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LIMNOLOGICAL PROFILE OF RIVER WARDHA AT BALLARPUR, NEAR CHANDRAPUR (MAHARASHTRA), INDIA

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ABSTRACT:
Our country is blessed with large number of lotic ecosystems in the form of rivers and streams. Importance of rivers in maintaining a healthy as well as a prosperous nation is amply understood from the very existence of the civilization on this globe. Today biological diversity is emerging as an economic resource of great promise. The importance of biological diversity as a valuable natural and genetic resource, as an instrument of maintaining a stable and healthy ecosystem and as a means of optimum utilization and conservation of abiotic resources in the ecosystems is unquestionable.
The Ballarpur town is located at 19° 51^{l} latitude and 79° 20^{l} longitude at a height of 321.95 meters above MSL on the bank of the river Wardha which is a perennial and originates in the Satpuda ranges in Madhya Pradesh. A year round investigation during June-2005 to May-2006 has been made on the river Wardha near Ballarpur in order to characterize the planktonic status. The data summarized indicates presence of 34 species of phytoplankton and 27 species of zooplankton considered as fairly good genera and species diversity. Statistically the density of zooplankton exhibits positive correlation with phytoplankton, which suggested the dependence of former on later.

Keywords: - Phytoplankton, Chlorophyceae, Zooplankton, Wardha river, Ballarpur.

INTRODUCTION :

Organisms, populations and communities composed of different species make up the biological diversity of aquatic ecosystems. Loss of sensitive species may have feedback effects on other residential organisms that can lead to catastrophic shifts in the composition of aquatic communities and the functions they provide. As such, the overall diversity of biological communities enables many ecosystems to function normally and in a stable state. The extent of degradation of water bodies can be reliably evaluated with plankton (Vareethiah and Haniffa, 1998). In India, number of rivers has been extensively studied with respect to plankton diversity (Ray 1955, Sampath *et al.,* 1979, Bhowmick and Singh 1985, Chaudhari and Billgrami1991, Balamurugan *et al.,* 1999, Sawane *et al.,* 2006, Waghmare and Mali 2007, Sharma 2021).

MATERIALS AND METHODS:

A year round investigation during June-2005 to May-2006 has been made on the river Wardha near Ballarpur. Samples were collected from the site at monthly intervals during the period of investigation by filtering 50 liters of water through a plankton net made of nylon bolting cloth (No. 25 with mesh size 50 microns). Individual plankters were observed and identified using pertinent literature (Edmondson 1959, Plaskitt 1997). Quantitative enumeration of plankton was done by Sedgwick Rafter Cell method following APHA, 1985.

RESULTS AND DISCUSSION:

Phytoplankton are the basic members in the aquatic ecosystem and hence changes in the phytoplankton population have a direct link with

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the change of water quality in any aquatic medium. They are very sensitive to change in environmental conditions and their blooms being for only few weeks duration and their species replacement takes place within month or less (Bhutiani 2004).

In plankton, particularly phytoplankton has been used as indicator of water quality. Some species flourishes highly in eutrophic waters, while others are very sensitive to organic or chemical waste. Phytoplankton of river Wardha at sampling site studied under four groups viz. Chlorophyceae, Bacillariophyceae, Cyanophyceae and Euglenophyceae and qualitative analysis have been presented in Table 1.

Among planktonic algae, Chlorophyceae generally dominate in terms of numbers followed by Bacillariophyceae. In the present investigation, Chlorophyceae (48%) was dominant followed by Bacillariophyceae (34%) and Myxophyceae (16%). The dominance of Chlorophyceae was also recorded by Sakhare and Joshi (2002) and Jayabhaye *et al.*, (2007).

In the present investigation, total 34 phytoplankton species were recorded which consists of Myxophyceae (08), Bacillariophyceae (07) Chlorophyceae (17) and Euglenophyceae (02) (Table 1). Kumar *et al.,* (2012) reported 48 species of phytoplankton, among which 21 species are of Chlorophyceae, 13 species of Bacillariophyceae, 11 species of Cyanophyceae and 3 species of Euglenophyceae. Negi *et al.,* (2012) reported 53 genera belonging to 5 classes with dominance of green algae, chlorophyceae (26), followed by Bacillariophyceae (12) Cyanophyceae (10) Euglenophyceae (4) and Xanthophyceae (1).

The freshwater blue greens occurring in clean or polluted water body generally exhibits a characteristic cyclic growth. In the present investigation, Myxophyceae comprises mainly the species of *Nostoc, Microcystis, Rivularia Scytonema, Anabaena, Spirulina Anacystis and Oscillatoria.*

Bacillariophyceae are widespread and occur in abundance in various lotic ecosystems. The water quality in terms of levels of physical factors, DO, pH and organic matter play an important role in the ecological distribution of Bacillariophyceae (Sabata and Nair, 1987).

In the present investigation, Bacillariophyceae was represented by *Nitzchia spp. Navicula spp., Pinnularia spp Diatoma spp., Mastagloia spp., Fragilaria spp. and Gyrosigma spp.* The abundance of *Diatoma spp* and *Naviculla spp*, in Bacillariophyceae as indicators of contamination recorded by Naz *et al.,* (2014) in river Padma in Bangladesh.

Chlorophyceae was the most dominant group among all the phytoplankton. It was represented by *Pediastrum spp., Chlorella spp., Ulothrix spp., Cladophora spp., Spirogyra spp., Zygnema spp., Closterium spp., Oedogonium spp., Scendesmus spp., Spirogyra spp., Micrasterias spp., etc.* The abundance of species like *chlorella, zygnema, spirogyra, ulothrix* in chlorophyceae was recorded by Waghmare and Kulkarni (2015) in Lendi river district Nanded, Maharashtra.

The dominance of Chlorophyceae was also recorded by Dahegaonkar (2010) in river Erai near Chandrapur and Arvindkumar and Singh (2002) with high fluctuation at different sites in river Mayurakshi. Somashekhar (1988) reported the dominance of Chlorophyceae at unpolluted stations of river Cauvery and Kapila while the dominance of Cyanophyceae at polluted stations.

Euglenophyceae are commonly found in small water bodies having rich organic matter. Palmar (1969) demonstrated that Euglenophyceae are the key species of biological indicator of organic pollution. In the present investigation, Euglenophyceae was mainly represented by Euglena and Phacus species only. Rai (1978) also recorded only two species i.e. *Euglena* and

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Phacus from river Ganges at Waranasi and found that the polluted water of Rajghat sustain the growth of these forms.

Zooplankton communities are very sensitive to environmental changes. They play an integral role and serve as bioindicators in lotic ecosystems (Contreas *et al.*, 2009). In the present investigation zooplankton community studied under four groups viz. Rotifera, Cladocera, Copepoda and Ostracoda. In all, 27 species of zooplankton were recorded and from the observed genera and species, group Rotifera (14) was dominated the water body in diversity followed by Cladocera (8), Copepoda (4) and Ostracoda (1).

Rotifera are amongst some of the most abundant and important members of the freshwater fauna, along with Protozoa and Crustacea. The predominance of Rotifera was observed in quantitative relationship amongst different groups of zooplankton, Rotifera was dominated by contributing 43 % followed by Copepoda 28%, Cladocera 23% and Ostracoda by 6% in the river under study. The distribution and ecology of Rotifers have interesting evolutionary implication (Reid and Wood, 1976). The rotifers are considered as most important zooplankters (Hutchinson 1967). Predominance of Rotifera in zooplankton was also reported by Kakkasery (1990) in river Cauvery. Hameed (1992) reported 33 species, Mathivanan *et al.,* (2007) recorded 13 species of Rotifera from the same lotic ecosystem. Dabhade and Chhaba (2019), also studied zooplankton diversity around Washim region of Maharashtra and recorded different 27 zooplankton species from the different sampling sites of Washim region comprising of 11 species of Rotifera, 06 Copepods, 09 Cladocera and 1 Ostracoda. Comparatively higher number of rotifers may indicate the input of waste as reported by Arora (1966).

The abundance of ostracoda provides very good food for the fishes (Tonapi, 1980). In the present investigation, the ostracoda group was dominant during summer and represented by only one species i.e. *Cypris spp.* The summer maxima might be due to rise in temperature that provided a suitable environment for their growth as has also been opined by Mezquita (1999) and Balamurugan *et al.,* (1999)

The Cladocera component of zooplankton plays an important role in the benthic trophodynamics. Most of the Cladocerans are primary consumers and feed on microscopic algae and fine particulate matter in the detritus thus influencing the cycling of matter and energy in benthos. In the present investigation, the Cladocera was represented by 08 species i.e. *Alona davidi punctata, Bosmina longirostris, Cereodaphnia reticulata, Moina micrura* etc. Balamurugan *et al.,* (1999) reported 7 species of cladocerance and Biswas and Konar (2000) reported six species of cladocerans from river Damodar in West Bengal. Arvindkumar and Singh (2002) recorded 3 species of Cladocera from river Mayurakshi.

Copepods are important member of the zooplankton community for their role in the tropic dynamics and in energy transfer in the aquatic ecosystem, provide food for fishes and play a major role in fish production (Pawar *et al.,* 2003, Kamble and Meshram, 2005).

In the present investigation, the Copepod diversity was represented by 4 species i.e. species of *Cyclops, Diaptomus, Mesocyclops and Eucyclops.* Balamurugan *et al.,* (1999) reported six species of copepods belonging to order Cyclopoida from river Cauvery.

CONCLUSION:

The data summarized, indicates presence of 34 species of phytoplankton and 27 species of zooplankton considered as fairly good genera and species diversity. Statistically the density of zooplankton exhibits positive correlation with phytoplankton, which suggested the dependence of former on later.

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Table 1. Monthly Variation in Phytoplankton at River Wardha During The Year 2005-06

S. N.	Phyto/Month	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Total
Myxophyceae														
1	Nostoc spp.	4	2	0	0	4	3	3	6	3	7	7	9	48
2	Microcystis spp.	2	0	0	2	5	9	1	6	8	12	10	13	68
3	Rivularia spp.	2	0	0	4	4	6	7	14	6	11	13	13	80
4	Scytonema spp.	7	0	0	1	2	2	4	2	3	8	6	5	40
5	Anabaena spp.	9	0	0	0	11	6	7	10	12	11	12	12	90
6	Spirulina spp.	4	0	0	0	12	12	8	3	0	8	26	14	87
7	Anacystis spp.	7	0	0	2	3	13	6	0	6	8	14	12	71
8	Oscillatoria spp.	7	0	0	0	4	6	4	9	7	17	10	8	72
Bacillariophyceae														
1	Nitzchia spp.	0	0	0	2	4	6	6	10	6	4	0	0	38
2	Navicula spp.	17	2	0	24	29	27	25	33	0	0	23	14	194
3	Pinnularia spp.	11	0	0	19	26	34	20	28	6	13	15	19	191
4	Diatoma spp.	9	7	2	20	27	32	24	33	13	22	27	21	237
5	Mastogloia spp.	13	5	0	7	25	37	16	27	38	21	8	13	210
6	Fragilaria spp.	12	0	0	14	33	18	39	35	14	18	11	3	197
7	Gyrosigma spp.	2	0	0	10	12	14	14	0	0	13	5	10	80
Chlorophyceae														
1	Volvox spp.	7	0	0	5	3	5	2	0	0	6	7	3	38
2	Pediastrum spp.	7	0	2	7	1	13	17	12	0	4	2	0	65
3	Chlorella spp.	5	0	1	3	19	27	29	19	3	8	5	7	126
4	Ulothrix spp.	0	0	0	4	9	9	13	0	6	8	2	0	51
5	Cladophora spp.	2	1	3	15	24	17	9	7	1	22	6	8	115
6	Oedogonium spp.	5	1	0	3	2	5	9	5	0	1	4	5	40
7	Spirogyra spp.	11	0	7	13	25	21	39	50	23	8	17	10	224
8	Zygnema spp.	25	0	0	17	51	36	47	61	11	4	8	7	267
9	Closterium spp.	11	0	5	24	29	74	63	65	48	11	0	22	352
10	Cosmarium spp.	0	2	3	7	15	11	12	7	1	0	0	0	58
11	Gloeocystis spp.	2	0	0	4	5	2	7	9	13	0	0	0	42
12	Micrasterias spp.	3	0	0	0	5	0	3	3	1	1	0	0	16
13	Vaucheria spp.	3	0	0	4	12	19	11	11	13	13	8	3	97
14	Microspora spp.	0	0	0	0	2	3	2	2	0	0	0	0	9
15	Scenedesmus spp.	0	0	0	0	0	0	0	0	0	0	0	0	0
16	Chlorocloster spp.	4	2	0	0	0	13	18	23	23	7	8	0	98
17	Coelastrum spp.	3	2	0	1	6	8	7	2	0	0	0	0	29
Euglenophyceae														
1	Euglena spp.	6	0	0	0	1	4	7	4	7	10	7	12	58
2	Phacus spp.	2	0	0	3	3	6	4	2	2	2	3	2	29

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Table 2. Monthly Variation of Zooplankton at Site River Wardha During The Year 2005-06

S.N.	Zoo/Month	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Total
	Rotifera													
1	Filinia longiseta	1	0	0	6	5	2	0	0	0	0	0	0	14
2	Keratella tropica	0	0	0	12	15	17	0	0	2	3	25	7	81
3	Asplanchna spp.	0	0	0	0	3	2	1	6	1	0	0	0	13
4	Trichocerca cylindrica	2	0	0	0	1	0	2	2	0	2	2	1	12
5	Trichocerca longiseta	3	0	2	1	6	7	0	0	0	0	0	0	19
6	Brachionus calyciflorus	2	0	0	9	8	9	10	4	1	3	2	1	49
7	B. falcatus	1	0	0	0	9	7	10	6	1	2	4	1	41
8	B. quadricornis	0	0	0	0	2	2	3	5	2	3	2	0	19
9	B. forficula	4	0	2	3	3	0	11	4	0	1	1	3	32
10	B. rubence	1	0	0	0	4	6	1	3	1	1	1	0	18
11	B. plicatilis	1	0	0	0	2	1	5	1	2	1	2	1	16
12	B.diversicornis	2	0	0	10	0	0	0	4	4	9	0	0	29
13	Lecane spp.	0	0	0	2	7	9	6	12	0	0	3	1	40
14	Monostyla spp.	0	0	0	4	5	2	8	1	0	0	0	0	20
	Ostracoda													
1	Cypris spp.	7	4	0	0	0	0	0	0	11	13	8	14	57
	Cladocera													
1	Moina micrura	0	0	0	4	9	15	21	6	3	0	1	0	59
2	Moinodaphnia spp.	0	0	3	3	1	5	7	2	1	0	0	0	22
3	Cereodaphnia reticulata	0	0	0	4	9	4	6	8	5	1	2	0	39
4	Macrothrix laticornis	0	0	0	0	0	0	0	0	0	0	0	0	0
5	Bosmina longirostris	4	0	0	4	4	0	2	3	1	0	1	2	21
6	Alona davidi punctata	2	0	0	1	2	11	13	10	2	0	0	0	41
7	Chydorus parvus	2	0	3	0	1	0	0	4	7	2	2	0	21
8	Diaphanosoma spp.	0	0	0	0	0	2	3	5	6	0	0	0	16
	Copepoda													
1	Cyclops spp.	4	0	0	27	15	17	2	0	0	3	12	7	87
2	Diaptomus spp.	0	0	21	20	16	19	5	4	0	15	12	7	119
3	Mesocyclops spp.	5	0	0	2	4	2	0	0	0	4	11	11	39
4	Eucyclops spp.	4	0	0	5	2	0	0	0	4	3	3	2	23

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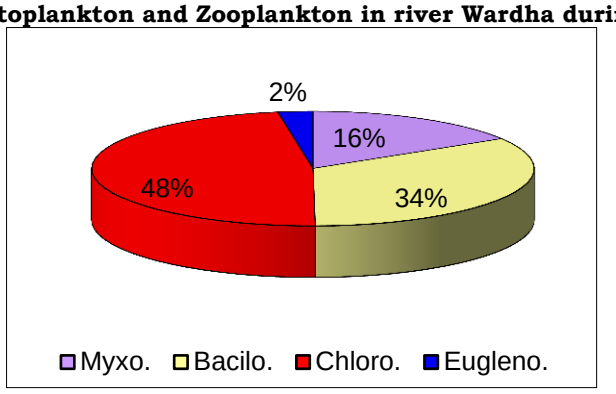
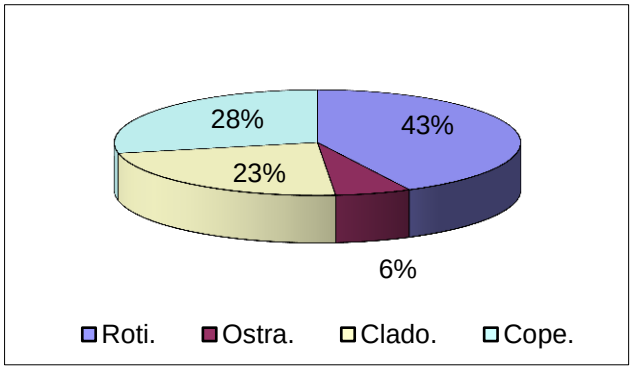
Fig 1. Distribution of Phytoplankton and Zooplankton in river Wardha during the year 2005-2006





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