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PHYSICO-CHEMICAL PARAMETERS OF GANGA RIVER TRIBUTARIES IN DISTRICT HARIDWAR, UTTARAKHAND

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Abstract: Physico-chemical study of all three water bodies carried out throughout the year and data recorded physically for pH, temperature, alkalinity, dissolve oxygen, CO_2, transparency and velocity. Physical properties generally environmentally controlled and fluctuating with the seasons but chemical properties *i.e.* pH, dissolve oxygen CO_2 and alkalinity largely changing due to anthropogenic stresses. The pH ranges 6-9, dissolve oxygen from 7.5-13.5 mg/L, CO_2 0.7- 4.7 mg/L, alkalinity 42-110 mg/L. Variations in observed parameters also posing controlling effect on floral and faunal diversity in theses water bodies.
Keywords: Ganga River, Physico-chemical Properties, Tributaries.
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INTRODUCTION

A large number of anthropogenic factors and geological conditions influence the correlations between different pairs of physico-chemical parameters of water samples directly or indirectly (Sinha *et al.,* 2000). In any water body physico-chemical and microbiological characteristics may describe the quality of water (Sinha, 1986). Several physical features such as temperature, velocity and transparency of water also reflect chemical nature (Welch, 1952; Pushpa, 2007). Time to time analysis of Physico-chemical parameters of tributaries of Ganga water was made by many workers (Praveen *et al.,* 2013; Chaphekar and Mhatre, 1986; Rani *et al,,* 2011). In district Haridwar, tributaries of river Ganga found in two types of streams i) permanent streams: the water of permanent streams does not dry throughout year as Ganga, Sailani, Dhanori, and Rawason and ii) seasonal streams: the water supply found only in monsoon and generally these are dried, they are known as raos.

EXPERIMENTAL

The ecological parameters of river Ganga and its tributaries have been analyzed by collecting samples in laboratory or at the study site. Three different sites selected within Hardwar district such as main Ganga River, Banganga River and Sailani River.

Physical Parameters:

(a) Colour: The colour of the water is studied by visual observations. Generally the colour of Ganga and others was clear but in monsoon it becomes turbid.

(b) Temperature: The temperature of the stream or river has been measured with the help of an ordinary thermometer. The thermometer dipped into the water and left or picked for some time.

(c) Transparency: The transparency of the water was measured by Sachi disc method. The depth at disc become invisible was noted down; again the disc taken out of the water and the depth at which it seen reappearance was noted down. Finally the average value was considered.

(d) Velocity/Flow rate: Water flow was noted by the stop watch method. A wood piece was flows in the running water and at the distance of 1meter it was caught, the stop watch was started when the wood starts flows and the watch was stopped when the wood piece was collected. This procedure is repeated many times.

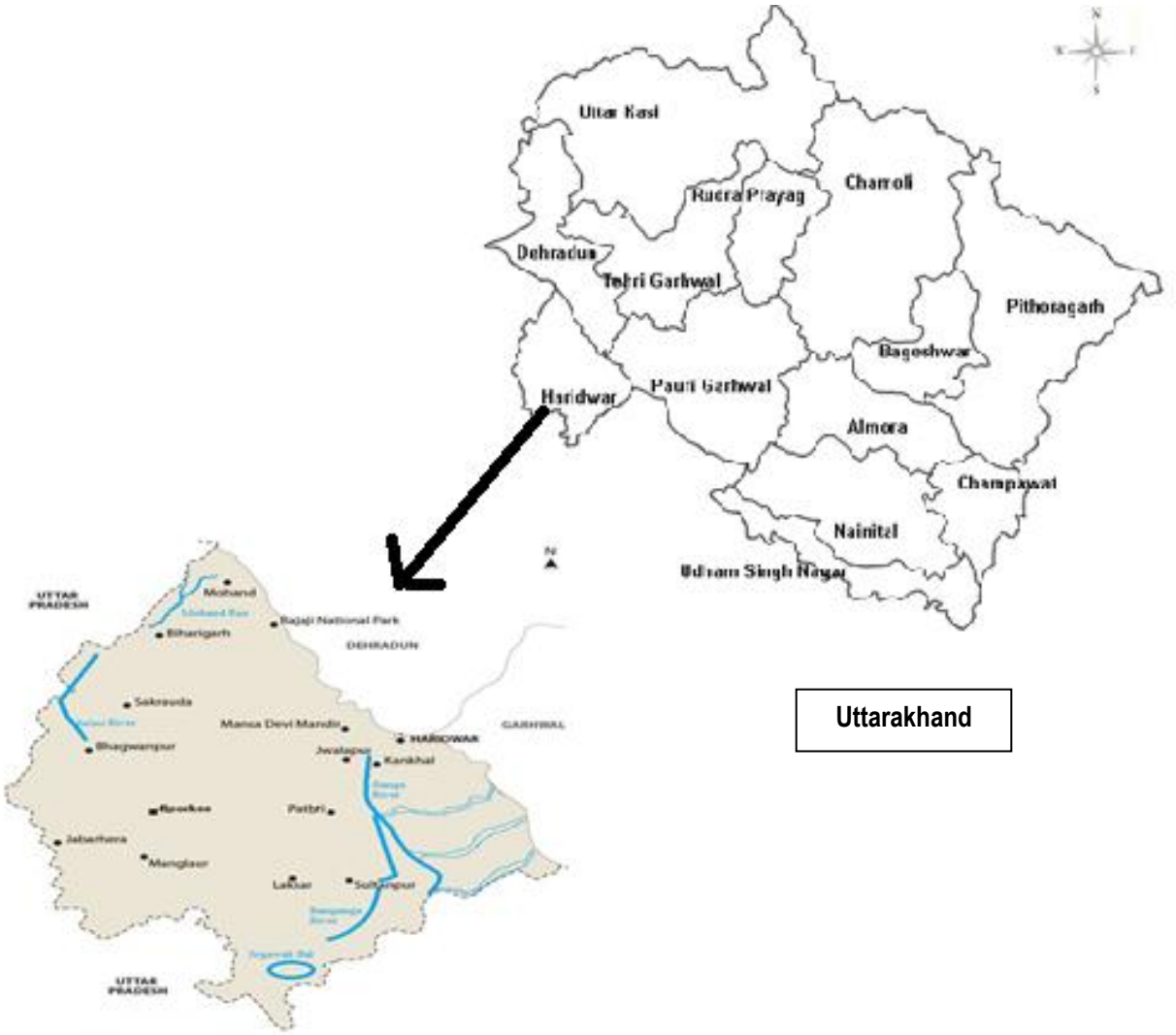


Figure 1. Location Map of Study Site in District Haridwar

Chemical Conditions:

(a) pH: the pH value was considered with the help of pH test papers, and the pH varies between 6.0- 9.0.

(b) Dissolved Oxygen Contents: The dissolved oxygen content was measured by the Winkler's titration method.

(c) Free Carbon Dioxide: Measured with the help of Nassler tube and 10 drops of phenolphthalein solution were added then it titrated with N/44 sodium hydroxide solution.

(d) Alkalinity: The concentration of carbonate and bicarbonate was calculated with help 0.5 mL phenolphthalein and methyl orange as indicator titrated with N/50 H_2SO_4.

RESULTS AND DISCUSSION

Temperature varies from stream to stream and according to season. In Ganga it ranges between 10.3 and 21.5 degree Celsius in Sailani between 10.3 and 19.5 and in Banganga between 11.2 and 22.6 degree Celsius. As temperature plays a key role in distribution and number of microorganism as well as salt and gas solubility, it also reduces or increases the value of other parameters (Bhadula, *et. al,* 2014, Matta, 2014). In all three streams pH value generally towards

alkaline varying between 7.0 and 9.0 in ganga, 6.0 and 8.4 in Sailani and 6.9 and 8.5 in Banganga . Transparency and velocity of water largely depends on seasonal changes. Transparency of water was generally found more from October to April and much less from May to September. Velocity generally recorded high during monsoon months. Both the factors related with intensity of rainy period.

Table 1. Physical and Chemical properties of water in Ganga River

Months	Temp. (⁰C)	pH	D.O. (mg/L)	$C0_2$ (mg/L)	Alkalinity (mg/L)	Transparency (cm)	Velocity (m/s)
August	18.4	8.5	7.8	3.4	44	4.9	1.4
September	21.5	7.5	8.5	2.0	58	5.9	1.2
October	20.2	7.0	9.0	1.9	65	68	0.9
November	16.2	8.0	9.5	1.8	80	105	0.8
December	13.1	7.5	11.2	1.3	75	128	0.9
January	10.3	7.5	11.4	1.2	97	152.2	0.8
February	12.4	8.0	13.5	0.7	89	169	0.6
March	15.4	8.5	13.2	1.7	92	158	0.9
April	18.6	8.5	8.4	2.4	94	127.4	1.2
May	19.6	7.0	8.56	3.0	64	15.8	0.7
June	20	9.0	9.25	3.4	50	15.5	0.6
July	19.5	9.0	9.8	4.4	46	12.5	1.6

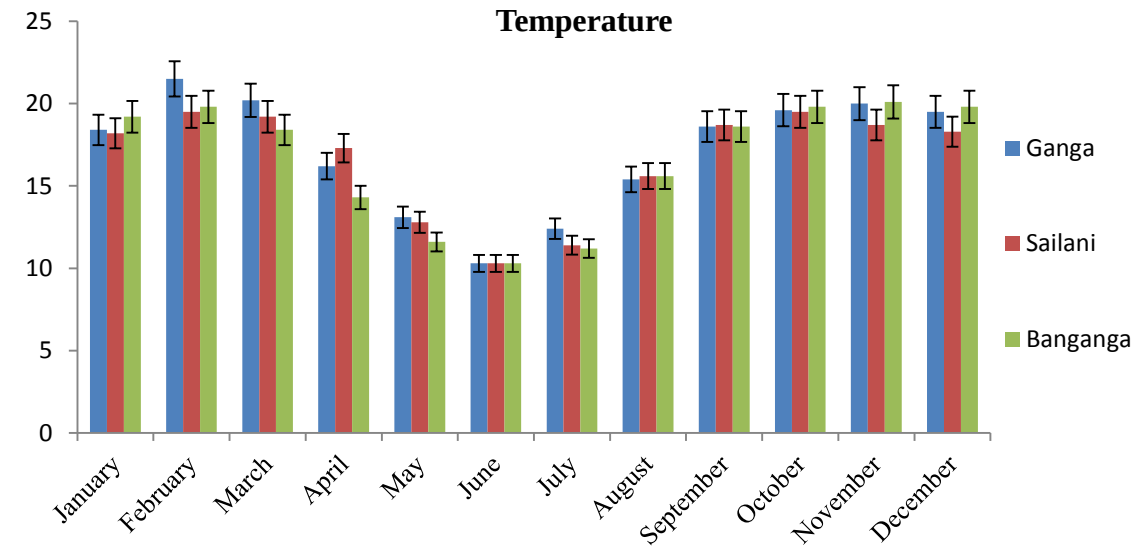
Table 2. Physical and Chemical properties of water in Sailani River

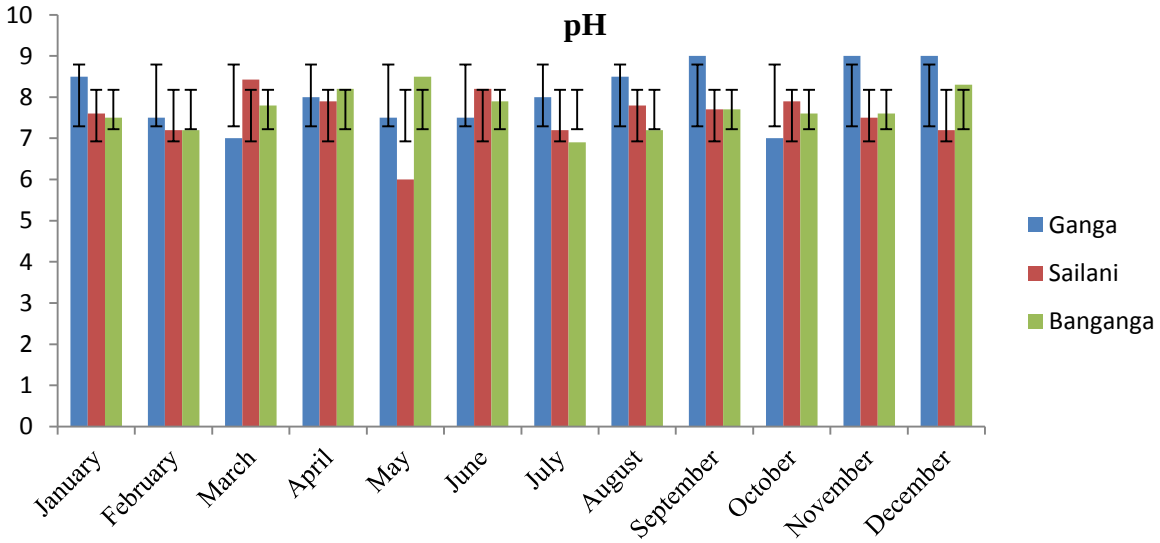
Months	Temp. (⁰C)	pH	D.O. (mg/L)	$C0_2$ (mg/L)	Alkalinity (mg/L)	Transparency (cm)	Velocity (m/s)
August	18.2	7.6	8.3	3.7	42	4.2	0.7
September	19.5	7.2	8.7	2.2	55	6.7	0.5
October	19.2	8.43	9.5	1.7	110	65	0.6
November	17.3	7.9	9.4	1.7	56	99.2	0.6
December	12.8	6.0	10.2	1.5	54	115	0.5
January	10.5	8.2	10.9	1.2	92	145	0.4
February	11.4	7.2	11.8	0.9	79	149	0.4
March	15.6	7.8	10.3	1.8	86	113	0.5
April	18.7	7.7	8.4	2.2	64	93.4	0.7
May	19.5	7.9	8.3	3.2	63	11.4	0.8
June	18.7	7.5	7.5	4.7	47	8.9	0.4
July	18.3	7.2	8.0	3.5	45	3.2	0.9

Table 3. Physical and Chemical Properties of water in Banganga River

Months	Temp. (⁰C)	pH	D.O. (mg/L)	CO_2 (mg/L)	Alkalinity (mg/L)	Transparency (cm)	Velocity (m/s)
August	18.4	8.5	7.8	3.4	44	4.9	1.4
September	21.5	7.5	8.5	2.0	58	5.9	1.2
October	20.2	7.0	9.0	1.9	65	68	0.9
November	16.2	8.0	9.5	1.8	80	105	0.8
December	13.1	7.5	11.2	1.3	75	128	0.9

January	10.3	7.5	11.4	1.2	97	152.2	0.8
February	12.4	8.0	13.5	0.7	89	169	0.6
March	15.4	8.5	13.2	1.7	92	158	0.9
April	18.6	8.5	8.4	2.4	94	127.4	1.2
May	19.6	7.0	8.56	3.0	64	15.8	0.7
June	20	9.0	9.25	3.4	50	15.5	0.6
July	19.5	9.0	9.8	4.4	46	12.5	1.6





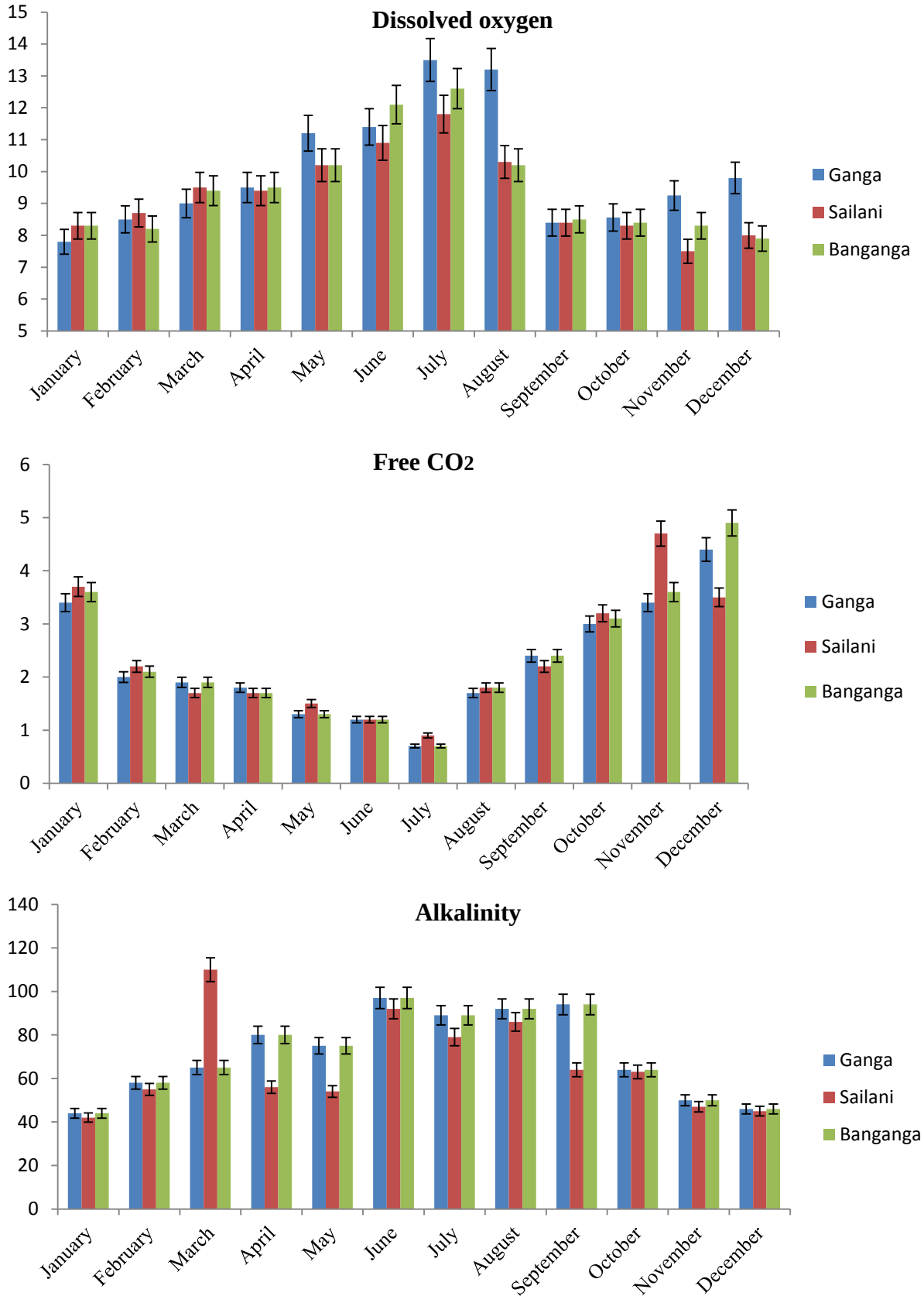


Figure 2. Graphs Showing Chemical Properties of Water in Different Study Sites

The dissolved oxygen content of water depends on its temperature as colder water is more oxygenated than the warm water. In all streams values of dissolved oxygen found

higher in winter seasons. Values of free carbon di oxide were highest during rainy season.

CONCLUSION

Physico-chemical study indicates that in all three streams pH value of water towards alkaline which is due in increase in temperature as well as encroachment on Ganga and its tributaries on uppermost urban regions of Haridwar. Untreated industrial as well as sewage discharge results contamination of water quality which also deteriorating floral and faunal diversity throughout its length.

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