P: ISSN NO.: 2321-290X RNI : UPBIL/2013/55327 VOL-8* ISSUE-2* October- 2020
E: ISSN NO.: 2349-980X **Shrinkhla Ek Shodhparak Vaicharik Patrika**

Seasonal Fluctuation of Zooplanktonic Community in Relation to Water Quality in Srinagar Pond

Paper Submission: 15/10/2020, Date of Acceptance: 25/10/2020, Date of Publication: 26/10/2020

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Abstract

Any alteration in the environment leads to a change in the plankton communities in terms of tolerance, abundance, diversity and dominance in the habitat. Therefore, plankton population observations may be used as reliable tools for biomonitoring studies to assess the pollution status of aquatic bodies. Dominance of zooplankton eutrophic indicator species like Brachionus, Moina and Cyclops indicate that the Srinagar pond is a highly polluted hard water body and eutrophic status of the pond.

Keywords: Pollution, Srinagar pond, Zooplankton, Bioindicator.

Introduction

In a fresh water ecosystem, the abiotic factors consist of the environment, the nature of water and the biotic factors comprise flora and fauna along with aquatic microbes such as algae, fungi, protozoan, benthos etc. Since both these components mutually influence and interact with each other, a thorough understanding of an ecosystem is not possible without analysing these factors in detail. As regards the environment, this too is well known that completion of life cycle of any organism entirely depends upon a favourable and friendly environment and hence analysis of the environment is extremely essential.

Zooplankton constitute a relatively smaller population of aquatic biomass. They form an important biotic component in cycling of organic matter in an aquatic ecosystem. The indiscriminate discharge of domestic sewage and other industrial wastes into pond water are imposing considerable impact on distribution and diversity of zooplankton. Zooplankton biomass directly reflects the prevailing conditions of aquatic environment and structure and function of biological system which are affected by environmental changes (Kulshreshtra*et al.*; 1992 a,b). Zooplankton being a major link in energy transfer at secondary level, play a significant role in transformation of food synthesised by phytoplankters to the higher trophic level.

These days the water of pond is used for bathing, washing and irrigation purposes. Sewage waste also drain into the pond. As a consequence, the pond water is subjected to various biotic and abiotic influences which in turn have affected its quality. Zooplankton are known to accumulate chemicals by direct absorption from water and through food intake. Several zooplankton species have been classified as indicator of polluted condition.

Aim of the Study

Lakes and ponds are popular picnic spots besides being used for irrigation, boating, bathing fishing, water sports etc. Thus, man's indulgence in their characteristics are causing deterioration in their structure and lowering their qualitative value which influence the biotic composition of zooplankton. Many such water bodies have been assessed for their tropic status and their water quality.

In understanding the significance and hence the importance of limnological studies as a pre-requisite to furthering a healthy fresh water environment, this research programme was contemplated. Emphasis was laid on the study of the quality of the abiotic and biotic components of the pond for assessment of the water body and also for help in formulating strategies for better management.

Material and Method

Water samples along with plankton were collected at monthly intervals. The monthly data collected were pooled together for statistical analysis and tabulated.

Area of Study

Srinagar Pond is a perennial pond which is annually filled by monsoon water. The water of this pond is being used for washing and irrigation purposes by people and bathing and drinking purpose by cattle. The south western area of the pond is covered by residential colonies. There are agricultural fields on the north, north-western and north-eastern sides of the pond. This small pond is also used as a dumping ground for domestic effluents and sewage contributed by people residing in residential areas near the pond

Plankton samples were collected and preserved for qualitative and quantitative analysis in the laboratory. For various limnological and biological parameters studied in the present work, standard methods of Jhingran*et al* (1969), Needham and Needam (1978), Tonapi (1980), Trivedi and Goel (1986), Adoni (1985), Trivedi *et al* (1987) and APHA (1998) followed.

The data obtained in the present study on different aspects of limnology were processed statistically. Statistical analysis was done by adopting appropriate programme in a personal computer.

Plankton Analysis

The plankton samples were collected from all the four sampling sites. For collecting samples, 30 litres of water was filtered through plankton nets made up of bolting silk no. 25 (mesh size 55 mm). Zooplankton sample were preserved in 4 percent neutral formalin solution, The identification of different zooplankton species was done with the help of standard references of Edmondson (1959), Needham and Needham (1978) Pennak (1978), Tonapi (1980), Sharma (1983) and Adoni (1985). For identification of phytoplankton, references were made to Fritsch (1935), Smith (1950), Desikachari (1959), Prescott (1962), Ramanathan (1964), Philipose (1967) and APHA (1998).

For quantitative estimation of plankton, Sedgwick-Rafter cell method was used. For quantitative estimation of zooplankton, Size of plankton was measured with the help of calibrated occulo-micrometer that was already fitted within the research microscope. Camera Lucida drawings of plankton were made. Besides these for qualitative studies, zooplankton samples were collected randomly from different parts of reservoir and preserved in 4 percent neutral formalin solution for identification in laboratory.

Discussion

From the analysis of results obtained from different groups of zooplankton the overall dominance of Ostracode was seen throughout the year.

In summer rotifers and cladoceras ranked next. In winter and monsoon, the zooplanktonic fauna indicated dominance of cladocera followed by rotifers. The highest density of zooplankton was found in summer (May) and in winter (November) and lowest in monsoon (September) at all the sampling sites. Das and Srivastava (1956), Khan and Siddiquie (1974), Lahon (1983), Yadav *et al* (1987) and Sanjer and Sharma (1995), Jindal Sunita (2002) found bimodal pattern of zooplankton density with summer and winter maxima. Similar summer maxima of zooplankton population has also been reported by George (1966), Adoni (1975), Selot (1977) and Billore and Vyas (1982). Sarwar Praveen (1996) and B.N. Panday *et al* (2004) opined that higher zooplankton number was recorded during summer in some tropical lakes. This seasonal variation of zooplankton may be due to environmental changes. The same findings were observed by Naik and Neelkantham (1984), Sharma and Pant (1984) Singh *et al.,* (1987) Srivastva *et al.,* (1990), Singh (1990), Jindal Sunita (2002), Manzer M.B.H. *et al.,* (2005). Whereas Ruttner (1963), Rao (1987), Bhatnager Abha (2005) observed high zooplankton population during monsoon. Presence of maximum zooplankton population in summer might be due to the presence of higher population of bacteria. Plankton depends on water quality, remain on dead and decaying vegetation as well as burnt and half burnt bodies. This resulted in an increase of the organic matter and growth of the bacterial population which increased the zooplankton density.

Planktonic life is a significant parameter to judge the quality and productivity of water.

Zooplankton status in Srinagar pond can be seen in table-2,3,4

Zooplankton community comprised the organisms belonging to protozoa, Rotifera, Cladocera, copepoda and ostracoda.

40 genera 55 species were recorded during the investigation period. Among these protozoa were represented by 8 genera and 8 species. They occurred in large numbers in the month of September. The Rotifera mainly comprised of the genera of 13. The maximum population of Rotifera was observed in July

Maximum population of Rotifers was seen in summer. It is interesting to note that the Rotifers have versatile capacity to thrive in different environments and as such they usually dominate over other zooplankton communities. Radwan (1976) and Hakkari (1978) have characterized rotifers as indicators of eutrophication. Similar observations were also recorded by George (1966), Michael (1968), Jana (1973), Goswami (1985), Baruch *et al.,* (1993), Sanjer and Sharma (1995), Pandey B.H. *et al.,* (2004), Sharma Jayshree *et al.* (2007).

The clardocerans were found to be the most prominent group during the present study. Cladoceran population was maximum in summers and the minimum values were recorded in monsoon. Similar results also found by Singh (1986a). Dominance of copepods and cladocerans in stagnant waters was reported by Ganapati (1943) and Alexander and Barsdata (1971).

Mahajan *et al.* (1981) stated that some cladoceran species are indicators of eutrophication.

Cladocerans maintain high population in nutrient rich eutrophic waters. Similarly, Khan and Rao (1981)

considered abundance of cladocera as indication of eutrophic condition due to pollution. Rao (1984) while studying zooplankton of the lake Jaisamand correlated Cladocera with eutrophic conditions. Gannon and Stemberger (1978) Michael (1985) and Johri (1989) have also considered cladocerans as bioindicators of eutrophication.

Copepode showed two peaks, one in May and other in November during the year. Similar observations were also reported by Singh (1986a), Unni *et al.* (1992), Sharma and Hussain (2001) and Jindal Sunita (2002).

Ostracoda showed their maximum population in summer at all sites during the year. Similar observations were also reported by Unni *et al.* (1992) and Krishnan and Azis (1999). In the present study ostracods formed the least occurring group in the total zooplankton density.

Conclusion

A number of zooplankton species are indicators of trophic status. The analysis of pollution indicator organism is based on the presence of particular species, which is indicative of a particular environmental condition rotifers such as Branchionus caudatus, B Calyciflorous, Keratella trophics, Filinia longiseta, Polyarthra sp. and Asplanchna sp. have been identified as eutrophic indicator species in India and elsewhere in world by Radwon (1976), Hakkari (1978), Gannon and Stemberger (1978), Mahajan *et al*. (1981), Sladecek (1983) and Sharma (1986).

Gannon and Stemberger (1978) considered cladocerons as bioindicators for eutrophication. Mahajan (1981) reported that Simocephalus and Ceriodaphnia were indicators of eutrophication. Bajpai *et al*. (2001) characterized Moina sp. and the Copepode cyclops sp as indicator of eutrophication.

High densities of Brachionous sp, Asplanchna sp, Moina sp. Cyclops sp. and Filina sp in Srinagar pond indicate the eutrophic nature of the pond water. Strategies should be employed for the conservation or restoration of the pond to increase its aesthetic value, make it suitable for aqua cultural purpose and in general to make it more eco-friendly.

Table-1

Systematic Account of Zooplankton

Protozoa
Plasmodroma
Sarcodina
Amoeba
Diffugia sp
Euglypha sp
Ciliophora
Ciliata
Gymnostomaticda
Metopus
Paramoecium
Didinuim
Stentor
Vorticella

Rotifer
Digonota
Bdelloidea
Philodina
Monogonata
Ploima
Anuraeopsis
Asplanchna
Brchionus mulleri
Brachionus bidenta
Brachionus angularis
Brachionus caudatus
Brachionus forficula
Brachionus calcyflorus
Keratella cochlearis
Keratella tropica
Keratella procurva
Lecane luna
Platyias
Polyarthra
Scaridium longicaudum
Floscullariacea
Filinia longiseta
Filinia opoliensis
Hexarthra
Testudinella sp
Arthropoda
Crustacea
Branchiopoda
Cladocera
Alona rectangulla
Alonella
Ceriodaphnia sp.
Chydorus
Daphnia carinata
Daphnia lumholtzi
Daphnia manga
Daphnia longispina
Daphnia similis
Macrothrix sp.
Monis sp.
Moina daphnia
Pleuroxus
Scapholeberis
Side crystallina
Simocephalus ventulus
Streblocerus sesricandatus
Copepoda
Diaptomus dilobatus
Eucyclops agilis
Eucyclops prinophores
Helicyclops sp.
Mesocyclops hyalinus
Mesocyclops leuckart
Nauplius
Ostracoda
Cypris shell
Stenocypris malocmsoni

Table -2Seasonal Variation in The Different Groups of Zooplankton at Different Sites Under Investigation

S. No.	Group	Season	Sites			
			1	2	3	4
1.	Protozoa	Winter	41	42	50	60
		Summer	52	51	59	79
		Monson	102	110	122	123
2	Rotifera	Winter	185	189	189	226
		Summer	209	225	242	260
		Monson	146	168	187	184
3	Cladocera	Winter	187	233	220	241
		Summer	274	301	320	326
		Monson	164	198	190	196
4	Copepoda	Winter	118	124	133	131
		Summer	114	142	138	129
		Monson	34	45	43	49
5	Ostracoda	Winter	23	12	26	31
		Summer	40	30	40	51
		Monson	23	15	25	32

Table-3

Total number of zooplankton in different seasons at different sites in the study area under investigation

Seasonal	Site I	Site II	Site III	Site IV
	Zooplankton	Zooplankton	Zooplankton	Zooplankton
Winter	554	600	618	689
Summer	689	749	799	845
Monson	474	536	568	584

Table-4 Percent value of different group of zooplankton at different sites in the study area under investigation

S. No.	Group	Sites			
		1	**2**	**3**	**4**
1	Protozoa	11.357	10.769	11.637	12.370
2	Rotifera	31.450	30.875	31.133	31.633
3	Cladocera	36.400	38.832	36.775	36.024
4	Copepoda	15.873	16.498	15.818	14.589
5	Ostracoda	5.008	3.023	4.584	5.382

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