Zooplankton Diversity of a freshwater perennial pond in Wani city of Yavatmal District, in Maharashtra, India

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Abstract

The present study was carried out to find zooplankton diversity of Singada lake near Wani in Yavatmal district of Maharashtra. For the present investigation water samples were collected from the four sampling stations of Singada Lake, Near Wani Maharashtra, India. Each planktonic replicate identified under the microscope with its standard identification and its monographs as well as keys which were suggested by APHA (1989); Tonapi (1980). There were 42 species belonging to five different classes from Zooplankton diversity. The class wise dominance of zooplankton was Rotifera > Cladocera > Copepoda > Ostracoda > Protozoa. *Keratella cochlearis* was found to be dominant species belonging to rotifera among other zooplankton species.

Key Words: Singada lake, Zooplankton, Heterotrophic, Diversity, Dominance, Wani.

Introduction

Zooplankton are the control trophic link between primary producers and higher trophic level. The fresh water zooplankton comprises of protozoa, rotifera, cladocerans, copepods, and ostracods. Most of them depend to a large extent on various bacterioplankton and phytoplankton for food. Many of the larger forms feed on smaller zooplankton some are detritivore feeder. Most of the aquatic organisms belonging to the major groups have their representative in the zooplankton as adults or as larvae. In estuarine habitats rotifers, cladocerans, ostracods and copepods are the dominant groups of zooplankton.

Water bodies like reservoir contain wide variety of zooplankton. These organisms by virtue of their adaptability are present in all the possible environmental conditions and are used as indicators of pollution. Zooplankton have attracted attention of many ecologists because of their wide distribution in all kinds of water and abundance in which, they frequently occur. Zooplankton play an important role in secondary food web of an aquatic ecosystem and form an intermediate link between tertiary producers.

One of the important group of bio-indicators in aquatic ecosystems are zooplankton. They are crucial components of aquatic food webs; as primary consumers, they respond strongly to environmental change. Thus, they can to be used to assess the conditions in aquatic ecosystems (Primo *et al*., 2015). The taxa of zooplankton present in aquatic ecosystems can have large impacts on the trophic transfer efficiencies from phytoplankton to zooplankton, and from zooplankton to fish. strong evidence that zooplankton are capable of controlling the transfer of energy through trophic levels by exerting a top down control on phytoplankton, limiting the amount of primary production with in a body of water (Jeppesen *et al*., 1997). Changes in zooplankton community composition can affect the degree of top down control on phytoplankton communities, influence the amount of nutrient processing, and determine the capacity of aquatic ecosystems to uptake carbon dioxide (Adamczyk and Shurin 2015). Zooplankton communities often vary in composition, as certain species are highly sensitive to changes in nutrient cycling, temperature, and variable environmental conditions (Primo *et al*., 2015). Zooplankton richness decreases in systems with increasing amounts of phosphorus, a nutrient commonly associated with eutrophic processes, and that certain species of cladocerans are especially sensitive to increased phosphorus (Jeppesen *et al*., 2011). Due to their trophic significance, as well as their unique responses to certain environmental dynamics, zooplankton are effective bio-indicators that can be used to measure the impact of disturbance in aquatic ecosystems.

There was no back record found about the zooplankton diversity of Singada lake near Wani in Yavatmal district, hence this task was undertaken. Zooplanktons are heterotrophic, minute aquatic organisms which play important role in food web. They are important link between primary producers and high tropic levels. Freshwater zooplanktons mainly contain protozoa, rotifers, cladocerans copepods, and ostracodes.

Review of Literature

Ugale and Jawale (2010) recorded the biodiversity and seasonal fluctuations of zooplanktons of Jagatunga Samudra Reservoir, Kandhar, Dist. Nanded, (M.S), India. The maximum number of zooplankton observed during winter season and minimum during monsoon season. Joshi (2011) conducted qualitative and quantitative studies of zooplanktons in Dhanora (Hattipaul) Lake of Buldhana district during February 2010 to January 2011. Verma *et al*., (2012) studied the effects of exposure time on aquatic toxicity with zooplanktons and various toxicants using the RLE model based on ambient exposure concentration. A calculated normal life expectancy (NLT) can be obtained from the single stage model and is in accord with reported NLT but those

obtained from the two stage RLE model are in excellent agreement. Ahmad *et al.*, (2013) evaluated the diversity of zooplankton groups and their seasonal variations. The study of zooplankton species diversity and abundance with respect to biotic factors may assist in future planning for the management of intensive fish culture in this reservoir. Pal and Chakraborty (2014) studied the physical and chemical parameters such as temperature, acidity, total hardness, pH, electrical conductivity, total dissolved solids, turbidity, chloride concentration and dissolved oxygen for the survivability of the zooplanktons and the aquatic ecosystems; these matters have been discussed in the study. Bhoyar (2015) carried out study on Kudla dam for a period of one year from Jun 2013 to May 2014. Patil and More (2016) conducted a study at Kurnur dam near Solapur district Maharashtra (India) to find out influence of various physic-chemical factors affecting community structure of zooplanktons. Chaturvedi *et al.*, (2017) studied the seasonal density of Zooplankton in the Ken River. They are strongly affected by environmental conditions and responds quickly to change in environmental quality. Hence, qualitative and quantitative study of zooplanktons is of great importance. Patil (2018) conducted a study to understand the diversity and abundance of zooplankton at Nandurmadhmeshwar Dam, Nasik district, Maharashtra. Result indicates that 16 species belonging to 4 different groups were recorded. Among them, rotifers comprise of 7 species, cladocerans 5, Copepoda 3 and Ostracoda 1. Deshmukh *et al.*, (2019) studied the correlation between abiotic factors and zooplankton diversity of wetland. Phytoplankton is an integral component of freshwater wetlands, which significantly contributes towards developmental of zooplankton and fish diversity. The study of Khaire (2020) deals with monthly variations in the zooplankton dynamics and their correlations with some physicochemical characteristics of Sina dam and observed 17 genera of zooplanktons belonging to four major groups.

Materials and Methods

For the present investigation water samples were collected from the four sampling stations of Singada Lake, Near Wani Maharashtra, India. The water was collected directly from each selected sampling station of Lake. The samples were transferred to the bottle and brought to the laboratory without disturbances. The water samples were collected by monthly intervals from the sampling stations for a period of one year. The samples were collected during morning hours. During the present study period the water samples collected from the Singada Lake with the interval of the month for the period of the year (June 2019 to May 2020) from the selected spots of Singada Lake. For the collection of zooplankton, 200 liters of water samples were filtered through plankton net numbers 25 bolting silk cloth (Pundhir and Rana, 2002). The collected planktonic sample

was concentrated to a 50 ml volume and it was preserved into 4% formalin solution for further study. Each planktonic replicate identified under the microscope with its standard identification and its monographs as well askeys which were suggested by APHA (1989); Tonapi (1980).

Results 1.Protozoa-

During the year of investigation, the monthly period observation was June 2019 to May 2020. The average number of group Protozoa was observed at sampling stations S1, S2,S3, and S4 respectively (table-1). In the observation of this group, 3 species were recorded i.e. *Balantidium* sp., *Ceratium* sp., and *Stentor* sp. Out of these 3 species the *Stentor* sp. wasdominant than other species.

2. Rotifer-

In June 2019 to May 2020, 12 species of group Rotifer were observed at sampling stations S1, S2, S3 and S4 (table-1) i.e. *Asplanchna brightwelli, Anuraeopsis fissa, Brachionus bindentata, Brachionus calyciflorus, Brachionus fulactus, Brachionus urceolaris, Keratella cochlearis, Filinia longiesta, Lecane bulla, Lindia intermedia, Testudinella patina* and *Trichocera similis.* Out of these 12 species, the *Brachionus bindentata* was found dominant to other species.

3. Cladocera-

During the year of investigation, 9 species of Group Cladocera were recorded at sampling stations S1, S2, S3 and S4 respectively (table-1) i.e. *Alona affinis, Bryospilus repens, Chydorus ovalis, Ceriodaphnia dubia, Ceriodaphnia quadrangular, Daphnia Catawba, Moinodaphnia macleayii, Scapholeberis mucronata,* and *Simocephalus vetulus*. Out of these all 9 species, the *Daphnia Catawba* was dominant than other species.

4. Copepoda-

During the investigation, 13 species of Copepoda were recorded at sampling stations S1, S2, S3 and S4 respectively (table-1) i.e. *Acanthocyclops vernalis, Attheyella alaskaensis, Bryocamptus hutchinsoni, Cyclops bicuspidatus, Cyclops languidoides, Cyclops strennus, Diacyclops bicuspidatus, Eucyclops agilis, Mesocyclops aspericornis, Orthocyclops modestus, Tropocyclops prassinus, Undulina valgaris* and *Heterocope septentrionalis*. Out of these 13 species, the *Cyclops bicuspidatus* was dominant than other species.

5. Ostracoda-

During present study, 5 species of Ostracoda were observed at sampling stations S1, S2, S3 and S4 respectively (table-1 i.e. *Chlamydotheca speciose, Condona jeaneli, icornucythere bisanensis, Cyprinotus pellucidus, Physocypria gibbara*. Out of these 5 species, the *Physocypria gibbara* was dominant than other species.

Table 1 Monthly Variation in Zooplankton population of Singada Lake

Class	Genera	Jun	Jul	Au	Sep	Oct	Nov	Dec	Jan	Feb	Ma	Apr	Ma
Protozoa	*Balantidium*	4	3	3	2	3	4	4	5	4	2	3	4
	Ceratium	2	3	4	2	4	5	6	7	5	3	3	4
	Stenter	5	3	3	3	3	4	6	6	3	6	6	4
Rotifer	*Asplanchna brightwelli*	12	11	9	9	10	13	7	11	8	5	6	10
	Anuraeopsis fissa	10	13	11	10	11	9	13	10	8	5	8	10
	Brachionus bindentata	26	29	24	25	23	20	26	24	22	23	25	24
	Brachionus calyciflorus	21	18	15	19	16	15	14	19	15	19	19	20
	Brachionus fulactus	13	15	12	13	11	12	13	10	11	10	11	13
	Brachionus urceolaris	9	7	9	10	9	8	10	8	7	7	8	9
	Keratella cochlearis	21	19	23	22	20	16	17	15	12	10	14	18
	Filinia longiesta	13	12	14	12	11	10	9	11	9	11	12	13
	Lecane bulla	11	8	12	10	9	7	6	6	6	5	9	11
	Lindia intermidia	11	7	9	9	8	10	9	11	10	9	8	11
	Testudinella patina	9	11	9	10	7	6	5	4	6	5	8	9
	Trichocera similis	6	9	6	6	7	9	6	5	4	3	4	6
Cladocera	*Alona affinis*	9	11	8	10	7	9	6	6	4	3	6	6
	Bryospilus repens	7	8	6	7	5	4	3	2	2	3	5	7
	Chydorus ovalis	6	6	7	8	5	5	4	3	3	2	4	6
Class	**Genera**	**Jun**	**Jul**	**Au**	**Sep**	**Oct**	**No**	**Dec**	**Jan**	**Feb**	**Ma**	**Ap**	**Ma**
	Ceriodaphnia dubia	4	3	2	3	3	4	2	1	1	2	3	3
	Ceriodaphnia quadrangula	11	9	10	11	9	8	8	7	6	8	10	11
	Daphnia Catawba	14	11	12	11	12	10	8	9	10	12	12	14
	Moinodaphnia macleayii	8	11	10	11	9	10	8	11	9	9	8	8
	Scapholeberis mucronata	9	12	9	12	9	8	6	5	8	8	9	9
	Simocephalus vetulus	12	14	11	10	9	9	8	6	8	10	11	12
Copepoda	*Acanthocyclops vernalis*	2	3	3	2	5	4	3	5	4	3	2	2
	Attheyella alaskaensis	5	4	4	2	2	3	1	0	0	3	4	5
	Bryocamptus hutchinsoni	9	9	6	3	5	4	1	2	1	5	7	9
	Cyclops bicuspidatus	12	10	8	6	10	9	11	7	9	11	11	12
	Cyclops languidoides	5	6	6	7	8	7	8	6	9	6	5	5
	Cyclops strennus	4	2	2	3	4	3	3	2	2	3	3	4
	Diacyclops bicuspidatus	3	1	2	3	3	6	6	5	5	4	3	3
	Eucyclops agilis	3	1	1	2	3	4	2	3	3	3	3	3

	Mesocyclops aspericornis	8	9	7	8	7	6	3	4	3	5	7	8
	Orthocyclops modestus	6	7	6	5	7	3	6	7	5	4	5	6
	Tropocyclops prassinus	3	4	5	4	3	1	2	2	1	2	3	3
	Undulina valgaris	1	1	1	1	2	3	2	1	1	1	1	1
	Heterocope septentrionalis	3	2	3	2	1	4	3	3	1	2	2	3
Ostracoda	*Chlamydotheca speciosa*	5	6	7	6	5	6	4	3	1	4	4	5
	Condona jeaneli	3	3	3	4	3	1	2	3	2	1	3	5
	Bicornucythere bisanensis	1	2	2	3	4	2	1	2	3	2	2	1
	Cyprinotus pellucidus	7	9	8	7	3	1	6	8	6	4	5	7
	Physocypria gibbara	9	11	12	10	4	1	10	9	8	7	8	9

Annual Percentage of Zooplankton-

Table 2 shows the annual percentage of Zooplankton at four different sampling stations of the Singada from June 2019 to May 2020. During the year of investigation, the annual percentage of Protozoa, Rotifera, Cladocera, Copepoda and Ostracoda was 3.93%, 47.18%, 22.68%, 18.30% and 7.90% respectively. Thus it is evident that maximum percentage was Rotifer group i.e. 47.18% and the minimum value of annual percentage ofZooplankton was observed for protozoa group i.e. 3.93% at Singada Lake.

Table 2: Annual percentage of Zooplankton of Singada Lake from June 2019 to May2020

Class	**Annual Percent of Zooplankton**
Protozoa	3.93
Rotifera	47.18
Cladocera	22.68
Copepoda	18.30
Ostracoda	7.90
Total	**100.00**

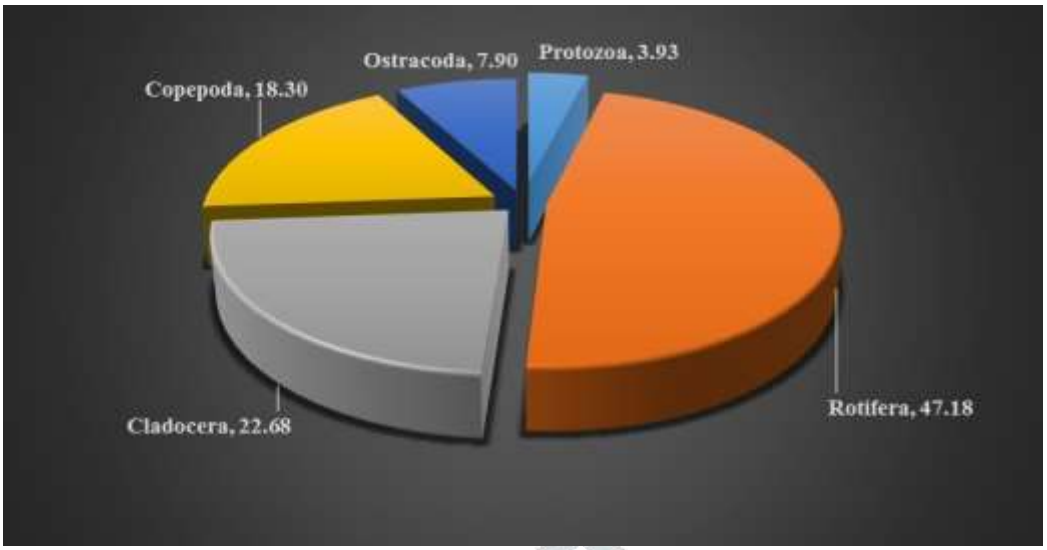

Fig. 1: Annual Percentage of Zooplankton of Singada Lake from June 2019 to May 2020

Discussion

Aquatic organisms in the ecosystem depends on the area and volume of the waterbody and the level of plankton primary production. Improve growth and survival rate of *Heterobranchus longisfilis* larval when fed on enriched zooplankton, compared to un- enriched. Balance diet for fish and prawn. Rotifers and Cladocerans are important componentof most freshwater communities. The population of zooplankton is a function of availabilityof suitable food for aquatic organisms. The importance of long chain omega-3 polyunsaturated fatty acids in rotifers as food for Sea bream larvae.

In present study 3 genera of Protozoa group were observed *Balantidium* sp., *Ceratium* sp., and *Stentor* sp. Out of these 3 species, the Stentor was dominant than other species. In their studies Bhagat and Meshram (2007) and Boxshall and Strong (2006) reported similar results.

Total of Rotifer species reported in this study was 12 belonging to 9 genera which include *Asplanchna brightwelli, Anuraeopsis fissa, Brachionus bindentata, Brachionus calyciflorus, Brachionus fulactus, Brachionus urceolaris, Keratella cochlearis, Filinia longiesta, Lecane bulla, Lindia intermedia, Testudinella patina* and *Trichocera similis*. Out of which *Brachionus bindentata* observed to be dominant species. Similar results were reported in the study performed Boxshall and Evstigneeva (1994) and Davies *et al*. (2009).

9 species of 8 genera of Cladocera are found in this study which include *Alona affinis, Bryospilus repens, Chydorus ovalis, Ceriodaphnia dubia, Ceriodaphnia quadrangular, Daphnia Catawba, Moinodaphnia macleayii, Scapholeberis mucronata,* and *Simocephalus vetulus*. Out of which, *Daphnia*

Catawba observed to be dominant species. Similar results were reported in the study performed Dhanapathi (2000); Devika *et al.*(2006); Gayathri *et al.*(2014); Goswami and Mankodi (2012).

The present study reports 13 species belonging to 11 genera of Copepoda including *Acanthocyclops vernalis, Attheyella alaskaensis, Bryocamptus hutchinsoni, Cyclops bicuspidatus, Cyclops languidoides, Cyclops strennus, Diacyclops bicuspidatus, Eucyclops agilis, Mesocyclops aspericornis, Orthocyclops modestus, Tropocyclops prassinus, Undulina valgaris* and *Heterocope septentrionalis*. Out of which *Cyclops bicuspidatus* observed to be dominant species. Similar results were reported in the study performed Jalilzadeh *et al.* (2007) and Raghunathan and Kumar (2002).

In the present study, 5 species of 5 genera of Ostracoda are observed which include *Chlamydotheca speciose, Condona jeaneli, icornucythere bisanensis, Cyprinotus pellucidus* and *Physocypria gibbara*. Out of which *Physocypria gibbara* observed to be dominant species.

Conclusion

The diversity of zooplanktons is richer in number and presence and dominance of zooplankton species play very significant role in the functioning of freshwater ecosystem. In the present investigation, there were 42 species belonging to five different classes from Zooplankton diversity. The quantity of zooplanktons in water provided significant information about the available sources for supporting life for fishery development. In present days, the biodiversity is in danger because due to pollution and human activities. Conservation of biodiversity is essential so it is compulsory to keep update knowledge of every aquatic species diversity. The density of planktons in water body determined stocking rate of fishes because they were the chief sources of the food of commercially important fishes as well as development in production of inland fishery sector. The presence and dominance of zooplankton species played a very significant role in the functioning of freshwater ecosystem.

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