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Research Article

QUALITATIVE STUDIES ON PLANKTONIC DIVERSITY OF RIVER GANGA AT HARIDWAR

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ABSTRACT

The plankton is an important biological indicator for evaluating the water quality. In the present study analysis of Ganga water sample for planktonic diversity has been carried out for a period of three years i.e. 2010-2013. During the course of study total plankton fluctuated from 2812.80 unit/l to 770.33 unit/l. Among phytoplankton Diatoms (1446.36unit/l± 630.79), Green algae (179.13 unit/l ± 100.25) and blue green algae (37.52 unit/l ± 19.54) and in zooplankton Protozoa (58.45 unit/l ±31.68), Rotifera (52.07 unit/l±25.78), Cladocera (40.35 unit/l± 28.16), Copepod (45.96 unit/l± 25.84) and Ostracods (39.21 unit/l± 22.72)constitute the main component.The overall result shows that the trends for phytoplankton flow in the following manner: Diatoms>Green algae>Blue green algae while among zooplankton the trend flows Protozoa > Rotifera > Copepod > Cladocera > Ostracods.

Keywords: Ganga, Green Algae, Phytoplankton, Planktonic diversity,Zooplankton

INTRODUCTION

Rivers are the raisin deter of India. The country is blessed with so many river systems that have a history of sustaining civilizations as old as Harappa and Indus Valley civilizations. That is why rivers are held in awe and revered in our country. But we have taken an unfair advantage of these lifelines of our country by polluting them. Ganga is considered as “the lifeline of India” as it drains a vast area of the country. It has great importance in respect of culture, economy as well as ecology. This river is vastly used for agriculture, power generation, fishery and pilgrimage. For such importance of the river, it was declared as the ‘National River’ of India on November 4, 2008. Ganga is often called as Maa Ganga (mother Ganga) probably because billions of lives are directly or indirectly dependant on it. Since time immemorial, the river has provided livelihood to millions of people and has been emotionally attached to the faith and believes of the people of India.The Ganga River is the most sacred river in the world and with whom people are sentimentally attached since the time immemorial. During recent years, due to increased population and industrial growth, the quality of Ganga water has deteriorated considerably from domestic and industrial sewage, which contains large number of chemicals and heavy metals. This has a devastating toxic effect both

individually and synergistically. The waste materials react with each other; as a result, the water is polluted and may become toxic, which ultimately make water un-potable. Not only these alter the physico-chemical characteristics but also affect the biological life prevailing in that aquatic environment. Keeping this in view, Khanna and Bhutiani (2004) studied ecology of some fishes of river Ganga at GohriGhat, Garhwal in relation to abiotic factors.

At place like Haridwar, thousands of pilgrims take bath daily in the Ganga and degrade its water quality not only by bathing, but also by dumping things like flowers, ash and bones of dead persons. Such activities are increased many fold on occasions like Kumbh, etc. These activities are affecting the Ganga water quality and biota. Many of the important cities of India are situated near Ganga River and are only the source of water for their daily use. If water quality status of Ganga deteriorates, it will result in deterioration of the health of crores of people. Khanna and Bhutiani (2003a) observed the limnological characteristics of river Ganga at Hardwar. Khanna and Bhutiani (2003b) studied the limnological status of Satikund pond at Hardwar. Here an attempt has been made to assess the qualitative study of planktonic diversity of river Ganga at foothills of Garhwal Himalaya.

MATERIALS AND METHODS

This study is an attempt to evaluate the historical changes in water quality of River Ganga by analysing qualitative variation of planktonic diversity at Haridwar.For Plankton study samples were collected from Ganga River from March 2010 to April 2013. The samples were taken in a borosil glass bottle of 300 ml capacity and in plastic container. For qualitative analysis the plankton samples were collected with the help of standard plankton net with uniform speed. Identification of plankton was made with the help of available literature. (Edmondson, 1992, APHA, 1998., Khanna and Bhutiani, 2004).

RESULTS AND DISCUSSION

The different chemicals, detergents that are used for bathing and washing activities, the distillery near the river Song (tributary of river Ganga), use of high soil nutrients, insecticides and pesticides for irrigation in the nearby agricultural lands along the Suswa river (tributary of river Ganga) and the discharge of ashes without giving a judicious thought to the qualitative and quantitative effect of these on the chemical composition of the river, its effect on the fishes and other aquatic life are the basic sources of pollution in the area (Khanna *et al.*,2007).The results of monthly variations (average of three years i.e. 2010-2013) in planktonic diversity are illustrated in Table 1-3. Species richness was found high in winter and it was minimum during monsoon. In the present study number of phytoplankton was found maximum (2996.40 unit/l) in the month of January and minimum (675.26 unit/l) was recorded in the month of July. On the other hand zooplankton diversity was recorded maximum (386.60 unit/l) in the month of April and minimum (95.00 unit/l) was recorded in the month of July. Total plankton reached their maximum number (2812.80 unit/l) in the month of January while minimum number (770.33 unit/l) was observed in the month of July. The average value of phytoplankton, Zooplankton and total plankton during the course of studywas observed as 1584.62 ±715.91 unit/l, 238.96± 106.68unit/l and 1705.81±671.45unit/l respectively (Table 1). The phytoplankters

constitute bulk of primary producers and are the base of food chains in any water body. Similar observation was also made by Canfield and Jones (1996), Alam and Khan (1998) and Khanna *et al.,* (2013) in their study. The phytoplanktonic community of river Ganga during the present study was represented by diatoms, green algae and blue green algae (Table 2). In phytoplankton, Diatoms were dominated and class Blue green algae was found least during study period. The number of diatom were observed maximum (2522.00 unit/l) in the month of January and minimum (624.20 unit/l) in month of July and average value was observed as 1446.36 ± 630.79 unit/l. Sharma (1980), Solomon (1994), Shekhawat (1997) observed dominance of blue green algae in Udaipur lake waters. Baghela (2006) observed the dominance of Chlorophyceae in Oligotrophic Lake. Bhutiani and Khanna (2007) modelled DO and BOD for ecological status of river Suswa a tributary of river Ganga.Effect of euphotic depth and mixing depth on phytoplanktonic growth mechanism was done by Khanna *et al.,*(2009).Algae are tiny aquatic plants that are found as single cells or in colonies of various sizes. They make a primary link in the aquatic food chain, acting as food for microscopic animals called zooplankton. These tiny animals are eaten by many fish and other aquatic animals. As a by-product of photosynthesis, algae also release oxygen into the water that can be used by fish and other aquatic animals (Battish, 1992). During the present investigation Green algae were found to be highest (332.66unit/l) in the month of December and lowest (49.73unit/l) in the month of August. The average count of Green algae was 179.13± 100.25unit/l. A more or less similar observation was made by Khanna (1993), Khanna and Bhutiani (2003) during his study on Sati Kundpond and Kumar *et al.,* (2004). Blue-green algae or cyanobacteria are natural to the environment's food chain and are found all over the world. Many live with other types of algae and microscopic animals collectively termed plankton (Ramteke and Moghe, 1988). Blue green algae were found to be highest (66.06 unit/l) in the month of December and lowest (5.06unit/l) in the month of August. The average count of Blue green algae was found as 37.52 unit/l ± 19.54. Zooplankton is the intermediate link between phytoplankton and fish, which are the secondary producers in the aquatic environment (Hutchinson, 1967). In River Ganga diverse taxonomic groups of zooplankton representing Protozoa, Rotifera, Cladocera, Copepoda and Ostracoda were found during course of study. In present investigation among zooplankton,Protozoa was maximum (104.46 unit/l) in the month of January and minimum (19.00 unit/l)was found in July month while average value for protozoa for three years was found as 58.45 ±31.68 unit/l. Similar study were made by Mahajan (1981), Khanna and Bhutiani, (2005), Khanna *et al.*,(2010).Rotifers are the microscopic faunal component living mostly in fresh water, are characterized by the presence of an anterior wheel like rotating structure called "Corona". The rotifers are being considered as the most important soft bodied invertebrates (Hutchinson, 1967). Rotifera was found to be highest (97.60 unit/l) in the month of March and lowest (17.93 unit/l) in the month of Julywhile average value for Rotifera for three years was found as 52.07 ±25.78 unit/l.Similar observations were also made by Sinha (1992) who had reported total absence of rotifers during the monsoon season in the Ganga river. Pandey *et al.*,(2004) also found similar result during his study of river

Ramjan in Bihar. Cladocera popularly called as 'water flea' prefers to live in deep water and constitute a major item of food for fish. Thus they hold key position in food chain and energy transformation (Uttangi, 2001). Cladocera was observed in their optimum peak during February (83.73 unit/l) and in lowest peak during the month of July (8.93 unit/l) while average value for Cladocera for three years was found as 40.35 ±28.16 unit/l. Michels*et al*., (2001), Pandey *et al*.,(2004) and Khanna *et al.,* (2012) also found similar result during their study. Copepods are group of small crustaceans found in the sea and nearly every freshwater habitat (Kalff, 2002). Copepod was maximum (85.73 unit/l) in March and minimum was found in the month of July (14.13unit/l) while average value for Copepod for three years was found as 45.96 ± 25.84 unit/l. Similar trend was observed by Chauhan (1993) in Renuka lake, Himachal Pradesh and Kaushal and Sharma (2007). Ostracods are bivalve have shape like small seeds. They inhabit all kinds of fresh water and marine environments. The freshwater Ostracods occur in lakes, tanks, pools, swamps, streams and even polluted waters. The abundance of these provides a good food for aquatic organisms. Ostracods sp. was observed in their optimum peak during March (75.46unit/l) and in lowest peak during the month of July (10.66 unit/l) while average value for Ostracods for three years was found as 39.21 ±22.72 unit/l.

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Table 1: Average value of Quantitative analysis of the plankton during course of study (2010-2013)

Month	Phytoplankton *(Unit/l)*	Zooplankton *(Unit/l)*	Total Plankton *(Unit/l)*
March	1813.20	361.66	2182.13
April	1803.30	386.60	2198.06
May	1245.86	233.00	1479.06
June	819.40	120.53	939.93
July	675.26	95.00	770.33
August	816.66	105.13	991.06
September	1076.00	157.00	1106.86
October	1373.20	190.00	1448.33
November	1827.26	232.93	1876.26
December	2491.46	324.00	2306.26
January	2996.40	365.33	2812.80
Febryuary	2077.60	296.40	2358.60
Average ± SD	**1584.62 ± 715.91**	**238.96 ± 106.68**	**1705.81± 671.45**

Table 2: Average value of number of different groups among the Phytoplankton during course of study (2010-2013)

Month	Total Diatoms (Unit/l)	Total green algae (Unit/l)	Total Blue green algae (Unit/l)
March	1523.33	212.86	41.80
April	1641.73	177.20	48.60
May	1615.60	110.46	38.80
June	968.66	99.00	29.26
July	624.20	67.86	8.93
August	804.53	49.73	5.06
September	843.46	86.66	18.86
October	1010.33	153.86	40.20
November	1406.66	287.53	35.66
December	1927.40	332.66	66.06
January	2522.00	316.46	64.20
Febryuary	2468.40	255.26	52.80
Average ± SD	**1446.36± 630.79**	**179.13 ± 100.25**	**37.52 ± 19.54**

Table 3: Average value of number of different groups among the Zooplankton during course of study (2010-2013)

Months	*Protozoa* (Unit/l)	*Rotifera* (Unit/l)	*Cladocera* (Unit/l)	*Copepod* (Unit/l)	*Ostracods* (Unit/l)
March	93.20	97.60	78.20	85.73	75.46
April	91.40	87.00	80.13	72.60	61.26
May	55.40	59.86	36.60	48.80	24.13
June	28.73	21.53	12.06	12.26	12.93
July	19.00	17.93	8.93	14.13	10.66
August	32.20	20.46	11.20	15.73	14.53
September	31.33	37.60	22.80	32.40	29.60
October	35.06	39.46	25.46	36.20	25.46
November	39.53	49.00	30.40	31.40	40.26
December	71.66	65.40	32.40	59.80	50.46
January	104.46	63.66	62.33	74.80	65.00
February	99.40	65.33	83.73	67.73	60.80
Average ±SD	**58.45 ± 31.68**	**52.07 ± 25.78**	**40.35 ± 28.16**	**45.96 ± 25.84**	**39.21 ± 22.72**