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LIMNOLOGICAL PROFILE OF RIVER ERAI NEAR CHANDRAPUR, MAHARASHTRA, INDIA

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ABSTRACT:
The present investigation deals with limnological profile of river Erai near Chandrapur, in Maharashtra state, India. The Chandrapur is known for hot and dry climate with an average rainfall of about 1400 mm; and is a border and backward district in eastern part of Maharashtra. Due to the rapid industrialization almost all the aquatic ecosystems have become greatly polluted with their differential impact on water quality and biodiversity therein. A year round investigation during June-2005 to May-2006 has been made on the river Erai in order to characterize the physicochemical and planktonic status of it. In physicochemical parameters, pH of water was alkaline throughout the year. TSS values were high during monsoon period due to higher amount of floating particles. The qualitative and quantitative evaluation of plankton showed high density of phytoplankton and zooplankton throughout the study period. The present study revealed that the water quality of Erai river at investigation site is mildly polluted by direct contamination of sewage and other industrial effluents.

Keywords: - Water quality, Hardness, Phytoplankton, Rotifera, Erai, Chandrapur.

INTRODUCTION :

Rich diversity of organisms in an aquatic ecosystem reflects good water quality and any change in water quality due to effluents addition, affects diversity and abundance of organisms. Plankters are highly sensitive to environmental variation, as a result; change in their diversity, density or community composition indicates environmental change or disturbance. Many species feed on particulate organic matter in detritus suspension thereby forming several links in the food web of aquatic ecosystems. Thus, knowledge of their abundance, diversity, temporal and spatial distribution is important aspect in understanding trophodynamics and trophic progression of a water body (Sheshagiri Rao and Khan 1984 and Verma and Datta Munshi, 1987).

Perusal of the available literature on the above aspects of the lotic ecosystem, reveal that lot of published documentation is available on the various aspects of above investigations on lotic ecosystems not only from the other countries of the world (Berner 1951, Greenberg 1964, Garnier *et al.,* 1995) but also from India (Venkateshwaralu 1969, Chaudhari and Bilgrami 1991, Khanna *et al.,* 1997, Sawane *et al.,* 2006, Sharma 2021).

MATERIALS AND METHODS:

In order to get comprehensive data, samples were taken on monthly basis in midst of each month between 9-10 am. Surface water samples were collected in polythene bottles of two liters capacity. The parameters analyzed as per standard literature (APHA, 1985).

Plankton samples were collected by filtering 50 liters of water through plankton net made of Nylon bolting cloth (No. 25 with mesh size 50 microns) with a bottle of 50 ml capacity attached to the narrow end of net, from the selected sampling site. Quantitative enumeration of

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plankton was done by Sedgwick Rafter Cell method following Michael 1984, Saxena 1987 and Dhanapathi 2000.

RESULTS AND DISCUSSION:

The results obtained by physical and chemical analysis of all samples are given in table 1. The monthly variations in the physical and chemical parameters are discussed under following points. The water temperature varied from 24.3 °C to 34.6 °C. The pH values falls within the alkaline range fluctuating between 7.56 to 7.89. Pearsall (1930) observed that the pH of the water appears to be dependent upon the relative quantities of calcium, carbonates and bicarbonates. The lower pH in winter may be due to short period and decreased photosynthetic activity (George, 1997). Saraf and Shenoy (1986) during their study on Wardha river near Ballarshah recorded similar observations. Electric conductivity was maximum in May (0.402 mmhos/cm) and minimum in July (0.262 mmhos/cm).

Maximum transparency (109 cm) was recorded in March and minimum (52.5 cm) in August. The minimum values may be due to fine silt held in suspension in rainy season as a result of large inflow of water runoff from catchment area. Shyam Sunder (1988) in river Jhelum, Kashmir recorded minimum transparency during July, August, and maximum in September and January. The period corresponded with low river depth and absence of floods. High value of total alkalinity was recorded during summer and low during winter. Adebisi (1981) also reported maximum total alkalinity during summer.

Total hardness, Ca hardness and Mg hardness ranged between 72 to 205 mg/L, 44 to 134 mg/Ll and 25 to 77 mg/L respectively. The minimum values recorded during winter and maximum in month of July. 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 from catchment area.

Total Dissolved Solids ranged between 143 to 376 mg/L. High TDS values recorded in summer and low in winter. 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). Total suspended solids were maximum in month of July and minimum in month of January. The maximum values may be due to high flow of sewage and silt from catchment area.

Dissolved oxygen concentration was maximum (7.88mg/L) in winter months (January) and minimum (4.31 mg/L) in postsummer month (June). Saraf and Shenoy (1986) also recorded the range of dissolved oxygen between 4.5 to 8.9 mg/L. 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. Minimum values of CO_2 were recorded during winter and maximum during summer. The minimum value of free CO_2 during winter months may be due to its 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 chloride in natural water bodies may also be contributed by sewage discharge and discharge of effluents from chemical industries and irrigation drainage. Most of the rivers receive chloride by leaching through soils with which the water comes in contact. Chloride concentration was maximum in the month of

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July and minimum in month of January (34.2 to 217 mg/L). Ramana Murthy and Karthikeyan (1994) observed chloride concentration in between 80 mg/ltr to 369 mg/ltr.

The BOD and COD values ranged between 3.51 to 11.02 mg/L and 16.2 to 54.8 mg/L respectively. Saraf and Shenoy (1986) reported the range of BOD between 1.0 to 5.0 mg/L in river Wardha at Ballarshah. Chug (2000) in Ganga River at Hardwar reported maximum B.O.D. in monsoon season and minimum in winter. Rai (1978) has recorded, higher values of C.O.D. during winter and summer at Rajghat station. Bhadra Bhaskar *et al.,* (2003) recorded maximum C.O.D. in the month of February in river Torsa.

Phosphate concentration ranged from 0.240 mg/L in December to 1.107 mg/L in June. 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 was maximum in month of July and minimum in January (0.27 to 1.27 mg/L). 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. Arvind Kumar and Singh (2002) reported high values of nitrate during rainy season due to influx of nitrogen rich flood water that brings large amount of contaminated sewage water. Similar findings were recorded by Badge and Verma (1985), Sunder Raj (1988) in river Jhelum.

Biotic status

Phytoplankton are regarded as the chief primary producers of any aquatic environment (Wetzel 1975). They have great importance from ecological point of view. Some develop noxius blooms, sometimes creating offensive tastes with bad odour or anoxic or toxic conditions resulting in animal death or human illness to those who consume this water (Hosseti, 2002). In the present investigation, 34 planktonic algal species were identified and were found in the following order of abundance

Chlorophyceae > bacillariophyceae > Myxophyceae > Euglenophyceae

Chlorophyceae (Green Algae): Chlorophyceae was the dominant group among the phytoplankton represented by 17 species among which *Closterium, Spirogyra, Chlorocloster* and *Chlorella* abundance were pronounced at the sampling site. The *Spirogyra spp.* and *Zygnema spp* were recorded in appreciable number which could be indicated as pollution tolerant genera. Palmer (1980) has also reported these genera as the bioindicator of organic pollution.

Myxophyceae (Blue – green algae): This group is considered to be highly adaptive and colonized even in polluted water at higher temperature. They are more efficient in utilizing CO_2 at high pH level and low light availability under eutrophic condition (Shapiro, 1990). In present investigation 08 species have been recorded among which genera like *Anaebena, Rivularia, Oscillatoia* and *Anacystis* are abundant.

Bacillariophyceae: Diatoms constitute the most important group of algae even though most species are sessile and associated with littoral substrate (Wetzel 1983). The group Bacillariophyceae was represented by 07 species among which the genera like *Diatoma, Pinnularia, Navicula* and *Fragillaria* were found to be dominant. Lowe and Gale (1980) opined that diatoms are the most important colonizers of rivers and their species composition depend upon temperature, current pattern, substrate type and water quality. Because of extensive growth of Chlorophyceae which release extra cellular products, the density of diatoms is affected (Somashekhar, 1988).

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Euglenophyceae: This group have shown very poor distribution and represented by only two genera. Palmar (1969) demonstrated that Euglenophyceae are the key species of biological indicator of organic pollution.

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 community studied under four groups i.e. Rotifera, Cladocera, Copepoda and Ostracoda. Species variation has been presented in Table 3.

Total 26 species of zooplankton were recorded from the study site. The quantitative relationship amongst different groups of zooplankton was as follows

Rotifera > Copepoda > Cladocera > Ostracoda.

Rotifera : Rotifers are regarded as valuable bio-indicators of water quality. They also serve as an essential food source for many fishes as well as many invertebrate and vertebrate predators. 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). Rotifers represented by 14 species among which genus *Brachionus* is found to be dominant. Anjeli (1976) reported that simultaneous presence of several rotiferans species is an indication of eutrophic nature of aquatic ecosystem. Premazzi and Chiaudani (1992) shown that eutrophication affects zooplankton composition, shifting the dominance from larger species to smaller species (rotifers). Mone and Madlapure (2003) studied the dominance of rotiferans in Manar river and reported high DO content in water.

Cladocera: During the present investigation, the group Cladocera was represented by 07 species. 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. In the present investigation following genera were found to be dominant *Moina micrura, Bosmina longirostris, Alona davidi punctata and Chydorus parvus*

Copepoda: 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. Kulshreshta *et al.,* (1992) and Kumar and Singh (1994) observed that *Cyclops* are sensitive to pollution and increase with an increase in nutrients and which 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 Ostracoda. The group is found to be dominant during summer season. Mezquita *(*1999) reported that abundance of Ostracods was more in the summer when the water temperature was rising in Mediterranian rivers.

CONCLUSION :

In the light of present findings, it can be inferred that there is a clear variation in the physico-chemical parameters. The evaluation of plankton showed high density of phytoplankton and

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zooplankton species throughout the study period. However, phytoplankton species were more diverse and abundant than the zooplankton species. Increase in density of Cyclops and other indicator species revealed that the water quality of Erai river at investigation site is mildly polluted by direct contamination of sewage and other industrial effluents. This study would be useful for future assessment after interlinking. Issues related to various threats to aquatic environment.

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