Glimpses of Research in Life Sciences

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Zooplanktonic communities in two water bodies of Lanja tahasil of Ratnagiri district, Maharashtra state

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Abstract:

Some freshwater bodies from Lanja tahasil of Ratnagiri district have been studied to understand seasonal variations in Zooplanktonic communities during the year 2019-20. These inland water bodies are mostly used for irrigation purpose and some time for aquaculture by local farmers. In present investigation, reservoirs from village Khorninko and Vhel were studied to understand presence of zooplanktons and their role in maintaining ecological status of water body. Seasonal changes in these water bodies reveal a total of 73 zooplankton species mostly dominated by Rotifers like Keretalla troika and Brachionus species. Different species of crustaceans, such as Copepods, Cladocerans and Ostracods were recorded along with highly abundant Rotifer communities. Rich diversity and abundance of zooplankton in these water bodies indicates that these waters are still in good conditions and are suitable for irrigation and aquaculture purpose.

Key words:

Zooplanktons, Seasonal fluctuations, Ratnagiri

INTRODUCTION:

In an aquatic ecosystem, zooplanktons play very important role as rich source of food for all aquatic animals including fishes. Zooplankton being primary consumers in aquatic food web helps in maintaining ecological balance of this fragile ecosystem (Berde and Berde, 2015). Though zooplankton community includes microscopic animals, which live at the mercy of water currents have taxonomically different organisms and share habitats with other higher organisms like crustaceans, fish, amphibians etc. They live in surface layer also known as limnionic layer of water bodies. They play intermediate role as primary consumers and feeds on phytoplankton or algae and act as food for fishes and transfers energy from phytoplankton to fishes.

Many zooplanktons are ecological indicators of water quality and even indicate presence of organic or in organic pollutants present in water. In the present scenario of climate change and habitat distractions in aquatic ecosystems all over the world, role of Zooplanktons as water quality indicator is very important, Pai and Berde, (2005).

The freshwater bodies located in coastal district like Ratnagiri and Sindhudurg districts of Maharashtra state are highly sensitive habitats and are getting affected due to human interference like mining activity for aluminum and iron as well as deforestation in hilly regions. They are also getting affected due to extraction of lateritic stone for construction of buildings and other purposes. These water bodies though are very special and unique ecosystems with diversity of animals and plants based on different seasons of the year. The biodiversity of these water bodies can be checked for aquatic endemism if any, and degradation of these habitats may lead to permanent extinction of many aquatic endemic species. Though these water bodies were not studied for their limnological status, due to their remote location in village like Khorninko and Vhel in hilly region of Lanja tahasil in Western Ghats of Maharashtra state, they may represent some unique combination of aquatic biodiversity.

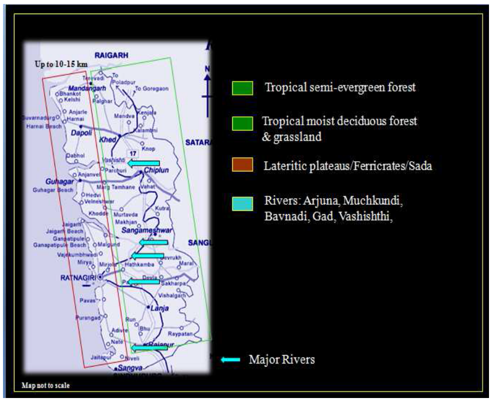
Hence to understand relationship between zooplanktonic community present in these aquatic bodies with that of agro-climatic conditions of these water bodies, present research work has been undertaken.

The diversity and density of the zooplankton is dependent on various factors which includes physico-chemical parameters like -Temperature, pH, alkalinity, phosphates, sulphates, nitrates, level of Dissolved oxygen (DO), organic matter etc. Vegetation and sunlight controls the growth of Zooplanktons, Pai and Terdalkar (2001); Bhati and Rana, (1987).

Studies on fluctuations in planktonic communities of water bodies in relation to restoration of aquatic resources are very important in conservation pint of view. Availability of zooplankter as food for larval fish is thought to be one of the key factors that determine the class strength of commercial fishery (George and Winfield, 2000). Study of plankton biomass is also important for the fish production. In India, considerable work has been done on ecology and seasonal distribution of plankton than other countries (Battish, 1992; Ranga Reddy, 2001). The high biomass values indicate the high fish production. The distribution and abundance of plankton in polluted and unpolluted waters can provide information on the status of water body. Hence, these water bodies located in lateritic soil conditions of Ratnagiri district of Maharashtra, India have been selected to study its limnological status.

Study area:

Ratnagiri district is situated in the western coast of Maharashtra state which is surrounded by Sahyadri hills (with Satara, Sangli and Ratnagiri districts) in the east side while Arabian Sea in the western side while Sindhudurg district in the south and Raigad district in the north side. The rocky plateaus on the Western Ghats are described as terrestrial habitat islands facing extreme micro-environmental conditions, and even though it is documented that rocky outcrops such as inselbergs, barrens and others support rich and threatened floristic endemism. Tropical grasslands on coastal lateritic soil conditions are extremely important from the scientific point of view as they are populated by quite wide variety of species, with interesting unique, physiological and behavioural properties. The species form a part of functional communities, they make the good subject for the study of ecology, especially the habitats are small and the data is applicable to larger situations and ecological theory in general. These coastal lateritic water bodies are sources of irrigation and other domestic use for local people. Both Khornink and Vhel water reservoirs are scenic beauties and attracts many tourists throughout the year. Vhel reservoir specially used for aquaculture purpose too as shown in the picture of Plate- 1



Khorninko reservoir Vhel reservoir

MATERIALS AND METHODS

Khorninko and Vhel reservoirs have been surveyed randomly during three seasons for presence of zooplanktons. Samples were collected from each of these sites for the period June 2019 to April, 2020. In month of April and

May these water bodies get dehydrated and water remains in central part of water body. Water samples were collected for analysis of physico-chemical parameters. To collect planktons, water samples were filtered through bolting nylon silk plankton net (No.25 mesh size 50 μ) and zooplankton samples were collected in vials. Water samples were also analyzed for surface water temperature and pH. Analysis of other variables was conducted in the laboratory using standard procedures. The samples were then observed and analyzed for presence of Zooplankton by using Olympus B X -4 0 trinacular microscope and Labovision Streo Microscope. Zooplanktons were identified, by using available standard literature (Fitter and Manuel, (1986); Trivedy, (1984); APHA, (1985); Battish, (1992); Kodarkar, (1998) and Dhanapati, (2000). Witty L.M. (2004)

RESULTS AND DISCUSSION

Zooplankton are susceptible to variations in a wide number of environmental factors including water temperature, light, chemistry (particularly pH, oxygen, salinity, toxic contaminants), food availability (algae, bacteria) and predation by fish and invertebrates. It is generally desirable to have as much information on these variables. However, some variables are relatively easy to measure (e.g. temperature), but others are more difficult (e.g. fish predation intensity, toxic contaminants). Many environmental factors affect zooplankton only at extreme levels (e.g. toxic contaminants, salinity, and oxygen) and will not be important in all lakes.

Abiotic factors such as temperature, pH, alkalinity, chlorides, *etc.* along with suitable food availability are related to abundance and occurrence of zooplankton. It is believed that, single factor never acts independently as limiting factor but, only with interaction with others. Species, which can tolerate highly variable biotopes are known as 'Eurytopic', while those capable of tolerating limited range are termed 'Stenotopic'.

Temperature affects the embryonic development and thus significantly influences the population dynamics of zooplankton (Hannazato and Yasuno, 1985). Seasonal succession and specific adaptations are seen in the tropics with changing temperatures. Environment tends to change towards optimal conditions and result in increase in population size.

Probably for the first time a comprehensive study on the freshwater bodies of Lanja taluka was undertaken. In present study zooplankton species encountered were rotifera, cladocera, cyclopoida, calanoida, copepoda larvae, and very nominal of harpacticoida and ostracoda. Table: 1 shows zooplankton diversity in Khorninko and Vhel reservoirs of Lanja tahasil. In the year 2019, As far as abundance is concern Rotifers dominated both water bodies. They were found less in June, 2019 and were abundant in December, 2019. Rotifers were found throughout the year and density peaks were observed in December and August. Cladocerans and Copepods co-dominate both water bodies and shows fluctuation in abundance and diversity throughout the year. Cladocerans were less in number in December and July while they were at peak in September. The density of cladocerans was being lower during the first seven months and was on the higher side from September onwards. Cyclopoids were minimum in October and maximum in April 2020. They suddenly disappeared in June, 2019. Calanoids another group of copepods occurred rarely in both water bodies. They were minimum in December and Maximum during March and April. Harpacticoids and Ostracods were rarely present during investigation period. Naupliar larvae was found to be dominant in entire copepod group.

The physico-chemical analysis of these water bodies showed close similarities following result with maximum temperature of 33.4 °C was recorded in April, 2020 and minimum of 21.7 °C was recorded in December, 2019. The pH ranged between 6.5 – 6.8 in the months of August '2019, September '2019, April '2020, August '2019,and 7.9 in October '2019. Alkalinity was recorded maximum at 250 ppm in April '2020 and minimum at 124 ppm in February '2020. A minimum concentration of 90 ppm was observed for hardness in November '2019, while in April '2020, maximum concentration of 175 ppm was noted. The calcium content in the lake water ranged between 42 ppm measured in December '2019 and 88 ppm in May '2020. Chlorides were minimum in September ‘2019 with the concentration being 12 ppm, while maximum concentration of 75 ppm was seen in June ‘2020. Magnesium content was in the range of 34 and 94 ppm in June ‘2020 and October ‘2019, respectively. Maximum iron concentration was measured at 0.7 ppm in August ‘2019 and the minimum concentration was found in March, April and December mpnths at 0.2 ppm. The phosphates showed its lowest concentration at 0.1 ppm in the months of May- 2020, July, August ‘2019 and June ‘2019, while in September ‘2019, its content was maximum at 0.6 ppm. Sulphates ranged between 100 and 200 ppm measured in July ‘2019and August ‘2019, respectively.

The zooplankton species encountered during the period from 2019 - 2020 in the lake were rotifera, cladocera, cyclopoida, calanoida, copepoda larvae, and very nominal of harpacticoida and ostracoda. Table: 1 shows zooplankton diversity in water bodies on lateritic plateaus of Ratnagiri.

In the year 2019, rotifers were found throughout the year and density peaks were observed in January, June, August and December. Cladocerans were less in July and maximum in September. Unlike in other lakes, they were found throughout the year in these water bodies and in high numbers. The density of Cladocerans were being lower during the initial seven months of sampling and on the higher side from September onwards. Cyclopoids were lowest in October and highest in April. They were not reported during July ‘2019. Calanoids were minimum in December and population increased during March and November month.

Thus, highest density was of rotifers and lowest density was of harpacticoids. The percentage of zooplankton occurrence was in the following decreasing order: rotifera (37.42 %) > cladocera (29.37 %) > copepoda larvae (14.32 %) > cyclopoida (14.08 %) > others (below 10 %).

Following is the list of zooplankton species recorded in two water bodies in Lanja tahsil of Ratnagiri district.

Table: 1 Checklist of Zooplanktons recorded during 2019-20 from two water bodies in Lanja tahasil of Ratnagiri district

Sr. No	Family	Name of species (Rotifers)	Khorninko reservoir	Vhel reservoir
1	Euch-lanidae	Euchlanis dilatata (Ehren-berg, 1832)	++	+
2		E. oropha (Gosse, 1887)	+	
3	Bra-chioni-dae	Anuroeopsis falcatus (Gosse, 1851)	++	++
4		Brachionus ruben (Gosse, 1851)	++	++
5		B. caudatus f. vulgatus (Ahl-strum, 1940)	++	++
6		B. diversicornis (Daday, 1883)	+	+
7		B. calyciflorus f. borgerti (Apstein, 1907)	+	
8		B. bidentata (Anderson, 1889)	+	+
9		B. quadridentatus sp. mira-bilis (Daday, 1897)	+	++
10		B. patulus (Muller, 1786)		+
11		B. budapestitensis (Daday, 1885)	+	+
12		B. forficula (Wierzejski, 1891)		+
13		Keratella cochlearis (Gosse, 1851)	+	+
14		K. tropica (Apstein, 1907)	++	++
15	Trichot-ridae	Trichotria tetractis (Ehren-berg, 1830)	+	-
16		Macrochaetus sericus (Thorpe, 1893)	+	-

17	Mytilin-idae	Mytilina acanthophora (Hauer, 1938)	+	-
18		Mytilina ventrlis (Ehrenberg, 1832)	+	-
19	Lecani-dae	L. ovalis f. larga (Sharma, 1978b)		-
20		L. (Lecane) luna (Muller, 1776)	++	++
21		L. (Lecane) nana (Murray, 1913)	++	++
22	Tricho-cercidae	Trichocera longiseta (Schrank, 1802)	+	+
23		T. cylindrica (Imhof, 1891)	++	++
24	As-planch-nidae	Asplanchana brightwelli (Gosse, 1850)	++	++
25		Polyarthra vulgaris (Carlin, 1943)	++	++
26	Floscu-lariidae	Sinantherina spinosa (Thorpe, 1893)	++	++
27	Con-ochili-dae	Conochiloides dossuarias (Hudson, 1885)	++	++

Sr. No	**Family**	**Name of species (Cladocerans)**	**Khorn-inko reservoir**	**Vhel reser-voir**
1	Sididae	Pseudosida bidentata (Herrick, 1884)	++	++
2		Sida crystallina (Muller, 1776)	+	+
3		Diaphanosoma sarsi (Richard, 1894a)	-	++
4	Daphniidae	Daphnia lumholtzi (Sars, 1885)	++	+

5		D. pulex (Leydig, 1860)	++	++
6		Simocephalus vetulus (Muller, 1776)	+	++
7	Moinidae	Moina micrura (Kurz, 1874)	++	+
8		M. macrocopa (Straus, 1820)	++	++
9		M. branchiata (Jurine, 1820)	+	+
10	Macrothricidae	Macrotrix spinosa (King, 1853)	+	+
11		M. laticornis (Jurine, 1820)	+	+
12	Chydoridae	Alonella excisa (Fisher, 1854)	++	++
13		Chydorus sphaericus (Muller, 1776)	++	++
14		C. parvus (Daday, 1898)	++	++

Sr. No	Family	Name of species (Copepods)	Khorninko reservoir	Vhel reservoir
		Calanoids		
1	Diaptomidae	Rhinediaptomus indicus (Kiefer, 1936)	++	++
2		Heliodiaptomus pulchella (Gurney, 1907)	+	++
3		H. viduus (Gurney, 1916)	++	++
4		Diaptomus judayi (Marsh, 1907)	++	++
		Cyclopoida		
5	Cyclopidae	Eucyclops agalis (Koch, 1838)	++	++

6		E. speratus (Lilljeb-org, 1901)	+	
7		Macrocyclops fus-cus (Jurine, 1820)	++	++
8		Cyclops bicolor (Sars, 1863)	++	
9		C. bicuspidatus thomasi (Forbes, 1882)	++	+
10		Mesocyclops leuck-arti (Claus, 1857)	++	+
11		M. dybowskii (Lande, 1890)	-	+
12		Halicyclops sp. (Norman, 1936)	+	+

In the present investigation 27 species belonging to phylum Rotifera has been identified in sampling locations. *Keretella tropica, Brachinous falcatus, B. caudatus, B. rubens, B. forficula* were more dominant among the rotiferans. High population was observed during summer season followed by winter and lowest population observed during rainy season. *B. falcatus, B. caudatus f. vulgatus, B. rubens, Keretella tropica, Lacane* sp. were absent in Rainy season. Low diversity of species and lower richness during monsoon period was due to reflection of environmental stresses oxygen, turbidity and transparency play an important role in controlling the density and diversity of cladocera (Edomondson, 1992; Baker,1979). The occurrence of species of Cladocera like *Ceriodaphnia, Moina* indicates best conditions of temperature for their development.

Presence of zooplankton and their abundance in any water body is influenced by inflowing streams, depth of water body, soil structure, soil chemistry, wind flow, dilution during monsoon season, qualitative variation of water, physico-chemical properties of water, shoreline and current plankton swarms, diatoms and blue green algae, minor peak may be attributed to the abundance of phytoplankton in the present study. In present study due to lower depth of water and temporary natures of water bodies, seasonal variation in zooplankton diversity and abundance is observed.

CONCLUSION

Depending on the study it can be concluded that the diversity and density of zooplanktons from two water bodies in Lanja tahasil of Ratnagiri district exhibited by three major groups (Rotifera, Cladocera, and Copepod) with 13 genera showed seasonal variability in density due to different parameters which impact on them. Due to changing nature of these water bodies and shallow depth, they have a compact ecosystem with sufficient nutrient circulation. Though almost all these water bodies are away from human settlement area and also away from industrial development, due to this rich diversity of zooplanktons was observed in these water bodies. Simultaneously dissolved oxygen and hardness level though not mentioned in the result were also favorable for planktonic growth. Overall both Kondye and Majal reservoirs were seem to be in healthy limnological conditions during study period.

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