

Seasonal Fluctuations in the Plankton of Suswa River at Raiwala (Dehradun)

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Abstract

The present paper is an attempt to present the findings of investigation on the river Suswa. It is evident from the present study that the water quality of Suswa River has deteriorated during the recent past due to increased human influx.

Key Words: Suswa, river, water quality, Himalaya

Introduction

In India, fourteen major rivers systems share about 83 % of the drainage basin i.e. Indian rivers carry about 16,45,000 million cubic metres of water annually Rao 1975. The Himalayan rivers receive 20 –30 % of their water from melted snow and ice during summer and monsoon seasons. The Suswa river is a spring fed tributary of the River Ganga. The water quality of Suswa river has deteriorated considerably due to increased human interferences in several ways viz. bathing, dumping of domestic wastes, sewage discharge, etc. These anthropogenic activities have not only affected the river water quality and its biota adversely, but have also increased the unusability of water for social and economical purposes. Hence, the present study was conducted to investigate the riverine ecological factors of the river Suswa at Raiwala in district Dehradun, the foot hills of Siwalik Himalayas.

Materials and Methods

The water samples were collected fortnightly from different sampling stations in morning hours (07.00 to 10.00AM). The analysis of different physico – chemical and biological parameters was done by following the methods by Welch 1948, Trivedi and Goel 1984 and APHA 1995.

Results and Discussion

The ecological conditions of a river or stream have a direct bearing upon the different producer to consumer level in aquatic life and physico – chemical parameters impart a major role in determination of the quality of any water body. The average values of physical and chemical parameters are tabulated in Table 1 and 2. The seasonal quantitative analysis of the planktonic number and percentage of different groups among photoplankton has shown in Table 3 and 4.

In the Suswa river at Raiwala, a difference in the fluctuation of water temperature was maximum ($26.25^{\circ}\text{C} \pm 1.68$) observed in summer and minimum in winter. The maximum velocity ($1.16\text{m} / \text{sec} \pm 0.169$) was recorded in summer. The velocity starts continuous decreasing from summer to winter. The velocity and the residue shared positive relationship. Badola and Singh, 1981 reported similar trends in the river Alaknanda. High pH (8.36 ± 0.40) in winter may be due to higher algal population in the river. The pH and dissolved oxygen showed a positive relationship. The maximum value of free CO_2 was recorded ($3.59 \text{ ppm} \pm 0.22$) in summers. The dissolved oxygen was found maximum ($9.10 \text{ ppm} \pm 0.25$) in winter due to the photosynthetic and respiratory activities of the biota as also observed by Hynes 1970, Dobriyal and Singh 1981 and Khanna 1993. The maximum value of alkalinity ($326.86 \text{ ppm} \pm 14.76$) was observed in winter due to decomposition of the organic matter. Similar type of findings were observed by Venkatesvarlu and Jayanti 1968 in the river Sabarmati.

The maximum value of hardness ($100.83 \text{ ppm} \pm 2.65$) was recorded in summer and showed a positive relationship with chloride as also observed by Chopra and Patric 1994 in the river Ganga at Rishikesh. The amount of calcium in the river Suswa was found to be maximum ($85.14 \text{ ppm} \pm 1.76$) during winter. The river may be regarded as rich in calcium contents ($80.39 \text{ ppm} \pm 1.59$ to $85.15 \text{ ppm} \pm 1.76$). Similar type of relationship was observed by At Kin and Harris 1924 in fresh water bodies. BOD and COD showed a positive relationship with one another. Similar type of relationship was reported by Chopra and Patric 1994 in the river Ganga at Rishikesh. BOD and COD have showed a negative relationship with dissolved oxygen as also observed by Verma *et.al.* 1984 in eastern Kalinadi.

The plankton are the heterogenous assemblage of minute organisms present in the natural waters. The total planktonic concentration was recorded maximum $91236.59 \text{ units/L} \pm 196.38$ in winter, due to the blanketing effect caused by velocity. Allen (1920) has shown that the water current above the moderate speed is directly inhibitory to plankton development. Maximum percentage of different groups were noted as Bacillariophyceae (Diatoms 81.83 %) in winter Chlorophyceae (Green algae) 19.49 % in summer, and Cynophyceae (Blue green algae) 4.55% in summer. Among the total plankton, Bacillariophyceae dominated over Chlorophyceae, Cyanophyceae and Zooplankton. Same trend of domination was reported by Khanna 1993 and Joshi *et.al* 1996 in the river Ganga at Haridwar.

Table 1. Seasonal variations in physical parameters of Suswa River

Parameters	Seasons	Summer	Monsoon	Winter	Average
Temperature (°C)		26.25 ± 1.68	23.52 ± 0.24	21.80 ± 1.45	23.86 ± 0.045
Velocity (m/Sec)		1.16 ± 0.169	0.95 ± 0.021	0.65 ± 0.19	0.92 ± 0.036
Total Solids, TS (ppm)		219.30 ± 29.74	170.04 ± 5.09	142.39 ± 24.64	177.24 ± 4.18
Total Dissolved Solids, TDS (ppm)		211.53 ± 27.43	166.59 ± 4.34	140.06 ± 23.01	172.73 ± 4.14
Total Suspended Solids, TSS (ppm)		7.77 ± 2.31	3.45 ± 0.75	2.33 ± 1.54	4.51 ± 0.053

Table 2. Seasonal variations in chemical parameters of Suswa River

Parameters	Seasons	Summer	Monsoon	Winter	Average
pH		7.47 ± 0.23	7.53 ± 0.18	8.36 ± 0.40	7.79 ± 0.008
Free CO ₂ (ppm)		3.59 ± 0.22	3.36 ± 0.63	2.86 ± 0.29	3.27 ± 0.013
Dissolved Oxygen (ppm)		8.31 ± 0.31	8.84 ± 0.06	9.10 ± 0.25	8.75 ± 0.022
Mineral Acidity (ppm)		61.12 ± 3.24	55.89 ± 0.46	52.61 ± 2.77	56.54 ± 0.56
Total Acidity (ppm)		3.76 ± 0.06	3.71 ± 0.028	3.53 ± 0.098	3.67 ± 0.025
Alkalinity (ppm)		288.90 ± 12.08	302.17 ± 2.69	326.86 ± 14.76	305.98 ± 0.91
Chloride (ppm)		21.99 ± 2.75	16.84 ± 0.89	15.48 ± 1.85	18.10 ± 0.13
Hardness (ppm)		100.83 ± 2.65	97.45 ± 0.26	92.95 ± 2.92	97.08 ± 0.39
Calcium (ppm)		85.14 ± 1.76	82.40 ± 0.18	80.39 ± 1.59	82.65 ± 0.36
Magnesium (ppm)		15.69 ± 0.89	15.05 ± 0.43	12.56 ± 1.32	14.43 ± 0.036
BOD (ppm)		2.05 ± 0.21	1.77 ± 0.14	1.42 ± 0.23	1.75 ± 0.037
COD (ppm)		4.49 ± 0.11	4.36 ± 0.014	4.18 ± 0.11	4.34 ± 0.013

Table 3. Seasonal quantitative analysis of the plankton of the River Suswa

Parameters Seasons	Number of plankton per litre of water		Total plankton per litre of water
	Phytoplankton	Zooplankton	
Summer	629.92 \pm 150.39	94.25 \pm 15.56	724.17 \pm 165.95
Monsoon	804.00 \pm 27.30	111.83 \pm 3.13	915.83 \pm 30.43
Winter	1093.92 \pm 177.70	142.67 \pm 18.68	1236.59 \pm 196.38
Average	842.61 \pm 191.38	116.25 \pm 20.01	958.86 \pm 211.40

Table 4. Number and percentage of different groups among the phytoplankton of the river Suswa during different seasons

Parameters Seasons	Total plankton/ L	Total diatom/ L	Total green algae/ L	Total blue green algae/ L	Percentage of different groups		
					Diatoms	Green algae	Blue green algae
Summer	629.92 \pm 150.39	477.52 \pm 135.74	123.78 \pm 12.11	28.62 \pm 2.55	75.96	19.49	4.55
Monsoon	804.00 \pm 27.30	638.61 \pm 21.84	136.05 \pm 3.43	29.34 \pm 2.04	79.12	17.14	3.74
Winter	1093.92 \pm 177.70	892.35 \pm 157.59	162.88 \pm 15.54	38.69 \pm 4.58	81.83	14.61	3.56
Average	842.61 \pm 191.38	669.49 \pm 170.76	140.90 \pm 16.32	23.22 \pm 4.30	78.97	17.08	3.95

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