

# Biodiversity of River Ganga at Sapt Rishi Ashram, Hardwar, Uttaranchal

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**Abstract** - Ganga is one of the oldest rivers which are recognized as major natural resources not only as sources of domestic, industrial, agricultural water and hydroelectric power but also for the food production and to have supported human settlements. The river has been the place of development of human civilization to a great extent. However, the occupancy over the year and industrialization is now having its ill effects on the river slowly but surely destroying the river in time and space. Ganga river is facing grave danger. The quality and biodiversity of Ganga River is getting degraded more severe every day. The concern over deterioration of quality and its biodiversity has stimulated research into the basic dynamics of river environment and its biotic communities so that the biodiversity of river could be conserved. Keeping this view in mind a study was conducted on biodiversity of River Ganga at Saptrishi Ashram during the year 2016-17. This paper reports the finding of a survey carried out at Saptrishi ashram region of Uttaranchal on the basis of season. The work was carried out to generate information on the freshwater aquatic system to help to manage the freshwater system using the ecosystem approach. Hardwar lies between approximately between approximately latitude 29°58' North and longitude at 78°13' East. Physico-chemical and biological parameters were observed in the first and third week of each month at study area. It was recorded that phytoplankton dominated over zooplankton. It was recorded that plankton were maximum in winters and minimum in monsoon period, there is a direct interrelation between physico-chemical parameter and biological parameters. The fluctuation of planktonic communities can be affected by the variation of the physico-chemical parameters.

**Keywords:** aquatic system, Hardwar region, phytoplankton, zooplankton

## I. INTRODUCTION

The very name “Ganga” conjures up a picture of holiness of peace and joy of beauty and sweetness of all that is uplifting in the mind of Hindus. She is not just a river, she is a symbol of something higher than what the world has to offer. The river system is both holy and a life line for millions of people. The Ganga rises in the snow bound heights of the Himalaya, nearly 4000 mtrs above sea level, from a dark icy cavern, shaped like the mouth of cow known as Gomukh glacier. Ganga is a perennial river formed by confluence of two smaller rivers at Devprayag. Bhagirathi is one of them originating at Gaumukh and other is Alaknanda. It enters indogangatic plains at Hardwar, after covering a distance of around 220 km in the Himalaya. From Hardwar, the Ganga starts slowing down its pace. In general the river Ganga

contains sufficient quantities of various macro and micro nutrients to support the diverse population of flora and fauna, and is enriched with plankton throughout the year. However, Ganga River is facing grave danger. Ganga River is getting degraded more severe every day. Keeping this view in mind a study was conducted on biodiversity of River Ganga at Saptrishi Ashram during the year 2016-17. This paper reports the finding of a survey carried out at Saptrishi ashram region of Uttaranchal on the basis of season. The work was carried out to generate information on the freshwater aquatic system to help to manage the freshwater system using the ecosystem approach.

## II. MATERIALS AND METHODS

### 2.1 Study Area

Saptrishi ashram is situated at 5 kms in the north of Hardwar. The Ganges split into seven currents at this place. This is one of the important main centers of pilgrims and tourists activities at Hardwar city. Hardwar lies between approximately latitude 29°58' North and longitude at 78°13' East.

### 2.2 Sampling and Analytical Experiment

To study biodiversity of River Ganga at Saptrishi Ashram, the water samples were taken in the first and third week in each month during July 2016 to June 2017 in morning hours. In this study the physico-chemical and biological parameters of river Ganga at Saptrishi Ashram were studied.

## III. EXPERIMENTAL SIMULATIONS

The result obtained from the observations made during this period at sampling station is shown in Table 1 to 2. Among Physico-chemical parameters temperature is one of the most important factors in an aquatic environment. The water temperature of any aquatic system is influenced by local weather conditions and the ground temperature with which it comes in contact. The water temperature showed an upward trend from January to June followed by a downward trend from June onwards. The minimum temperature was recorded 10.25 °C in the month of January and maximum 22.5 °C in the month of June. The temperature of water started decreasing due to melting of snow at the peaks of Himalaya. A similar study was conducted by Joshi et al.,(1996) in the Ganga canal at Jwalapur (Hardwar). The velocity of Ganga is a composite work of several factors like bed gradient, bed nature, water volume playing effective roles. In this study the maximum velocity was recorded during the rainy season, because the velocity of water current is influenced by rainfall.

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Maximum velocity was recorded 1.63 m/sec in the month of July (rainy season) and minimum 0.64 m/sec in the month of February (winters). Similar observations were recorded by the Seth et al., (2000) for the river Ganga at Hardwar.

The maximum turbidity was recorded 275 NTU in July and minimum 2.6 NTU in February and March. Turbidity of water was recorded maximum during the rainy season because, siltation is the main source of turbidity, non living material being added to the water mass, due to heavy soil erosion as a result of heavy rains during the monsoon period. Turbidity is also caused by sand, clay, silt, microscopic organisms and organic material suspended or dissolved in it. Ash of people after their funeral rites and variety of flowers, fruits, hair etc which are continuously added to the water of Ganga, bathing at all the Ghats and villages at the bank of Ganga also causes increase in the turbidity of water. High amount of water makes it totally unfit for the domestic use and other purposes and has adverse effect on the bottom dwelling organisms, as it makes water impenetrable to light. A similar study was recorded by Joshi and Singh (1999) in the river Ganga between Devprayag and Rishikesh.

Transparency is the capacity of penetration of light in water largely depends upon optical properties, which is influenced by the particulate matter in it. Maximum transparency was recorded 106.75 cm in the month of February and minimum 4.14 cm in the month of July. In this study high transparency was recorded during the winter and decreases during the rainy season, because during the rainy season, siltation is increased and the other causes which reduce the transparency were addition of flowers, ash and other things by the human beings. During winter season the siltation is very less. Similar results were obtained by Joshi et al.,(2001) in the hill stream, between Byasi and Rishikesh, in Uttarakhand Himalaya. The depth of water was recorded 205 cm in the month of August and minimum 31 cm in the month of February.

The total solid is a measurement of dissolved and suspended impurities of water. In the present study the total solids were observed maximum in the monsoon months 1450 mg/l and minimum 127.5 mg/l in the month of March. In natural water minerals, salts and organic substances present in dissolved form like carbonates, bicarbonates etc, while silt, clay, sand particles are found in suspended form. The excess of solids are responsible for the turbidity in the water reduces the penetration of light which adversely affects the phytoplankton production. It also makes water unfit for portability. Seth et al., (2000) recorded maximum total solids in the month of August (monsoon) and minimum in December in the river Ganga at Hardwar.

pH is one of the most important attribute of any aquatic system, Since all the bio chemical activities depends on the pH of surrounding water.(Sabata and Nayar) pH is very important factor for the growth of plankton. The fluctuation of pH in alkaline range is good for life of fish (Khanna1993). In the present study it was recorded that pH was slightly alkaline round the year. High values of pH were noted during winter months and lower during the monsoon months. During monsoon it was less due to decreased photosynthetic activity, which reduces due to the turbidity and low penetration of light. Bhowmick and Singh (1985) also observed that the maximum value of pH was during winter.

BOD (Biological Oxygen Demand) is of great importance in water quality assessment. The seasonal variation in the values of BOD appears to be function of change in degree of dilution, quantity of organic matter and activities of microorganism carrying out decomposition of carbonaceous and nitrogenous matters. In the present study the BOD in the river was maximum during the monsoon (1.7 mg/l) due to flood that carries organic waste and high temperature, stimulates the growth of the microorganisms. While it falls in winter season, it was minimum 0.30 mg/l in February, due to low temperature which reduces the biological activities. The other causes like bathing at Ghats, addition of flowers, fruits, ashes of people, hair and dead leaves etc which support great number of bacteria.

The total alkalinity is a cumulative product of metabolic carbon dioxide and ultimate insoluble calcium carbonate. During the study it was recorded the alkalinity was low during rainy season, due to heavy rainfall which may lead to dilution of ionic content of water and large dilution capacity of water. Alkalinity was maximum 160 mg/l in March and minimum 57 mg/l in the month of July. Similar results were observed by Khanna et al., (1992).

Total hardness is mainly governed by the calcium and magnesium ions. It was recorded that the Hardness was minimum during rainy season 66 mg/l in July and maximum 191 mg/l in March.

The plankton is primary producers of aquatic ecosystem and makes the base of food chain in any aquatic ecosystem. The qualitative and quantitative fluctuation of plankton has a great effect on the aquatic life in general and fish life in particulars. In this study it was found that phytoplankton dominated over zooplankton. During the study it was found that the plankton was maximum in winters and minimum in rainy season. It was recorded that the total planktonic concentration was recorded maximum 1942 unit/l in January and minimum 198 unit/l in the month of July.

In the present study it was recorded that the phytoplankton in Ganga River at the site mainly consists of Bacillariophyceae, Chlorophyceae and Cyanophyceae. Sharma et al., (1991) also found that phytoplankton predominates over zooplankton in the Tarai reservoir of Kumaon.

Among the phytoplankton maximum concentration of different groups were noted as Bacillariophyceae 650 unit/l in the month of January, Chlorophyceae 225unit/l in the month of January, and Cyanophyceae 34unit/l in December. Minimum concentrations of different groups were noted as Bacillariophyceae 110 unit/l in July, Chlorophyceae 58unit/l in July, and Cyanophyceae 3.0 unit/l in August.

It was found that zooplankton were also abundant during the winters, while low concentration was observed during the month of July and August. the maximum concentration of zooplankton was 44.0 unit/l in the month of December and minimum was 17.0 unit/l in the month of August

It was found that all groups of plankton were recorded maximum in the winter months and minimum in monsoon period.

**IV. CONCLUSION**

In present study of aquatic systems at Sapt rishi Ashram, Hardwar region of Uttaranchal, India, It was recorded that the physico- chemical parameters effect the growth of the plankton. Winter months were observed to provide most propitious conditions for abundance of plankton, whereas in the monsoon months, river was loaded with pollution resulting to lower growth. It was recorded that the total plankton found maximum in winters and minimum in rainy season. It was observed that at the site phytoplankton dominated over zooplankton. Phytoplankton mainly

consisted of Bacillariophyceae, Chlorophyceae and Cyanophyceae. During rainy season due to increase in velocity, plankton were almost washed off from the stones and other substratum. On account of an increase in turbidity, plankton population decreased, because the turbidity affects the photosynthesis process adversely, as a result of less transparency the light penetration is very low and photosynthetic activity is low.

Human interference at the banks of river at different sites also affects the growth of plankton adversely. Bathing, discharge of waste material, flowers and ash also responsible for the decline of plankton.

**V. RESULTS AND DISCUSSIONS**

**Table 1. Monthly mean variation in Physico-chemical properties of River Ganga at Sapt rishi ashram**

Months	1	2	3	4	5	6	7	8	9	10	11
July	21.25	1.63	4.14	275	1450	190	1260	7.15	1.7	57	66
Aug	18.75	1.43	5.38	200	903	121	782	7.25	1.25	87	106
Sept	19.0	0.93	9.88	135	495	94	401	7.4	0.95	100	123
Oct	16.75	0.77	62.5	8.25	194.5	85.5	109	7.8	0.65	120	163
Nov	15.25	0.73	81.25	5.75	179.5	81.5	98	8.0	0.55	126	168
Dec	11.5	0.69	92.75	5.1	154.5	70.5	84	8.05	0.50	146	176
Jan	10.25	0.65	96.88	3.3	166	73	93	8.3	0.35	158	184
Feb	12.25	0.64	106.75	2.6	148	73	75	8.4	0.30	157	186
Mar	16.0	0.72	90.75	2.6	127.5	72.5	55	8.3	0.35	160	191
Apr	20.5	0.81	72.0	4.8	186	121	65	7.95	0.65	131	186
May	21.25	0.88	63.75	30.0	296	186	110	7.7	0.95	109	134
Jun	22.5	0.98	46.25	125	446	175	271	7.45	1.2	58	72

Temperature(Oc) 2) velocity(cm) 3) Transparency(cm) 4) Turbidity(cm) 5) Total solids (mg/l) 6) Total dissolved solids(mg/l) 7) total suspended solids (mg/l) 8) pH 9) BOD(mg/l) 10) Alkalinity (mg/l) 11) Hardness(mg/l)

**Table 2. Monthly variation in Biological properties (unit/l) of River Ganga at Sapt Rishi Ashram**

Months	Total plankton	Phytoplankton	Bacillariophyceae	Chlorophyceae	Cyanophyceae	Zooplankton
July	198	177	110	58	09	21
August	341	324	260	61	03	17
Sep.	573	549	420	110	19	24
Oct	979	943	780	139	24	36
Nov.	1114	1072	870	169	33	42
Dec.	1477	1433	1190	209	34	44
Jan	1942	1902	1650	225	27	40
Feb	1399	1364	1150	187	27	35
March	1226	1193	1010	150	33	33
April	873	845	700	124	21	28
May	781	754	610	129	15	27
June	541	519	410	96	13	22

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