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STUDIES ON POLLUTIONAL STATUS OF LOHARA NULLAH IN CHANDRAPUR (MAHARASHTRA), INDIA

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Abstract:
In aquatic ecosystem physicochemical environment exerts profound influence on its biotic components. It controls biodiversity, biomass and spatial distribution of biotic communities in time and space. The physical and chemical parameters exert their influence both individually and collectively and their interaction creates abiotic environment. The Lohara Nullah originates from the dense forest area near Lohara village. . It flows up to 12 kms, before merging into Zarpat river through the same area on the eastern part of the Chandrapur city. The present investigation attempts to study the water quality and diversity of zooplankton of Lohara nullah in Chandrapur. The seasonal variation in physicochemical parameters like Water Temperature, pH, Alkalinity, Hardness, DO, Free CO_2, BOD, COD etc. were studied as well as qualitative and quantitative study of zooplankton was carried out for a period of two years i.e. from June -2005 to May -2007. Glimpse of observations on physico-chemical parameters and diversity of zooplankton indicate that the nullah at the sampling site is polluted.
Keywords: Water quality, Lohara Nullah, Chandrapur

Introduction

The assessment of water resource quality from any region is an important aspect for the developmental activities of the region because the rivers, lakes and manmade reservoirs are used for water supply to domestic, industrial, agricultural and fish culture practices (Jain and Seethapati, 1996). The knowledge of physicochemical parameters along with its biological characteristics can provide clear idea about the tropic status of the water bodies.

As much as we need the industries to develop for national prosperity we are equally concerned with the protection of environment. In the recent years great concern has been universally voiced regarding water pollution arising as a side effect of industrial activity. The excessive load of pollutant brings about a paradigm shift in the biota of the ecosystems and thus affects the water quality as well as the biodiversity.

The analysis of various physicochemical factors and the rich and varied biodiversity from the lotic ecosystems under study would be of immense help in the future environment impact assessment studies and for sustainable development of these ecosystems, which are otherwise remain neglected from the point of view of hydrobiological studies.

In India, number of lotic ecosystems with respect to physicochemical characteristics and zooplankton has been extensively studied (Verma and Dalela 1975, Agarwal *et al.,* 1976, Shukla *et al.,* 1989, Adak *et al.,* 2001, Pandit *et al.,* 2007, Vishnoi *et al.,* 2008). The present investigation was undertaken to cover the study of physicochemical parameters and zooplankton diversity of Lohara nullah.

Materials and methods:

The water samples for physico-chemical parameters were collected in polythene bottle of 2 litre capacity once in a month from selected sampling site for the period of two years i.e. from June -2005 to May -2007. The parameters analyzed as per standard literature (APHA, 1985). Samples for zooplankton analysis were collected from the site at monthly intervals during the period of investigation by filtering 50 L of water sample through plankton net no. 25 made of Nylon bolting cloth (mesh size 50 microns) and preserved in 4% formalin. Qualitatively zooplankters were identified up to species under (Labomade microscope model DG Pro. 2 attached to computer), photographed, using pertinent literature (Edmondson 1959, Sehgal 1983, Michael 1984 and Dhanapathi 2000).

Results and Discussion:

The water temperature not only affects the chemical reactions in natural waters but also solubility of gases and nutrient cycles along with other biogenic processes. In the present investigation, the maximum water temperature (35.1°C) was recorded in month of May-06 and minimum (24.4°C) in January 06. Sawane (2002) in river Erai reported the minimum water temperature of 23°C in January and maximum of 37°C in April. Dhere and Gaikwad (2006) recorded the range between 18.2°C to 35°C from December to May respectively.

The variation in pH is an important parameter in water body since most of the aquatic organisms are adapted to an average pH and so not withstand abrupt changes. The lower pH in winter may be due to short period and decrease photosynthetic activity (George, 1997). Maximum pH (8.15) was recorded in August 06 and minimum (7.62) in October-05. Saraf and Shenoy (1986) during their study on Wardha river near Ballarshah recorded similar observations.

Natural bodies of water in tropics usually show a wide range of fluctuations in total alkalinity values depending upon the location, season, nature of bottom deposits, waters of hill stream, sandy rocky or clayey areas. During study, high value of total alkalinity was recorded during summer and low during winter. Maximum alkalinity 311 mg/L was recorded in May -06 and minimum 101 mg/L in December 06. Adebisi (1981) in seasonal upper Ogun river, Ibadafan, while reporting the seasonal variation in alkalinity reported that the total alkalinity was less during the winter and maximum during summer.

During present study, Total hardness, Ca hardness and Mg hardness ranged between 73 to 249 mg/L, 40 to 167 mg/L and 29 to 112 mg/L respectively. The minimum values recorded during January and November and maximum in July, August. Angadi *et al.,* (2005) observed the maximum value in the month of July might be due to the presence of high content of calcium and magnesium in addition to sulphate, nitrate and sewage inflow,

The high concentration of T.D.S. increases water turbidity this in turn decreases the light penetration and thus affects the photosynthesis. The high content elevates the density of water, influences osmoregulation of fresh water organisms and reduces solubility of gases like oxygen and utility of water for drinking, irrigation and industrial purpose (Harishkumar, 1998). During study, Total Dissolved Solids ranged between 138 mg/L to 342 mg/L. Sinha *et al.,* (1989) reported the low values 212.50 mg/l in winter season and high 526.33 mg/l in summer season in river Ganga at Kalankar (Pratapgarh).

The fraction of any given substance in dissolved phase and the fraction in particulate phase are directly related to the concentration of suspended particulate matter in the water (Hakanson, 1999).

In present investigation, maximum value (1893 mg/L) of total suspended solids was recorded in month of July 05 and minimum 525 mg/L in February 07. Gupta (2002) recorded the range of suspended solids from 145 and 485 mg/ltr. The highest value recorded during November and July in Kannada rivers (Netravati, Sita and Kollur rivers). Bhadra Bhaskar (2003) recorded the minimum value 26.3 mg/ltr in month of December and maximum 229 mg/ltr in month of March in river Torsa of North Bengal.

Sharma and Pande (1998) reported the high value of T.S.S. in monsoon season and low during winter in Ramganga river at Moradabad (U. P.). Ugale (2002) recorded maximum T.S.S. during monsoon season attributed to leaching of rocks and surface flow.

DO is one of the most important parameter of water quality, directly affecting survival and distribution of flora and fauna in ecosystem. The dissolved oxygen level in natural as well as wastewater depends on physical, chemical and biological activities in the water body. The analysis of dissolved oxygen is very important in water pollution control as well as wastewater treatment.

In present investigation, maximum DO (7.71 mg/L) recorded in winter months (December 06) and minimum (4.11 mg/L) in summer months (May-07). Saraf and Shenoy (1986) also recorded the range between 4.5 to 8.9 mg/l of DO in river Wardha in Ballarshah near Chandrapur. In river, Godavari at Nashik (M.S.) high dissolved oxygen content indicates well-aerated nature of water with low organic pollution load in winter season (Shinde *et al.,* 1997). Shivanikar *et al.,* (1999) reported increase in temperature of water in summer results in decrease of dissolved oxygen in Godavari river. Bobdey (2002) reported maximum DO in winter season and minimum during summer.

Carbon dioxide is a normal component of all natural waters. It is an end product of bacterial decomposition and respiratory processes of plant and animals. In the present investigation, maximum values (7.11 mg/L) of CO_2 were recorded during summer and minimum (3.09 mg/L) during winter. The minimum value of free CO_2 during winter months may be due to it's utilization through photosynthetic activity by the aquatic macrophytes and phytoplankters. However, the higher values of CO_2 can be attributed to the higher rate of decomposition of organic matter by microorganisms with consequent increased release of free CO_2, decrease in utilization in photosynthetic activity and high respiratory activity of benthos and microbes.

The B.O.D. is a direct measure of O_2 requirement and indirect measure of biodegradable organic matter. The C.O.D. values always recorded higher than B.O.D. values clearly indicate that the non-biodegradable oxygen demanding pollutants are present in the water, which comes into the system as effluents. During study, the BOD and COD values ranged between 4.97 to 11.67 mg/L and 18.28 to 55.82 mg/L respectively. Shanthi *et al.,* (2006) reported a sharp decline in B.O.D. in December might be due to low temperature, which slows down the microbial activities. Rai (1978) has recorded the higher values of C.O.D. during winter and summer at Rajghat station.

The major sources of phosphorus are domestic sewage, detergent, agricultural run-off, fertilizers, industrial wastes and decomposition of dead bodies at the bottom. The higher concentration of phosphorus therefore is an indicator of pollution. Though present in low concentration it is one of the most important nutrients limiting growth of autotrophs and so biological productivity in the aquatic ecosystem.

In present study, phosphate ranged from 0.39 mg/L in January 07 to 1.13 mg/L in May-06. Dora and Roy (1987) reported the phosphate range from 0.2 to 0.4 mg/l in Subernarekha river passing through Jamshedpur. Reginna and Nabi (2003) recorded the lowest value 0.01 mg/l in the month of September and May and highest value 0.9 mg/l in the month of June. Ansari (1993) reported high values of soluble phosphates in summer due to enhanced rate of decomposition in river Godavari at Nanded.

Nitrate content is excellent parameters to judge organic pollution and it represents the highest oxidized form of nitrogen. The nitrates are an important source of nitrogen for phytoplankton. Domestic sewage maybe the principal contributor of nitrogenous substance in a waterbody. Small quantity of nitrogen is enough for rapid growth of blue green algae in a water body (Singh and Swarup, 1979).

Saraf and Shenoy (1986) recorded organic Nitrogen in the range of 0.7 to 0.8 mg/l from river Wardha at Rajura Bridge near Ballarshah. In the present investigation, the Nitrates ranged between 0.22 mg/L to 1.36 mg/L, minimum was recorded in winter and maximum during monsoon season. The higher values of nitrates were due to the influx of nitrogen rich runoff water from catchment areas bringing large quantity of concentrated sewage water.

Zooplankton:

Zooplankton of lotic ecosystems consists of heterogeneous assemblage of minute floating microinvertebrates and their qualitative and quantitative study provides good indices of water quality and the capacity of water to sustain heterotrophic communities. The spatial heterogeneity within the river however is due to existing local environmental condition such as light, temperature, water discharge and flow velocity that change with time (Chakrapani, 2005).

The zooplankton of Lohara Nullah studied under four groups Rotifera, Cladocera, Copepoda and Ostracoda. Species variation has been presented in Table 1.2.

Total 23 species of zooplankton were recorded from the study site. The present investigation showed that Rotifera (11species) dominated the water body followed by Cladocera, Copepoda and Ostracoda. The biodiversity of rotifers from various river ecosystems is reported by Pahawa and Meharotra (1966) from Ganga river system, Chakraborthy et al., (1959) in river Yamuna, Chacko and Srinivasan (1955) in river Godavari and Krishna. Balamurugan et al., (1999) from Cauvery river, Tamilnadu reported 6 species of rotifers, predominance of rotifer in zooplankton in Cauvery river is also reported by Kakkasery (1990), Hameed (1992) 33 species and Sampath et al., (1979) 35 species from the same lotic ecosystem.

The diversity of rotifers is influenced by the water quality and variation in suspended solids, dissolved solids, organic matter etc., immediately affect their distribution (Holland et al., 1983). Sawane et al., (2006) also studied the rotifer diversity from Erai river and reported presence of large number of rotifers due to lentic condition of water in Erai Dam. Khune and Parwate (2012) reported 22 species of zooplankton with dominance of group Rotifera.

During the present investigation, the group Cladocera is represented by 7 species with dominance of *Moina micrura*. Balamurugan *et al.,* (1999) reported seven species of Cladocerans in Cauvery river at Tirucherapalli, Tamilnadu and Biswas and Konar (2000) reported six species of Cladocerans from river Damodar in W. Bengal

The Copepoda diversity was represented by 4 species. In the present investigation increase in number of *Cyclops spp.* was observed in sampling station which receives the domestic sewage. Verma et al., (1984), Kulshreshta et al., (1992) and Kumar and Singh (1994) observed that *Cyclops* are sensitive to pollution and increase with an increase in nutrients and is in agreement with our observations.

The group Ostracoda is represented only by Cypris *spp.* Environmental factors like temperature, salinity, DO and sediment composition seems to influence cumulatively on the distribution of Ostracoda. Khune and Parwate (2012) reported only one species of Cypris in group Ostracoda in Shionibandh reservoir of Bhandara district. Balamurugan et al., (1999) in Cauvery river reported 8 species of Ostracods and observed that environmental factors like temperature, DO and sediment composition seem to influence the distribution of Ostracods.

Monthly Values of Physicochemical Parameters of Lohara Nullah During Year 2005-2006

Sr. No.	Mon/ Para	Temp	pH	Alk	Hard	Ca-Hard	Mg-Hard	T.D.S.	T.S.S.	D.O.	CO_2	BOD	COD	Phos	Nit
1	Jun-05	32.9	8.12	268	219	157	62	312	1586	4.49	5.11	10.81	27.03	1.07	1.21
2	Jul-05	31.2	8.01	280	227	161	66	338	1893	4.83	4.63	7.92	25.24	0.86	1.36
3	Aug-05	29.7	8.11	203	208	149	59	329	1663	5.67	4.42	6.10	27.85	0.67	1.18
4	Sep-05	29.1	7.69	148	193	143	50	284	1153	5.91	4.81	5.58	18.28	0.61	1.05
5	Oct-05	27.9	7.62	175	164	119	45	203	859	6.12	4.19	6.12	27.03	0.43	0.96
6	Nov-05	27.1	7.72	198	101	72	29	198	730	6.31	3.12	7.04	33.81	0.47	0.46
7	Dec-05	26.2	7.73	182	89	52	37	169	821	6.84	3.41	6.22	48.48	0.58	0.31
8	Jan-06	24.4	7.64	164	73	40	33	147	794	6.76	3.83	6.67	51.72	0.44	0.22
9	Feb-06	27.2	7.92	201	78	46	32	138	828	6.42	4.28	8.27	47.52	0.57	0.69
10	Mar-06	31.1	8.02	254	137	84	53	257	826	5.99	5.59	9.92	41.91	0.99	0.92
11	Apr-06	32.3	8.14	278	179	116	63	264	881	4.92	6.91	10.05	39.43	1.01	1.09
12	May-06	35.1	8.13	311	206	148	58	306	971	4.65	7.11	11.2	36.51	1.13	1.28

Monthly Values of Physicochemical Parameters of Lohara Nullah During Year 2006-2007

Sr. No.	Mon/ Para	Temp	pH	Alk	Hard	Ca-Hard	Mg-Hard	T.D.S.	T.S.S.	D.O.	CO_2	BOD	COD	Phos	Nit
1	Jun-06	33.1	8.08	226	224	151	73	317	1045	4.13	6.13	10.37	24.08	1.08	1.11
2	Jul-06	30.9	8.13	152	243	167	76	328	1234	4.42	4.21	8.13	28.28	0.93	1.31
3	Aug-06	29.2	8.15	141	249	137	112	342	1445	4.94	4.42	7.32	34.46	0.56	1.08
4	Sep-06	28.9	8.10	165	204	143	61	289	1066	5.61	3.89	6.89	36.91	0.68	1.16
5	Oct-06	27.8	7.68	112	174	127	47	247	751	6.32	4.51	5.62	42.43	0.62	0.93
6	Nov-06	27.1	7.70	109	153	117	36	201	670	7.21	5.11	5.28	44.37	0.56	0.48
7	Dec-06	24.6	7.77	101	104	66	38	178	686	7.71	3.09	5.02	55.82	0.45	0.36
8	Jan-07	25.7	7.80	127	84	53	31	149	773	7.19	3.41	4.97	49.34	0.39	0.23
9	Feb-07	26.8	7.89	146	114	70	44	213	525	7.21	3.48	6.18	44.23	0.38	0.57
10	Mar-07	31.2	8.11	189	156	103	53	221	661	5.79	5.49	7.33	26.38	0.61	0.82
11	Apr-07	32.9	8.13	212	178	121	57	209	853	4.28	6.12	10.36	33.41	0.87	1.02
12	May-07	34.3	8.07	254	199	118	81	293	966	4.11	6.63	11.67	29.26	1.10	1.13

Table 1.2.

S.N.	Names
Rotifera	
1	*Keratella tropica*
2	*Asplanchna spp.*
3	*Trichocerca longiseta*
4	*Brachionus calyciflorus*
5	*B. falcatus*
6	*B. quadricornis*
7	*B. forficula*
8	*B. rubence*
9	*B. plicatilis*
10	*B.diversicornis*
11	*Lecane spp.*
Ostracoda	
1	*Cypris spp.*
Cladocera	
1	*Moina micrura*
2	*Moinodaphnia spp.*
3	*Cereodaphnia reticulata*
4	*Bosmina longirostris*
5	*Alona davidi punctata*
6	*Chydorus parvus*
7	*Diaphanosoma spp.*
Copepoda	
1	*Cyclops spp.*
2	*Diaptomus spp.*
3	*Mesocyclops spp.*
4	*Eucyclops spp.*

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