ISSN NO. 2320-5407

Journal homepage: http://www.journalijar.com

INTERNATIONAL JOURNAL OF ADVANCED RESEARCH

RESEARCH ARTICLE

Distribution and diversity of Zooplanktons in Madhya Pradesh, India.

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Manuscript Info

Manuscript History:

Received: 25 January 2013
Final Accepted: 01 March 2013
Published Online: March 2013

Key words:
Narmada river,
Diversity,
Zooplanktons,
Anthropogenic activities,

Abstract

The distribution and diversity of zooplankton in aquatic ecosystems terms depends mainly on the physico-chemical proportion of water. Pollution of water bodies by different sources will result in drastic changes in zooplankton potential of the ecosystem. The Narmada river is gifted with varied diversity of zooplanktons. The present study was carried out for the period of two years from October 2009 to September 2011. The study was carried out at selected sampling station Omkareshwar. During the present investigation, 39 species of zooplankton were identified. As far the qualitative (species wise) abundance is concerned, eight species belonging of Phyla protozoa, fifteen species of Rotifera, nine species of Cladocera and seven species belonging to Copepoda were recorded. Zooplankton diversity was maximum during months from January to April. The study aims to overcome the pollution caused in Narmada river due to various anthropogenic activities and domestic wastes. The study aims to conserve the zooplanktons which are declining day by day.

Introduction

The Narmada, the largest west-flowing river of the peninsula rises near Amarkantak, in the Shahdol district of Madhya Pradesh and flows through Mandla, Jabalpur, Narsinghpur, Hoshangabaad, Raisen, East Nimar, West Nimar, Dewas district and Dhar District. The total length of the river from the head to its outfall into the Gulf of Khambhat is 1,312 km (1,079 km are in Madhya Pradesh, next 35 km forms the boundary between the States of M.P. and Maharashtra, the next 39 km forms the boundary between Maharashtra and Gujarat and last length of 159 km in Gujarat).

There are about seven dams constructed on Narmada River. Due to the Dam formation the ecology of Narmada river is quite degraded which results in threat aquatic biodiversity of river. The idea of damming the Narmada was discussed as far back as the late 19th century during the days of the British Raj. Of the 30 big dams proposed along the Narmada, Sardar Sarovar Project and Narmada Sagar Project are the megadams. The Maheshwar and Omkareshwar dams along with Sardar Sarovar Project and Narmada Sagar Project are to form a complex which would ultimately cater to the needs of Sardar Sarovar Project. The struggle of the people of the Narmada valley against large dams began when the people to be displaced by Sardar Sarovar Project began organizing in 1985-86. Since then the struggle has spread to encompass other major dams in various stages of planning and construction chiefly Maheshwar, Narmada Sagar, Maan, Goi and Jobat. Tawa and Bargi Dams were completed in 1973 and 1989 respectively have seen the affected people organize post-displacement to demand their rights. The government is planning to build 30 big dams, 135 medium dams and 3000 small dams on the Narmada & its tributaries. If all of these dams ever get built then the river as we know it will disappear and all that will be left are a series of lakes.

Biodiversity describes the variety of biological organisms in a given habitat, area, or ecosystem. It includes several components involving variation in

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species, ecosystems, and genetics. Biodiversity is essential for stabilization of ecosystem, protection of overall environmental quality for understanding intrinsic worth of all species on the earth (Nelson 2006).

The zooplanktons from major link in the energy transfer at secondary level in aquatic biotopes. The occupy an intermediate position in aquatic food webs between autotrophs and heterotrophs. The distribution and diversity of zooplankton in aquatic ecosystems terms depends mainly on the physico-chemical proportion of water. Pollution of water bodies by different sources will result in drastic changes in zooplankton potential of the ecosystem. Zooplanktons are known to accumulate chemicals by direct absorption from water and through food intake.

The zooplanktons are animal plankton and move at the mercy of water currents. They occupy central position between the autotrophs and other heterotrophs in an aquatic ecosystem and form a major link in the entire food chain and main energy source for fishes truly planktonic animals in fresh waters are dominated by Rotifera, Cladocera and Copepoda. Protozoans also form a significant part of fresh water zooplankton.

Zooplankton assume a great ecological significance in ecosystem as they play vital role in food web of the food chain, nutrient recycling, and in transfer of organic matter from primary producers to secondary consumers like fishes (Krishnamurthy et al., 1979). They are more abundant within mangrove water ways than in adjacent coastal waters, and a large proportion of the juvenile fish of mangroves are zooplanktivorous (Robertson and Blabber, 1992). The zooplanktons determine the quantum of fish stock. The failure of fishery resources is attributed to the reduced copepod (zooplankton) population (Stottrup, 2000). Hence, zooplankton communities, based on their quality and species diversity, are used for assessing the productivity viza viz fishery resource, fertility and health status of the ecosystem.

The present study was carried out to study the distribution of zooplanktons in Narmada river. The study aims to overcome the pollution caused in Narmada river due to various anthropogenic activities and domestic wastes. The study aims to conserve the zooplanktons which are declining day by day.

Material and Methods

The present study was carried out for the period of two years from October 2009 to September 2011. The study was carried out at selected sampling station Omkareshwar. Omkareshwar is considered to be one of the holiest Hindu sites in the nation about 77km away from Indore city. The sampling was carried out during the morning hours twice a month. The samples were preserved in formalin and then transported to laboratory for identification.

Counting of the individual zooplankton was done by "Lac Keys" dropping method (1935). Using the formula.

$$\text{Zooplankton units/Liter} = \frac{N \times C}{y} \times 10$$

N = Number of zooplankton counted in 0.1ml. concentrate.
C = Total volume of concentrate in ml.
Y = Total volume of water filtered for sample in liters.

The zooplankton density was expressed on individuals/liter.

Zooplankton were identified with the help of keys' provided by Pennak (1978), Sehgal (1983), Needham and Needham (1962), Tonapi (1980), APHA (1980).

Results

The zooplanktons are animal plankton and move at the mercy of water currents. They occupy central position between the autotrophs and other heterotrophs in an aquatic ecosystem and form a major link in the entire food chain and main energy source for fishes truly planktonic animals in fresh waters are dominated by Protozoa, Rotifera, Cladocera and Copepoda. Protozoans also form a significant part of fresh water zooplankton.

Zooplankton population of the Narmada river comprised generally Protozoans Rotifers, Cladoceran and Copepods. Zooplanktons here showed variations in their abundance during different months of the year. The peak period of zooplankton were observed in winter and summer months throughout the study period.

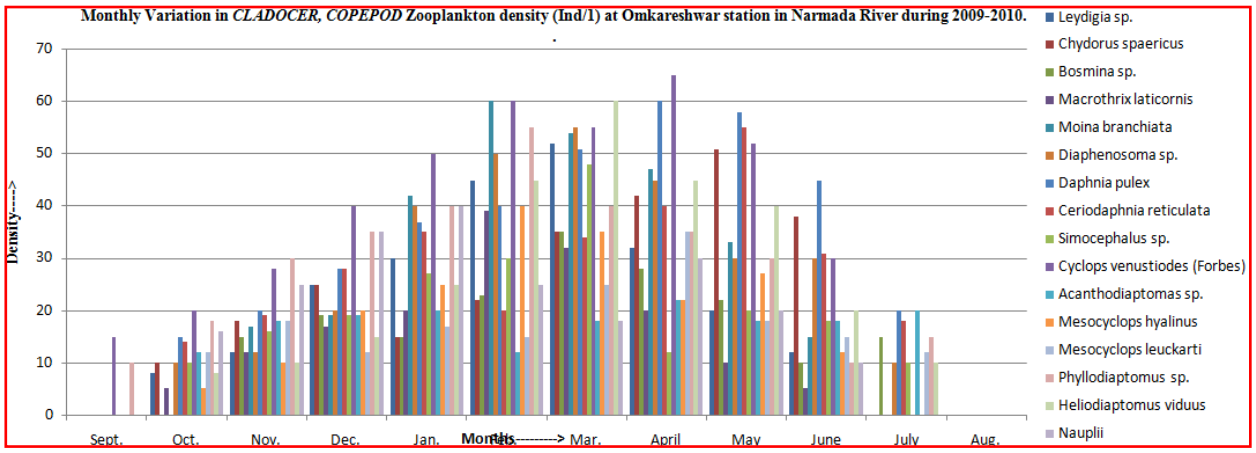
During the present investigation, 39 species of zooplankton were identified (Table 1.). As far the qualitative (species wise) abundance is concerned, eight species belonging of Phyla protozoa, fifteen species of Rotifera, nine species of Cladocera and seven species belonging to Copepoda were recorded. Zooplankton also showed seasonal prefer over, Zooplankton, the Production was maximum during months from January to April.

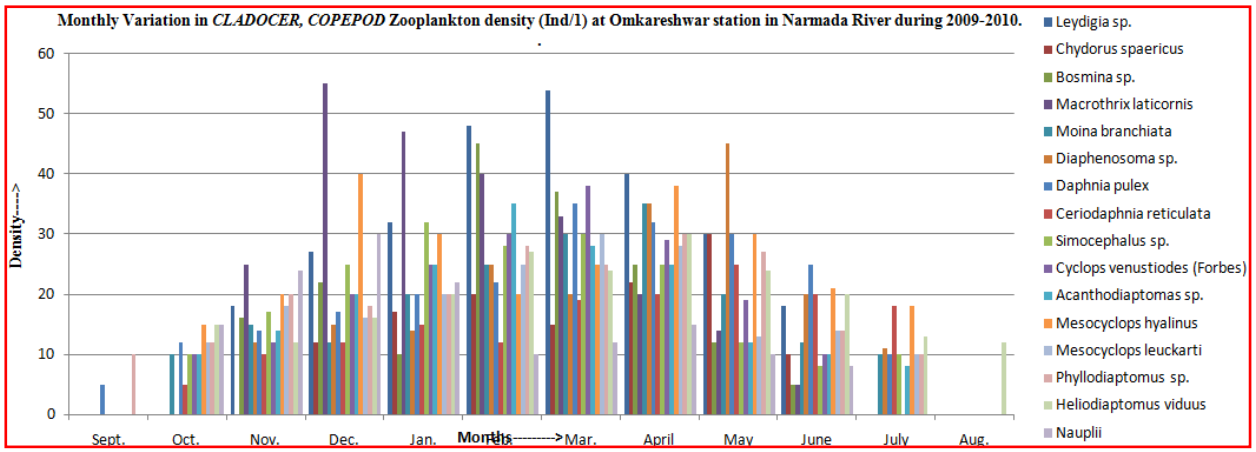
Population dynamics of Zooplanktons:

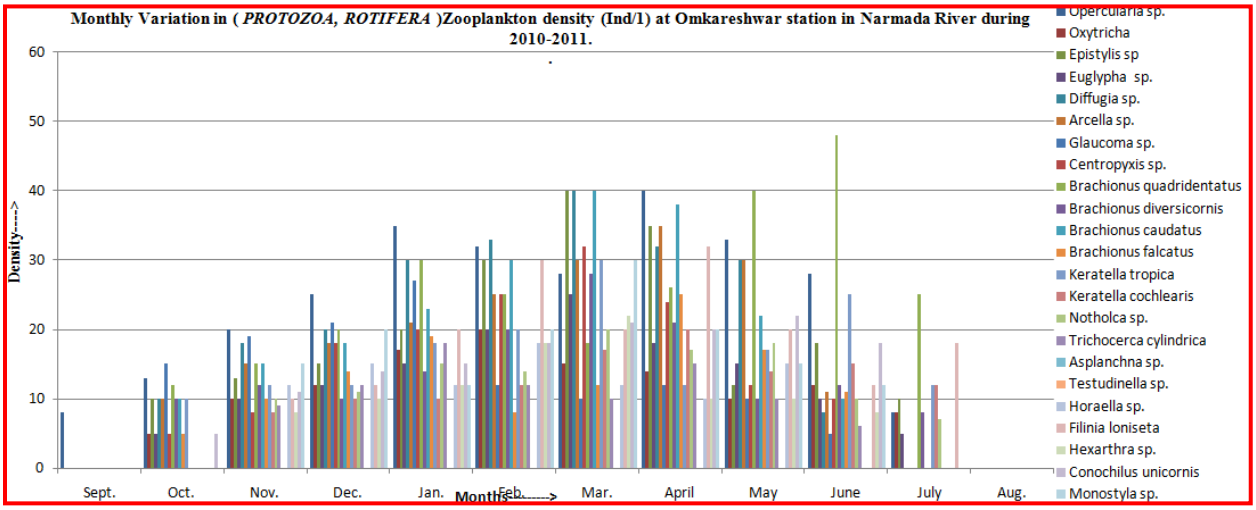
Protozoa: During the present investigation, 8 taxa of protozoa viz; Opercularia sp., Oxytricha, Epistylis sp., Euglypha sp., Diffugia sp., Arcella sp., Glaucoma sp., Centropyxis sp., were recorded. The maximum number of protozoans were reported in

March and the minimum during July, August and September. The minimum diversity during rainy season may be due to rainfall and heavy floods, poor water quality and less food availability.

Rotifera: The major portion of the zooplankton population were shared by rotifers. The population of rotifers was maximum in March and was minimum in August. Fifteen species of Rotifera were recorded during the study period.







This group dominated during winter and summer months and considerably were very low in number during rainy months of the both years. The maximum diversity in February to April months may be due to abundance in food. The less diversity of this group from July to September months due to rainfall and heavy floods, poor water quality and less food availability.

Cladocera: During the present investigation, nine species of Cladocera were recorded from river Narmada at Omkareshwar. The cladocera showed abundance from January to April. The maximum number was recorded in March with decline from May to onwards. Moina, Ceriodaphnia, Daphnia and Macrothrix species. common genera of Vladocera.

Copepoda: During the present investigation, seven taxa of protozoa were recorded. The maximum number of protozoans were reported in March and the minimum during July, August and September. This group thriven well from March to April. The maximum number was recorded in March.The minimum diversity during rainy season may be due to rainfall and heavy floods, poor water quality and less food availability.

Discussion

The Indian inland freshwater ecosystems harbor a rich wealth of primary producer component. Depending on the quality and quantity of these primary producers the quality and quantity of life forms belonging to different trophic levels of the food chain of the water body are determined. Every organisms of a water body whether plant of food chain and/or food web and thus plays an important role in flow of every in the system and as such the present study will remain incomplete without having a complete picture of biotic parameters. Hence an attempt was made to evaluate the biotic parameters of Narmada river under following heads.

The Narmada river is gifted with great diversity of Zooplanktons. The zooplanktons serve as an important link in the food chain and maintaining the ecological pyramid of the ecosystem. The zooplanktons were also recorded in abundant number throughout the study period. Among phylum protozoa, Arcella species was recorded in higher number followed by Glaucoma species. Among the minor phyla Rotifera, Filinia loniseta was recorded in maximum number followed by Monostyla species, while the species Branchinus caudatus was recorded in lesser number. Among claocera, the species Moina branchiate was present in maximum number followed by Simicephalus species. Among the copepod, the species Phyllodiaptomus was recorded in higher number.

Table 1. List of Zooplankton species collected for sampling station.

S. No.	Name of Group & Species
1	*Eudorina Species*
2	*Closteridium Species*
3	*Chlorella Species*
4	*Actinastrum Species*
5	*Crucigenia Species*
6	*Scenedesmus*
7	*Pediastrum Simplex*
8	*Pediastrum Duplex*
9	*Microspora Species*
10	*Oedogonim Species*
11	*Spirogyra Species*
12	*Zygnema Species*
13	*Closterium Species*
14	*Euastridium Species*
18	*Ulothrix Species*
19	*Volvox Species*
20	*Cosmarium Species*
21	*Tetraspore Species*
22	*Palmodictyon sp.*
23	*Lepocinclis Species*
22	*Chlamydomonas Species*
CYNOPHCEAE	
1	*Anacytis Species*
2	*Oscillatoria Species*
3	*Spirulina Species*
4	*Anabaena Species*
5	*Nostoc Species*
6	*Cyclotella Species*
7	*Lyngbya Species*
8	*Rivularia Species*
9	*Gleotrichia SP.*
EUGLENOPHYCEAE	
1.	*Euglena SP.*
BACILLARIOPHYCEAE	
1	*Asterionella Species*
2	*Melosira Species*
3	*Fragilaria Species*
4	*Gomphonema Species*
5	*Surevilla Species*
6	*Microcystis Species*
7	*Nitzscha sp.*
8	*Cymbella Species*

Zooplanktons of all major groups were observed in the summer season. The summer population maxima of zooplankton were co-related with higher temperatures, lower transparency, and a high standing crop of primary producers leading to greater availability of food. These same findings were expressed by Salve and Hiware (2010) who studied the zooplankton diversity of wan reservoir, Nagapur (MS.), India.

According to Bais and Agrawal (1995), a progressive increase in the alkalinity of water also increased the zooplankton population. The simultaneous presence of dissolved oxygen and hard water also favored the production of zooplanktons during the summer in both lakes. Similar results have also been suggested by a number of workers (Ramakrishnan and Sarkar 1982; Bhati and Rana 1987 and Kumar and Datta 1994).

Normally the monsoon is associated with lower population densities due to its dilution effect and decreased photosynthetic activity by primary producers. Similar results have been shown by Bais and Agrawal (1995). The summer population of total zooplankton falls during the monsoon due to a dilution effect. The population rises to a higher level in the winter as a result of favorable environmental conditions, including temperature, dissolved oxygen and the availability of abundant food in the form of bacteria, nanoplankton and suspended detritus. Edmondson (1965) and Baker (1979) have also confirmed these findings.

The abundance and distribution of zooplankton is guided by a variety of ecological factors. The physiochemical parameters such as temperature, light, pH, organic and inorganic constituents and the interrelationship with their organisms play an important role in determining the nature and pattern of fluctuation of population densities of zooplanktons in an environmental unit. The importance of these factors has been stressed by several workers including Arora (1966), John et al.(1980), Rajendra (1992), Kumar and Datta (1994), Kodarkar (1992) and Desilva (1996). However these parameters are extremely variable from place to place and from time to time. These parameters also interact with each other in a variety of ways.

In the present study the total Zooplankton density exhibited a single peak during March. However, a sudden increase was noticed in the month of October which continued till March .This increase is attributed to the settling of rain water return of favorable conditions in post monsoon period. However many workers Welch, (1952), Das and Shrivastava (1956), Mohanta (2000) reported bimodel pattern of Zooplankton list. Sompato et al., (2002) and Patil et al., (2003) also reported a single peak but in the month of October from Madurai water body.

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