Chapter 5

Monitoring of Water Quality Parameters in Upper and Lower Reaches of Dudhganga Catchment, India

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Additional information is available at the end of the chapter

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1. Introduction

Water is extremely essential for survival of all living organisms. The quality of water is vital concern for mankind since it is directly linked with human welfare. In India, most of the population is dependent on surface water (damp water) as the only source of drinking water supply. The groundwater is believed to be comparatively much clean and free from pollution than surface water. But prolonged discharge of industrial effluents, domestic sewage and solid waste dump causes the groundwater to become polluted and created health problems [1]. The problems of surface water quality are much more acute in the areas which are densely populated. The rapid growth of urban areas has further affected groundwater quality due to overexploitation of resources and improper waste disposal practices. Hence, there is always a need for and concern over the protection and management of surface water and groundwater quality. [2, 3, 4] Considering the above aspects of water contamination, the present study was undertaken to investigate the possible impact of the surface water quality. In Kashmir, most of the population is dependent on surface water as the only source of drinking water supply Thus, in this paper an attempt has been made to assess the physical and chemical properties of surface water of the Dudhganga stream of Dudhganga watershed, Kashmir valley, India.

Dudhganga watershed of Jammu and Kashmir (Figure 1) is located in the northern part of India between 34^0 42' to 34^0 50'N and 74^0 24' to 74^0 54' E, covers an area of 660 km^2. The area supports a varied topography exhibiting altitudinal extremes of 1610 to 4700 m above mean sea level. From southwest to northeast, the area consists of the lofty Pir-Panjal, and flat-topped karewas as foothills and plains. The Pir-Panjal mountain range covers the Kashmir valley on the south and southwest, separating it from the Jammu region. The soils in the area

are generally loamy soil, karewa soil and poorly developed mountain soil [5]. Drainage of the area is quite significant with most of the drainage flowing into river *Jhelum*. Dudhganga is the important tributaries of river *Jhelum* which originates near Tatakuti Mountain. The literature survey reveals that no water quality management studies are made in this region so far. Hence the present study was planned and undertaken

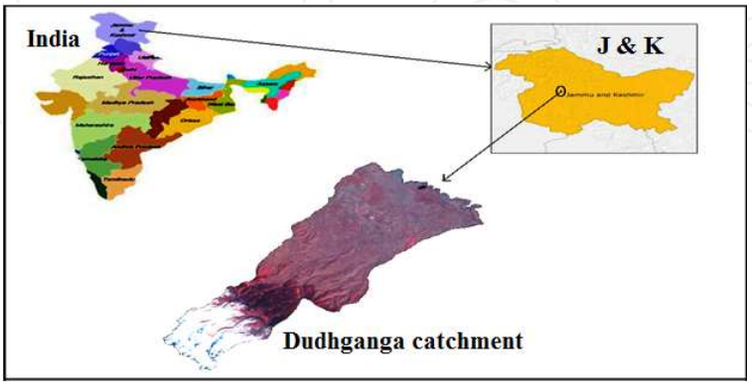

Figure 1. Geographical location of Dudhganga Catchment, India

2. Method and materials

The present study was planned and undertaken at following sampling locations.

Station No.	Station Name	Latitude and Longitude in degrees	Altitude (meters)
S1(Forest Area)	Branware	33° 50' 37.3"N 74° 39' 21.3"E	2278
S2(Urban Centre)	Barzulla Baghat	34° 03' 00.0"N 74° 48' 00.6"E	1605

Table 1. Sampling locations

2.1. Preparation of water samples

The sample were collected from all the stations at 09.00 am to 11.00am for physico-chemical examinations, different methods of collection and handling were adopted based the standard procedures [6]. Water samples were collected carefully in a glass stoppered sterilized container (Volume approx. 1000ml) at a depth of 15cm without any air bubbles. The instruments were used of accuracy. The pH of two locations were checked on spot. The instruments used for the pH was portable pH meter. Water samples from two sampling sites were collected during May to July months (2011).

2.2. Physicochemical analysis

Analysis was carried out for various water quality parameters such as pH, electrical conductivity (EC), dissolved oxygen (DO), free carbon dioxide, total alkalinity (TA), total hardness

(TH), calcium hardness, calcium content, chloride (Cl^-), nitrate, nitrite, sulphate, phosphate, Ortho Phosphate Silicates, and TDS and ammonia using standard method [7,8].

2.3. Statistical analysis

The simple linear correlation analysis has been carried out to find out correlation between two sampling sites (Branware and Barzulla Baghat) using SPSS.

3. Results and discussion

The average results of the physicochemical parameters for water samples are presented in Table 2. and the deterioration of water quality is shown in (figure 2).

3.1. pH

pH is a term used universally to express the intensity of the acid or alkaline condition of a solution. Most of the waters are slightly alkaline due to presence of carbonates and bicarbonates. The pH values of water samples varied between 7.52 to 7.1 and were found

Within the limit prescribed by WHO.

Parameters/Sites	Branware (Upper Reaches)	Barzulla Baghat (Lower Reaches)	Average	Standard Deviation
DO mg/L **(X1)**	12.25	5	8.625	5.127
CO2mg/L **(X2)**	3.17	12.31	7.74	6.463
Nitrite µg/L **(X3)**	0.05	18.73	9.3888	13.21
Ammonia µg/L **(X4)**	7.0	400	203.85	278.4
Phosphate µg/L **(X5)**	62.37	155	108.69	65.5
Cl^- mg/L **(X6)**	2.73	12.56	7.6488	6.946
pH **(X7)**	7.52	7.1	7.31	0.297
Total Hardness mg/L **(X8)**	85.5	280	182.75	137.5
Ca. Hardness mg/L **(X9)**	22.25	68.66	45.455	32.82
Ca. Content mg/L **(X10)**	8.64	64.53	36.585	39.52
Alkalinity mg/L **(X11)**	55.5	83.11	69.305	19.52
Conductivity ohm.cm **(X12)**	37.25	300.23	168.74	186
Nitrate mg/L **(X13)**	0.15	0.99	0.5721	0.588
Sulphate mg/L **(X14)**	1.62	7.56	4.5925	4.197
Ortho Phosphate µg/L **(X15)**	32.375	120.25	76.313	62.14
Silicates mg/L **(X16)**	1.75	4.625	3.1875	2.033
TDS mg/L **(X17)**	22.35	180.138	101.23	111.6

Table 2. Average results of the physicochemical parameters

3.2. Electrical conductivity

Electrical conductivity is a measure of water capacity to convey electric current. It signifies the amount of total dissolved salts [9]. EC values were in the range of 37.25ohm./cm to 300.23 ohm /cm High EC values was observed at sampling station Barzulla Baghat indicating the presence of amount of dissolved inorganic substances in ionized form.

3.3. Dissolved oxygen

Dissolved oxygen is important parameter in water quality assessment and reflects the Physical and biological processes prevailing in the water. The DO values indicate the degree of pollution in water bodies. DO values varied from 5 to 12.25. The sampling point Barzulla Baghat showed low DO values indicating heavy contamination by organic matter.

3.4. Free carbon dioxide

The origin of free carbon dioxide is from air, algal respiration and organic breakdown. The Free Carbon Dioxide ranged from minimum of 3.17 mg/L to maximum of 12.31 mg/L at site1 and site 2 respectively. It indicates the presence of sewage at site 2 in the Dudhganga stream.

3.5. Total alkalinity

Alkalinity of water is its capacity to neutralize a strong acid and it is normally due to the presence of bicarbonate, carbonate and hydroxide compound of calcium, sodium and potassium. Total alkalinity values for all the investigated samples were found within the limits prescribed by WHO.

3.6. Total hardness

Hardness is the property of water which prevents the lather formation with soap and increases the boiling points of water [10]. Hardness of water mainly depends upon the amount of calcium or magnesium salts or both. The hardness values shown range from 85.5mg/L to 280 mg/L. All samples were found within the limits prescribed limits.

3.7. Calcium hardness and calcium content

Calcium is directly related to hardness. Calcium hardness ranged between 22.25 mg/L to 68.86 mg/L and Calcium content ranged from 8.64 to 64.53 found within permissible limit, prescribed by WHO.

3.8. Chloride

The chloride concentration serves as an indicator of pollution by sewage. In the present analysis, chloride concentration was found in the range of 2.73 mg/L to 12.56 mg/L. The values are within the limits. The length of the river from Branware to Barzulla Baghat is small

approximately 30 kilometers so an increase of even 5 mg/l at one station from another station may give rise to suspicions of a sewage discharge [11].

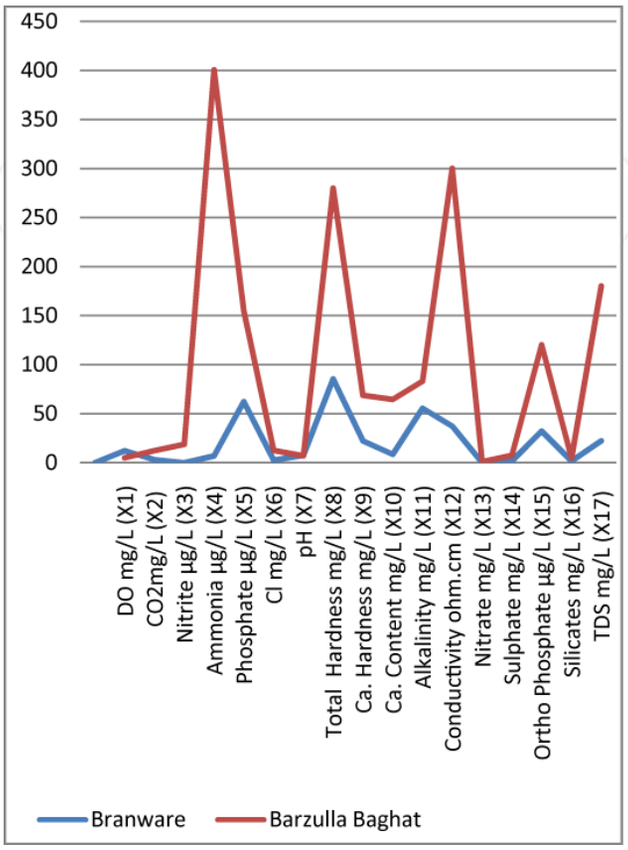

Figure 2. Water quality parameters

3.9. Nitrite

Nitrite exists normally in very low concentrations and even in waste treatment plant effluents levels are relatively low, principally because the nitrogen will tend to exist in the more reduced (ammonia; NH^3) or more oxidized (nitrate; NO^3) forms. Because nitrite is an intermediate in the oxidization of ammonia to nitrate, because such oxidation can proceed in soil, and because sewage is a rich source of ammonia nitrogen, waters which show any appreciable amounts of nitrite are regarded as being of highly questionable quality. Levels in unpolluted waters are normally low, below 0.03 mg/l Values greater than this may indicate sewage pollution [11]. In present study it ranges from 0.05µg/L to18.73µg/L.

3.10. Nitrate

Surface water contains nitrate due to leaching of nitrate with the percolating water. Surface water can also be contaminated by sewage and other wastes rich in nitrates The nitrate content in the study area varied in the range 0.15 mg/L to 0.99 mg/L and found within the prescribed limit.

3.11. Sulphate

Sulphate occurs naturally in water as a result of leaching from gypsum and other common minerals [12]. Discharge of industrial wastes and domestic sewage tends to increase its concentration. The sulphate concentration varied between 1.62 mg/L and 7.56 mg/L. and found within the prescribed limit.

3.12. Phosphate

Phosphate may occur in groundwater as a result of domestic sewage, detergents, agricultural effluents with fertilizers and industrial waste water. The phosphate content in the study area was found in the range of 62.37μg/L to 155μg/L and found within the prescribed limits.

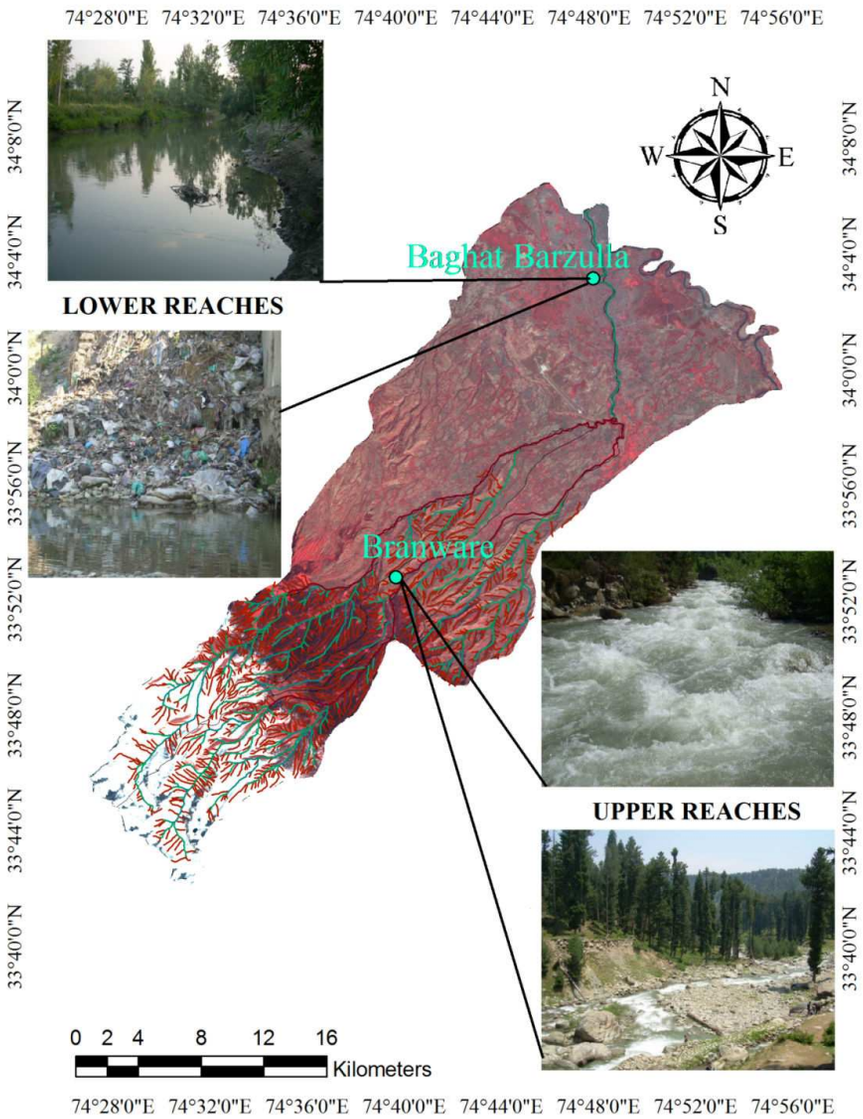

Figure 3. Shows sampling sites in upper and lower reaches of Dudhganga Catchment, India

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3.13. Ammonia

Ammonia is generally present in natural waters, though in very small amounts, as a result of microbiological activity which causes the reduction of nitrogen-containing compounds. When present in levels above 0.1 mg/l N, sewage or industrial contamination may be indicated [11]. In present study ammonia value ranges from 7μg/L to 400μg/L at site1 and site 2 respectively.

3.14. Statistical analysis

Interrelationship studies between two sampling sites are very helpful tools in promoting research and opening new frontiers of knowledge. The study of correlation reduces the range of uncertainty associated with decision making. The numerical values of correlation coefficient (r) for two sites are tabulated in Table 3.

Correlations			
		BRANWARE	**BARZULLA BAGHAT**
BRANWARE	Pearson Correlation	1	.514*
	Sig. (2-tailed)		.035
	N	17	17
BARZULLA BAGHAT	Pearson Correlation	.514*	1
	Sig. (2-tailed)	.035	
	N	17	17

*. Correlation is significant at the 0.05 level (2-tailed).

Table 3. Correlation matrix of two sampling stations.

4. Conclusion

Dudhganga is fresh water stream of Kashmir valley; it has a length of almost 35 km^2. All lotic water bodies have regenerating capacity then lentic water bodies because they are continuously flowing so little deviations in their water quality parameters are of great concern. Deviations were observed in water quality parameters from Site 1 to Site 2. As such no contamination of water is observed at Site S1 (Branware) because this region lies in upper catchment and having mostly forest as land cover. In upper catchment physicochemical parameters are within the water quality standards and the quality of water is good and it is fit for drinking purpose. But at last site S2 (Barzulla Baghat) which lies in the urban centre has the level of DO beyond the permissible limits and water has been contaminated by direct passage of sewage from households and it is unfit for drinking purpose.

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