]. During observation, rotifers population the numerical superiority was found to be high in the case of *Brachionus* species which are considered typical for and most frequent in tropical environment[14,16] Genus *Brachionus* is one of the most ancient genus of monogonont rotifers and is represented by 46 species in India[9,18]. Among

TABLE-4 : Pollution indicator zooplankton of Morna Lake

Sr. No.	Zooplankton	Station A	Station B	Station C	Station D
1.	*Brachionusfalcatus*	+++	+++	++	+
2.	*Rotariarotatoria*	+++	+++	+	-
3.	*Monostyla*	+++	++	-	-
4.	*Lepadella*	+++	++	-	-
5.	*Ceriodaphnia*	+++	+++	-	+
6.	*Moina*	+++	+++	+	+
7.	*Simocephalus*	++	++	-	+
8.	*Cyclops*	+++	++	-	-
9.	mesocyclop	+++	+++	+	-
·	+++-more number of zooplnkton				

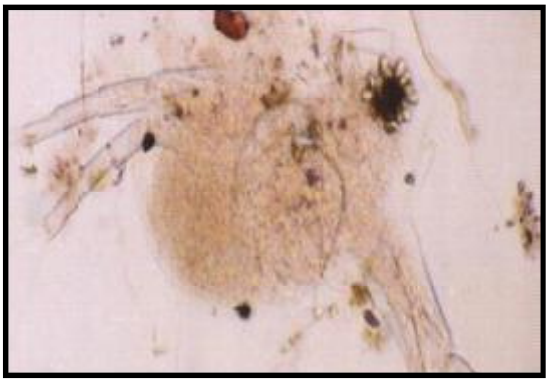

Fig. 9 : *Moina Sp.*

observed rotifers, four species *Brachionusfalcatus*, *Rotariarotatoria*, *Monostyla, Lepadella*are pollution indicator species and they were abundant at sampling site A and B (Table 4). The distribution of these species was typical at specific sampling sites. High value of Simpson's diversity index(0.629)the greater planktonic diversity[5].

The group of cladocerans was represented by 7 species. Three species (*Ceriodaphnia, Moina, Simocephalus*) were predominant at site A and B. Abundance of cladocerans was found to be directly correlated with water temp. (r =0.629). This pattern of distribution of cladocernans may be due to the interaction of various physico-chemical and biotic factors[23].

Copepods were represented by three species from observed species, pollution indicator like Cyclops, mesocyclops were abundant at sampling sits A and B. The present investigations agree with the earlier finding[8].

Temperature is one of the essential and changeable environmental factors, since it

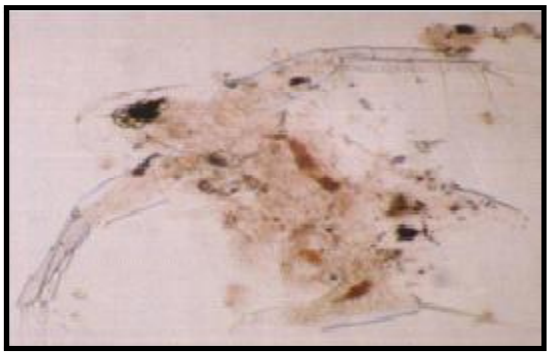

Fig. 10 : *Moinamicrura.*

Fig. 11 : *Nauplies larva.* In Copepoidae stage

influences the growth and distribution of flora and fauna. In present observation water temperature was highest (26.74) in summer and lowest (13.94) in winter (Table-1). Higher summer temperature may be suitable for the development of the planktonic organism[7,11]. In present study population,

Fig. 13 : *Mesocyclopehyalinus.*

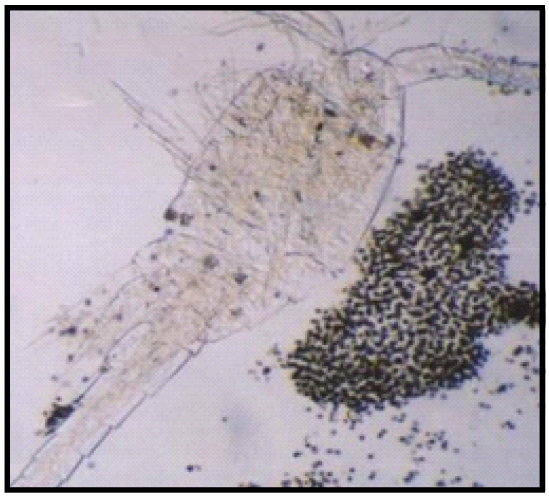

Fig. 12 : *Mesocyclopeleuc*

zooplankton was positively correlated with water temperature. Similar observations were made earlier[3].

The pH value indicated alkaline nature of water. High pH value was recorded in winter(8.19). In present investigation high electrical conductivity (EC) value (297.75) was observed in summer and this might be due to high temperature at low solubility and high degradation of organic substances. EC value shows positive correlation with zooplankton. Total alkalinity value was higher in summer and it was positively correlated with zooplankton diversity,

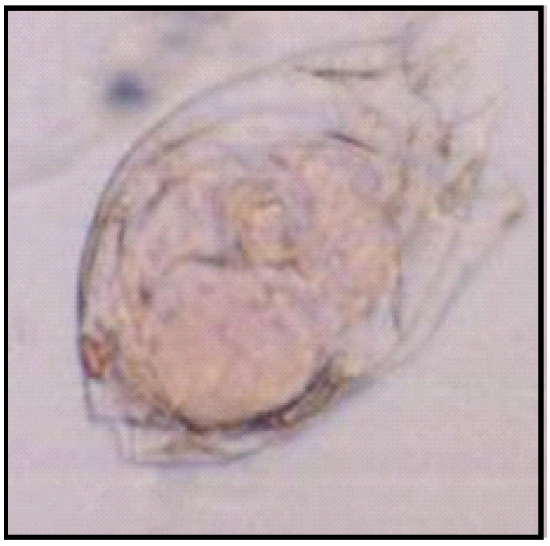

Fig. 14 : *Brachionuscalyciflorus.*

suggested that high value of total alkalinity coinciding with the high planktonic yield[8,19]. The value of Total Hardness was higher in summer and it was positively correlated with zooplankton population[17].

Estimation of BOD is an important measure to the oxygen required for the degradation of organic matter. High BOD value recorded during summer. BOD value shows positive correlation with zooplankton population. Dissolved oxygen is an important aquatic parameter whose measurement is vital in the context of culture of any aquatic animal as oxygen plays a crucial role in its life processes. High concentration of dissolved oxygen(9.86) recorded during winter.

Results obtained suggest that Morna lake is moderately polluted and showed a trend of increasing eutrophication. The values of some physico-chemical parameters and abundance of pollution indicator species study particularly at sampling sites A and B, It appears that the lake water is unsafe for intestine pisciculture if proper measures are not undertaken.

References

1. APHA (1995) Standard methods for examination of water and wastewater, Nineteenth Edition, Washington D.C.

2. BATTIS, S.K. (1998) Freshwater zooplankton of India. *Oxford and IBH publication co-pvt.Ltd*.,1-23

3. BHUIYAN, J.R. AND GUPTA, S. (2007) A comparative hydrobiological study of a few ponds of bark valley, Assam and their role as sustainable water resources. *J. Environ. Bio*., **28,**799-802.

4. CAIRN, J. AND DICKSON, K.L. (1971) A simple method for biological assessment of the effect of waste discharges on the aquatic bottom dwelling organisms. *J. Wat.Poll. Control* Fed, 775.

5. DASH, M.C. (1996) Fundamental of Ecology, Tata McGraw Hill publishing Company limited, New Delhi.

6. DHANAPATI, M.V.S.S.S. (1989-2000) Taxonomic note on the rotifer from India.,1-168.

7. GAIKWAD, S,R., INGLE, K.N. AND THORAT, S.R. (2008) Study of zooplankton patter and resting egg diversity of recently dried water bodies in North Maharashtra region. *J.Environ. Biol*.,29,353-356.

8. GOSWAMI, C.S. AND SELVAKUMAR, R.A. (1977) Plankton studies in the eustarine system. Geo-proc-syip warm water-Zoopl-Spl. Publication UNESCO, 226-241.

9. HARIKRISHNAN, K. (1995) Rotifer fauna of Thiruvananthapuram, Kerala. *Zool. Print J*.,**10**,13.

10. IAAB (1981) Method of water analysis published by Indian Association of Aquatic Biologists, Hyderabad.

11. KAMAT, S.V. (2000) Hydrobiological studies of two temple ponds in PondaTaluk, Goa. *Ecol.Environ.. Cons*.,**6**,361-362.

12. KIRAN, B.R., PUTTAIAH, E.T. AND KAMATH, D.C. (2007) Diversity and seasonal fluctuation of zooplankton in fish pond of Bhadra fish farm, Karanataka. *Zoos. Print J.*,**22**,2935-2936.

13. MAITI, S.K. (2001) Handbook of Methods in Environmental studies: water and waste water Analysis. ABD. publishers, Jaipur (Rajasthan) India,1-279.

14. MULANI, S.K., MULE, M.B. AND PATIL, S.U. (2009) Studies on water quality and zooplankton community of the Panchganga River in Kolhapur city. *J.Environ. Biol.,***30**,455-459.

15. MURUGAN, M. (1998) Cladocera. Indian Association of Aquatic Biologists (IAAB), publication No.5.

16. NOGUERIA, M.G. (2001) Zooplankton composition, dominance and abundance as indicators environmental compartmentalization in Jurumirim reservoir (Paranapanema river), Sao Paulo, Brazil. *Hydrobiologia*, **455**,1-18.

17. PARK, K.S. AND SHIN, H.W. (2007) Studies on phyto and zooplankton composition and its relation to fish productivity in a West Coast fish pond ecosystem. *J.Environ. Biol*.,**28**,415-422.

18. SHARMA, B.K. AND SHARMA, S. (2001) Biodiversity of rotifers in some tropical flood plains lakes of the Brahmaputra River basin, Assam (N.E.India), *Hydrobiologia*, **446**,305-313.

19. SINGH, S.P., PATHAK, D. AND SINGH, R. (2002) Hydrobiological studies of two ponds of Satna (M.P.), India. *Eco. Environ. Cons*.,**8**,289-292.

20. TAS,B. AND GONULOL, A. (2007) An ecological and taxonomic study on phytoplankton of a shallow lake, Turkey.*J.Environ.Biol*.,**28**,439-445.

21. TIWARI, A. AND CHAUHAN, S.V.S. (2006) Seasonal phytoplankton diversity of Kitham lake, Agra. *J. Environ. Biol*., **27**,35-38.

22. VARD, H.B. AND WIPPLE, G.C. (1959) Freshwater Biology. 2nd Ed.John Wiley and Sons, New York.

23. WETZEL,R.G. (1983) Limnology second edition Saunders college publishing USA.,767.