



## Survey on Biotic Communities of The Ganga River System Around Prayagraj (Allahabad), India

P R Singh<sup>1\*</sup> • Koshal Kumar<sup>2</sup> • A K Dobriyal<sup>3</sup>

<sup>1</sup>Department of Fisheries GNSU Sasaram Bihar

<sup>2</sup>Department of Himalayan Aquatic Biodiversity, HNB Garhwal University, Srinagar Garhwal

<sup>3</sup>Department of Zoology, HNB Garhwal University Campus, Pauri Garhwal-246001

\*Corresponding Author Email: [drprsingh@rediffmail.com](mailto:drprsingh@rediffmail.com)

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**Abstract:** A survey was conducted on the biotic communities of the Ganga River system around Prayagraj at Mehdauri, Shivkuti (River Ganga) and Gaughat, Sadiapur (River Yamuna) during 2017-18. Plankton and benthos showed identical pattern at all the centers investigated. Peak production of plankton was observed during summer months and their minimum number was recorded in monsoon months. Abundance of chironomids, bivalves and gastropods were recorded. Maximum values of phytoplankton were recorded 1413 units.l<sup>-1</sup> and benthos 464 units.m<sup>-1</sup> in the Ganga River System. Possible detrimental factors responsible for biota fluctuations are also discussed.

**Keywords:** Plankton, Benthos, Diatoms, Rotifers, Abiotic factors, Ganga River System

### Introduction

Biotic communities play an important role in aquatic ecosystems. These organisms are very important for food chain and ecological balance, their scarcity can affect the ecosystem productivity. The Ganga River system is the most important river system of the country in view of its cultural and economic significance. A number of workers have studied the biotic life in Ganga River system at various places. Neelam Shukla et.al. (2016) studied the phytoplankton diversity in the Ganga River system and recorded the production of algal blooms at Chhatnag Ghat whereas at Sangam, low phytoplankton in number and diversity were observed. Gagan Matta (2015) observed the maximum phytoplankton during winter season and minimum during monsoon. Vass et.al. (2010) and Sinha (2015) have also examined the interface between biotic and abiotic parameters in Ganga River ecosystem. Payne, et.al (1996) studied the fisheries ecology of the Ganga River system and enumerated the detrimental factors on fish productivity.

### Methodology

Four important spots viz, Mehdauri, Shivkuti along the river Ganga and Gaughat & Sadiapur along the river Yamuna were selected for the present study. Weekly sampling was carried out during July 2017 to June 2018. Plankton and benthic organisms were sampled periodically with help of plankton net and benthic sampler. The plankton and benthic organisms were identified using standard monographs and keys (Needham and Needham, 1962 and Ward and Whipple 1959). Diversity index (Shannon and Wiener) was calculated as  $H' = - \sum p_i \ln p_i$ , where  $H'$  is the species diversity index,  $p_i$  is the proportion of individuals of each species belonging to the  $i$ th species of the total number of individuals,  $\ln$  is log natural. The ecological parameters were studied by the standard methodology (APHA 1998)

### Results And Discussion

Seasonal fluctuations in the planktonic and benthic communities were studied in the



Ganga River system around Prayagraj. Peak production of these organisms was recorded during summer months and minimum during monsoon. At some spots where water quality was good, high number of plankton and benthos were observed. Maximum value of phytoplankton was recorded 1413 Units.l<sup>-1</sup> and benthos 464 Units.m<sup>-2</sup> in the Ganga River system (Table 1). The following Organisms were observed at different places in Ganga River system:

**Diatoms:** *Fragilaria, Gomphonema, Melosira, Navicula, Nitzschia, Gyrosigma, Pinnularia, Synedra, Cocconeis, Cyclotella, Cymbella, Diatoma, Gomphonema, Stauronei* and *Frustulia*.

**Green algae:** *Hydrodictyon, Spirogyra, Pediastrum, Mougeotia, Zygnema, Tetraspora, Ankistrodesmus, Cladophora, Hydrodictyon, Chaetophora, Microspora, Ulothrix, Oedogonium, Tribonema, Pandorina* and *Pediastrum*.

**Blue-Green Algae:** *Anabaena, Tetrapedia, Oscillatoria, Microcystis, Nostoc, Rivularia* and *Spirulina*.

**Desmids:** *Gonatozygon, Closterium, Netricum*

and *Microsterias*

**Protozoans:** *Ceratium, Eudorina, Euglena, Arcella*

**Rotifers:** *Brachionus, Keratella, Rotaria*

**Crustaceans:** *Diaptomus, Cyclops, Eubranchipus; Daphnia, Bosmina*

**Annelids:** *Tubifex*

**Molluscs:** *Lymnaea, Pisidium, Gyraulus, Goniobasis, Margaritifera, Unio, Cobricula, Novaculina*.

**Insects:** *Isoperla*, nymphs of dragon and Damselflies, *Ranatra, Belostoma*, Mosquito larvae, Chironomid larvae, Trichopteran larvae

Phytoplankton population fluctuation showed similar trend in the river Ganga and Yamuna. It showed two peaks, one during summer and other during winter. Poor concentration was recorded during monsoon. Among these organisms the Chironomids, Trichopterans (*Hydropsyche, Glossosoma*), Hemipterans (*Gerris*), gastropods, bivalves, rotifers, copepods and cladocerans were recorded as dominating groups.

**Table 1: Seasonal fluctuations of total plankton and macro-benthos in the Ganga River system (Average value) and its species diversity (Shannon and Wiener)**

	Summer	Monsoon	Winter
<b>R. Ganga</b>			
Plankton (Units.l <sup>-1</sup> )	1381 ± 127 (H' = 1.27)	45 ± 11 (H' = 0.4)	531 ± 27 (H' = 0.77)
Benthos (Units.m <sup>-2</sup> )	457 ± 58 (H' = 0.7)	86 ± 27 (H' = 0.38)	339 ± 18 (H' = 0.58)
<b>R. Yamuna</b>			
Plankton (Units.l <sup>-1</sup> )	1413 ± 98 (H' = 1.45)	52 ± 08 (H' = 0.45)	526 ± 25 (H' = 0.76)
Benthos (Units.m <sup>-2</sup> )	464 ± 19 (H' = 0.86)	102 ± 17 (H' = 0.42)	344 ± 14 (H' = 0.74)

*Brachionus, Keratella, Diaptomus, Daphnia, Bosmina*, mosquito larvae, *Sida, Moina, Nebalia, Arcella, Pisidium, Lymaea, Goniobasis, Unio*, etc. were observed in abundance among zooplankton and molluscs, and *Syndera, Navicula, Nitzschia, Sprogyra, Pediastrum*, and *Mougeotia* were observed to

be common among phytoplankton in all spots. Macrophytes like *Eichhornia, Azolla, Pistia* etc. were also found in common on different places on the studied spots in Ganga River system.

Presence of plankton flora and fauna was observed to be helpful in fish diversity (*Labeo*



*rohita, Labeo calbasu, Cirrhinus mrigala, Catla catla, Wallago attu, Rita rita, Bagarius bagarius*) and abundance.

If we compare the diversity of plankton and benthic fauna in the Ganga and Yamuna rivers taking an average value of two spots each, it was observed that the plankton were more diverse in Yamuna ( $H' = 1.45$  summer, 0.45 monsoon, 0.76 winter) than in Ganga ( $H' = 1.27$  summer, 0.4 monsoon, 0.77 winter). Similarly, benthos were also observed more diverse in Yamuna ( $H' = 0.86$ , summer, 0.42 monsoon, 0.74 winter) than in Ganga ( $H' = 0.7$

summer, 0.38 monsoon, 0.58 winter).

To correlate the fluctuations in biotic parameters with some detrimental ecological factors, certain impact full parameters were studied and presented in Table 2. Comparative analysis indicates that though there is no major fluctuation in these parameters in two rivers, but pH is relatively moderate and DO is on higher side in river Yamuna which has better biota in terms of both density and diversity. As usual the monsoon is less productive in both the streams (Dobriyal 1985)

**Table 2: Water Quality Parameters (Average values of the two study spots)) of the River Ganga and Yamuna near Prayagraj during different seasons (2017-18)**

Seasons/ water quality parameters	Summer	Monsoon	Winter
<b>River Ganga</b>			
Water Temperature (°C)	28.85 ± 1.75	25.25 ± 2.55	18.25 ± 1.75
pH	8.15 ± 0.2	7.95 ± 0.15	8.1 ± 0.25
DO (mg.l <sup>-1</sup> )	7.85 ± 1.3	7.35 ± 0.85	8.05 ± 0.8
<b>River Yamuna</b>			
Water Temperature (°C)	29.55 ± 2.25	26.15 ± 1.75	17.55 ± 1.85
pH	7.9 ± 0.25	7.75 ± 0.5	8.1 ± 0.3
DO (mg.l <sup>-1</sup> )	8.15 ± 1.4	7.75 ± 0.6	8.2 ± 0.4

The present observations were in corroboration with the studies made by Shukla et al., (2016) who studied the phytoplankton diversity in the Ganga River system and reported the dominance of bascillariophyceae, chlorophyceae and cyanophyceae and their abundance during summer season. Khanna et al (2012) also studied the Ganga water quality and reported the rotifera, copepoda, cladocera, ostracoda as the dominant group among zooplankton. Dominance of green algae were reported by Srivastava et al (2020) Tariq et.al. (2020) studied macrozoobenthic fauna from a hill stream river Balkhila from Uttarakhand and reported that monsoon season is least productive. Koshal et al., (2017) reported the presence of benthic diversity on the Rawasan stream in Uttarakhand, a tributary of the River Ganga and Srivastava et al., (2022) reported a

better quality of river water and diversity of plankton communities during lockdown period. Present study is an attempt to record the status of plankton and macrozoobenthic diversity in Ganga River system around Prayagraj which is considered as pious place and socio-culturally significant.

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