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A Comparative Analysis of Selected Environmental Parameters of Water Quality of the Subansiri River in Eastern Himalayas and the Alaknanda River in Western Himalayas

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ABSTRACT

The paper attempts to analyze, interpret, compare and contrast water quality of selected environmental parameters of the Subansiri river in the eastern Himalayas and the Alaknanda river in the western Himalayas. Standard methodologies (APHA, 1995) are adopted to analyze the data and obtain the values for the samples of both the rivers in summer season. The results of the analysis are compared with the drinking water quality standards such as WHO and BIS. It is found from the study that the water quality parameters show a similar trend in case of the pH and electrical conductivity, but most of the parameters show dissimilarities in the eastern and western Himalayan basins.

Keywords: Water Quality, Subansiri, Alaknanda, Eastern Himalaya, Western Himalaya

I. INTRODUCTION

Water quality parameters of a river provide us a clear indication of the suitability of utilization of the water body and how it is affected by the biotic and abiotic factors of its surrounding. Now a day's testing of water quality parameters are essential exercises in environmental monitoring because of the raising population trend, disturbing land use changes as well as unsustainable urban developments. It is important for evaluating management strategies for a watershed. Changes of water quality may occur due to both natural and anthropogenic interventions.

The rivers in India may be broadly classified into Himalayan, peninsular, coastal and inland drainage-basin rivers. The Himalaya is the main source of water for the rivers in the Indo Gangetic plains, and all the major river systems of north India. The Himalayan rivers traverse through poorly consolidated sedimentary rocks affected by folds, faults and thrusts, there is greater erosion and removal of silt in these rivers (Rao, 1975). Besides these natural factors, anthropogenic activities have impacts on the Himalayan Rivers.

II. METHODS AND MATERIAL

2. Study area

The study area (Figure 1) covers the western Himalayan region represented by the Alakananda river of Ganga basin and the eastern Himalayan region represented by the Subansiri river of Brahmaputra basin.

The Subansiri is one of the largest north bank tributaries of the river Brahmaputra. It originates in the Great Himalayan range in Tibet at an altitude of more than 5000 m and flows through the hills of Arunachal Pradesh and plains of Assam before joining the mighty river Brahmaputra at Subansirimukh. The Subansiri Basin comprises of the hilly terrain, deep gorges and river valley terraces. The Alaknanda is a Himalayan River in the state of Uttarakhand. It is one of the major headstreams of the Ganga and originates at the water divide between Satopanth and Bhagirath glaciers at an

altitude of approximately 3680 m in the southern slopes of the outer Himalayas.

Both the rivers originate from the great Himalaya, one on the eastern part and the other on the western part. However, there are lots of contrasting features regarding the geoenvironment of the same arc.

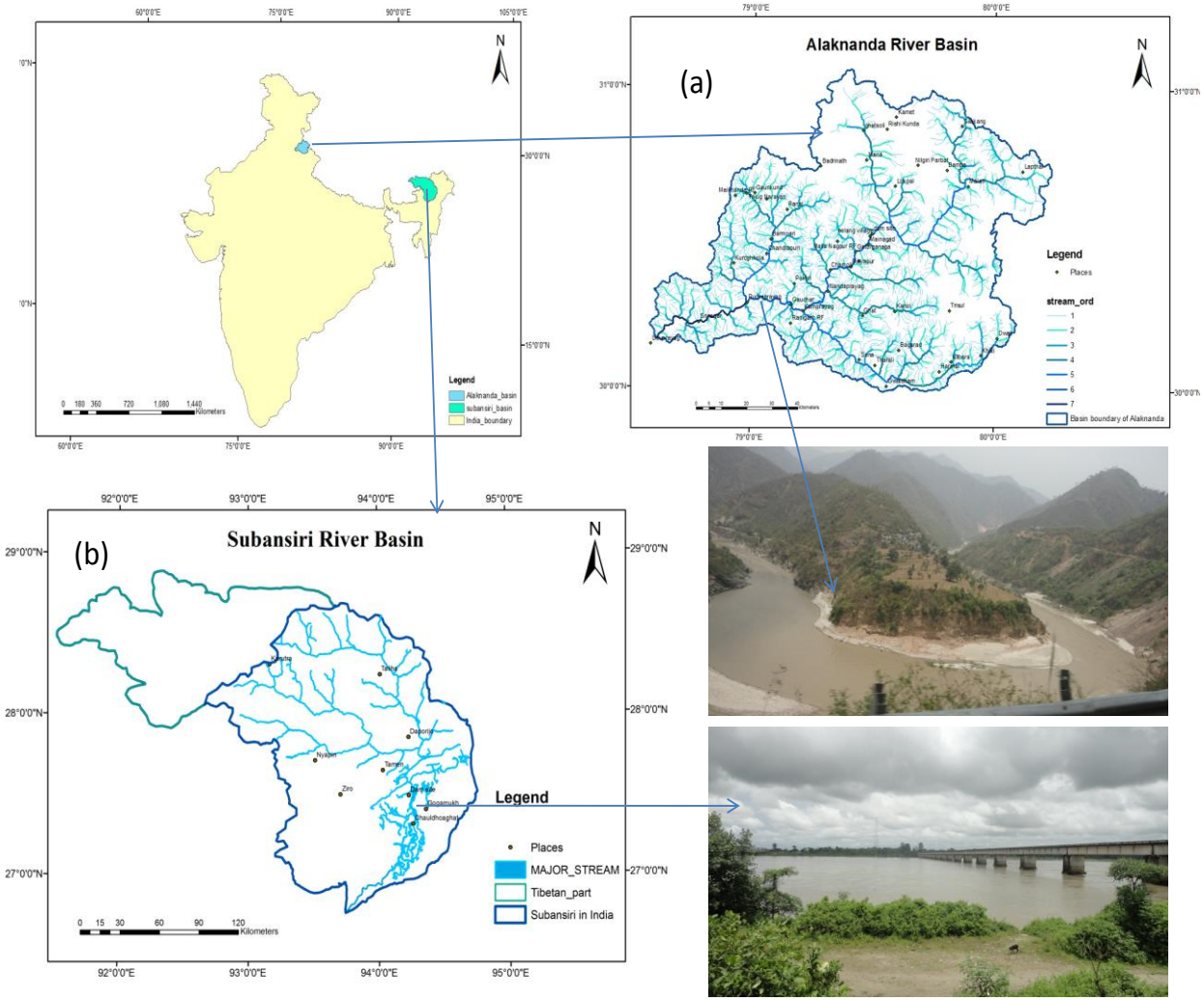

Figure 1: Location of the study area: (a) Alaknanda River basin in the western Himalayas and (b) Subansiri River basin in the eastern Himalayas

III. RESULTS AND DISCUSSION

Analysis of water quality results

Water quality of the two rivers is examined based on samples collected during field survey and analysed in the chemical laboratory. The results of the tested parameters of water quality are listed in the table1 followed by their interpretations.

Table 1: Analysis of water quality based on selected environmental parameters

Parameter	Sample No.	Elevation in (m)	Subansiri River (values)	Elevation in (m)	Alaknanda River (values)
pH	1	86.258	7.35	534.619	7.61
	2	88.392	7.32	535.838	7.70

Table 1 Contd.					
Parameter	Sample No.	Elevation in (m)	Subansiri River (values)	Elevation in (m)	Alaknanda River (values)
	3	92.964	7.35	632.460	7.94
Conductivity (µS/cm)	1	86.258	139.2	534.619	173
	2	88.392	170	535.838	158
	3	92.964	158	632.460	141.1
Turbidity	1	86.258	344.64	534.619	78
	2	88.392	394.6	535.838	62
	3	92.964	395.2	632.460	464
Total Solid (TS) in mg/l	1	86.258	980	534.619	260
	2	88.392	740	535.838	290
	3	92.964	920	632.460	530
Total Dissolve Solid (TDS) in mg/l	1	86.258	134	534.619	90.5
	2	88.392	116	535.838	110.43
	3	92.964	150.47	632.460	147.49
Total hardness (mg/l)	1	86.258	42	534.619	40
	2	88.392	46	535.838	43
	3	92.964	54	632.460	88
Ca^{++} (mg/l)	1	86.258	20.04	534.619	28.86
	2	88.392	18.44	535.838	30.02
	3	92.964	19.23	632.460	57.71
Mg^{++} (mg/l)	1	86.258	19.79	534.619	22.42
	2	88.392	14.77	535.838	24.71
	3	92.964	12.79	632.460	26.84
K^+	1	86.258	2.06	534.619	2.58
	2	88.392	1.62	535.838	2.72
	3	92.964	1.73	632.460	3.34
Na^+	1	86.258	1.26	534.619	7.74
	2	88.392	0.90	535.838	7.77
	3	92.964	0.77	632.460	6.21
Cl^- (mg/l)	1	86.258	80.94	534.619	93.72
	2	88.392	58.22	535.838	99.4
	3	92.964	65.32	632.460	139.16
$SO4^{--}$(ppm)	1	86.258	32.12	534.619	11.03
	2	88.392	33.41	535.838	9
	3	92.964	34.39	632.460	10.78
PO_4^{--} (ppm)	1	86.258	0.08	534.619	2.78
	2	88.392	0.07	535.838	3.40
	3	92.964	0.08	632.460	3.06
NO_3^- (ppm)	1	86.258	0.61	534.619	4.51
	2	88.392	0.11	535.838	1.56
	3	92.964	0.88	632.460	4.56

From the analysis of collected water samples (Table 1), it is found that there is similar trend in the case of the pH, electrical conductivity and K^+ in both the rivers of eastern and western Himalayas. But the other parameters of water quality show dissimilar values in the rivers of the eastern and western Himalayans. From the table 1 it is observed that the pH value ranges between 7.32 - 7.35 in case of the Subansiri river while the pH range is 7.61 - 7.94 in the Alaknanda river (Figure 2) indicating the slightly basic nature of the river water and no influence of pollution (Hem, 1991).

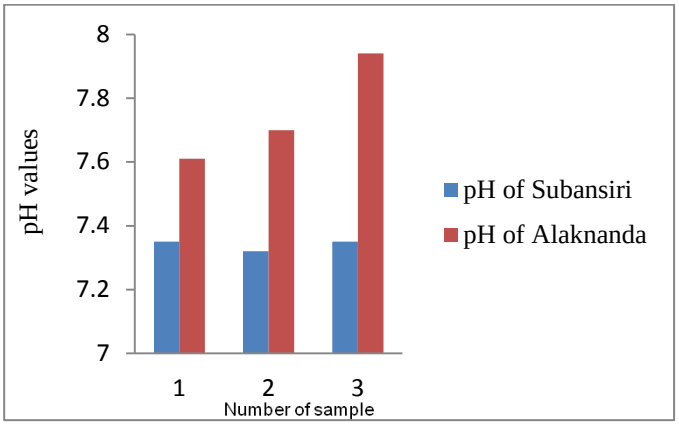

Figure 2: pH of the Subansiri and the Alaknanda rivers at selected locations

Electrical conductivity (EC) lies in the range of 139.2 – 170 µS/cm in the Subansiri river while the EC range is 141.1 - 173 µS/cm in the Alaknanda river (Figure 3). The maximum limit of EC in drinking water is prescribed as 1500 µS/cm. Conductivity in streams and rivers is affected by the geology of the area through which the channel flows. If the area have granite bed rock then conductivity tend to have a lower value as granite is composed of more inert materials that do not ionize when expose to water. Streams that flow through areas with clay soils tend to have higher conductivity because of the presence of materials that ionize when come in contact of water (AHEC/2011).

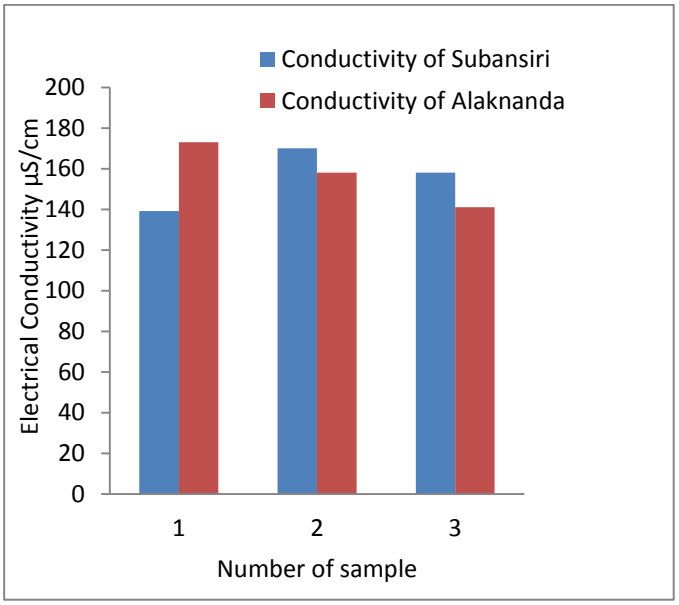

Figure 3: Electrical Conductivity of the Subansiri and the Alaknanda rivers at selected locations

Turbidity is much more in case of the Subansiri river than the Alaknanda river (Figure 4). The EPA drinking water standards specify a maximum turbidity value of 1NTU and BIS permissible limit is 10 NTU. But the sample collected from the Rudraprayag of Alaknanda river shows a high value being 464 NTU may be due to the muddy rain water flowing down at that time from the hills and also due to the high velocity of the flowing water.

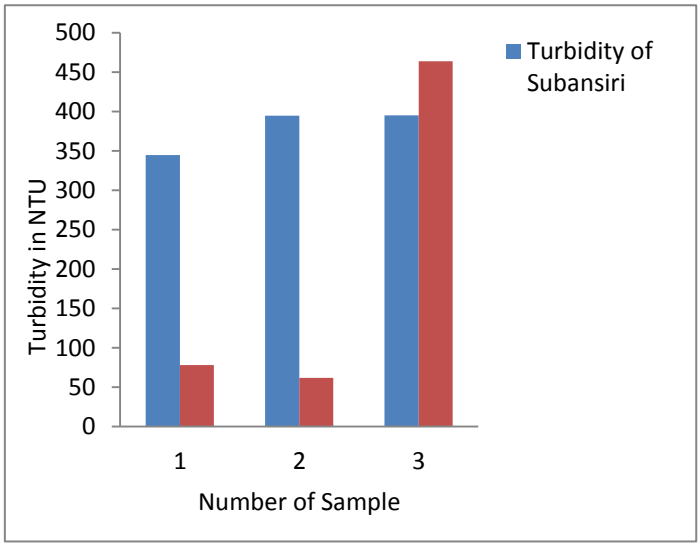

Figure 4: Turbidity of the Subansiri and the Alaknanda rivers at selected locations

Total Solid (TS) ranges in between 740 - 980 mg/l in the water of Subansiri river while it is observed 260 - 530 mg/l in case of the Alaknanda river which is comparatively much less than the Subansiri river (Figure 5).

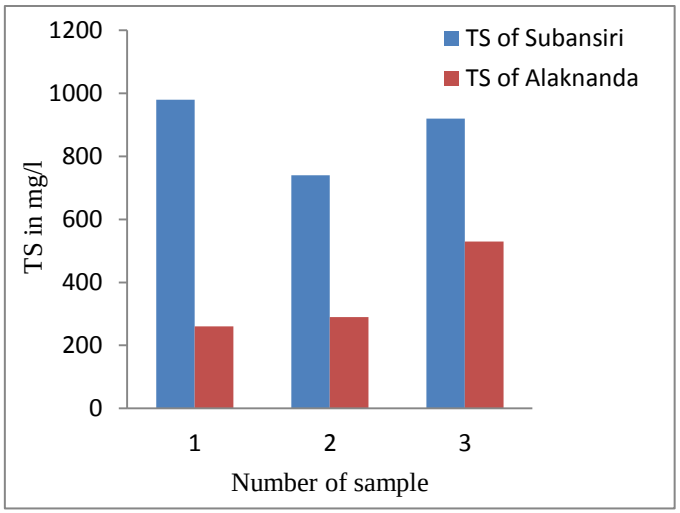

Figure 5: Total Solid (in gram) of the Subansiri and the Alaknanda rivers at selected locations

Total Dissolved Solid (TDS) is observed in the range between 116 – 150.47 mg/l in the Subansiri river while it varies in between 90.5-147.49 mg/l in the Alaknanda river (Figure 6) which is comparatively less than the Subansiri river of eastern Himalaya. The maximum permissible limit for TDS in BIS permissible limit as 500 mg/l and the highest desirable limit is 2000 mg/l. Hence, both the rivers have the TDS values within the permissible limit.

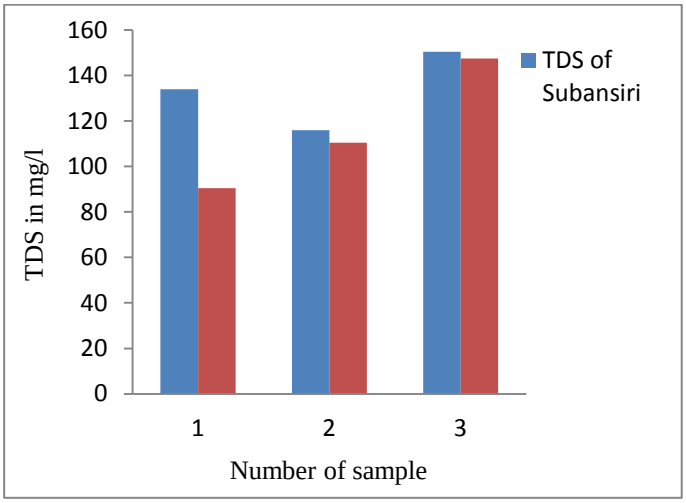

Figure 6: Total Dissolved Solid (in gram) of the Subansiri and the Alaknanda rivers at selected locations

Total Hardness lies in the range of 42 - 54 mg/l in the Subansiri river while it is 40 - 88 mg/l in the Alaknanda river which is comparatively higher than the Subansiri river (Figure 7) but within the BIS (1991) permissible limit of 600 mg/l. Table 1 shows the Ca++ ranges in between 18.44 -20.04 mg/l in the Subansiri river of eastern Himalaya while it is 28.86 - 57.71 mg/l in the Alaknanda river which is comparatively higher than the Subansiri river (Figure 8). The permissible limit for Ca++ as per BIS is 200 mg/l. Mg++ varies in the range of 12.79 - 19.79 mg/l which is comparatively less than the Alaknanda river (22.42 - 26.84) of western Himalaya (Figure 9). A concentration up to 30 mg/l is recommended for magnesium in drinking water.

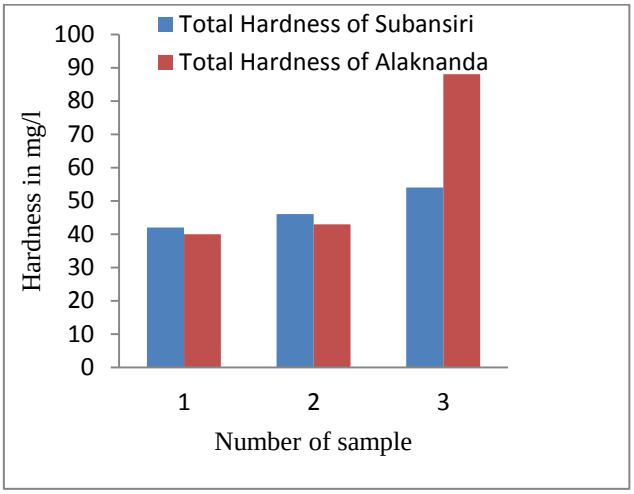

Figure 7: Total Hardness of the Subansiri and the Alaknanda rivers at selected locations

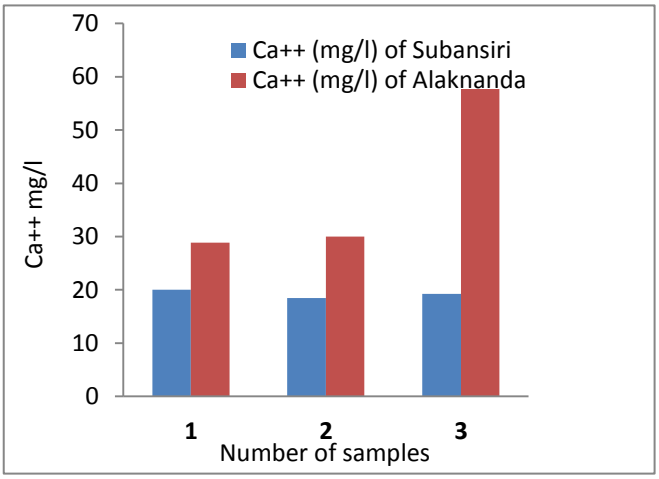

Figure 8: Ca^{++} (mg/l) of the Subansiri and the Alaknanda rivers at selected locations

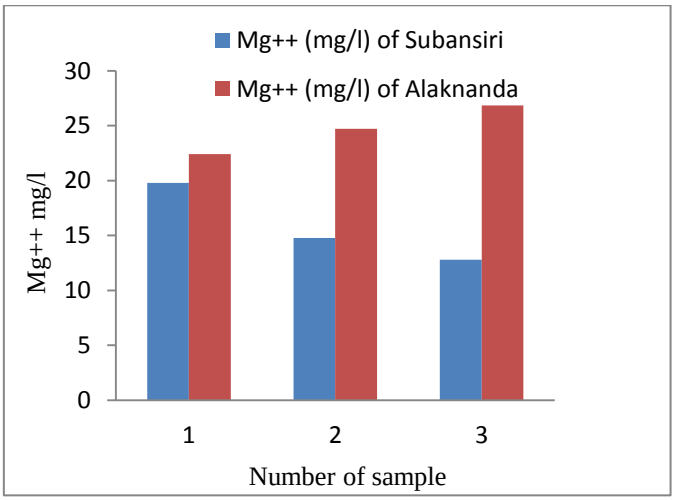

Figure 9: Mg^{++} (mg/l) of the Subansiri and the Alaknanda rivers at selected locations

K+ value ranges in between 1.62 - 2.06 in the Subansiri river while it is 2.58 - 3.34 in the Alakanda river which is comparatively higher than the Subansiri river (Figure 10). Na+ ranges in between 0.77 - 1.26 in the Subansiri river while it varies in between 6.21 - 7.77 in the Alaknanda river and it is comparatively much higher than the Subansiri river (Figure 11).

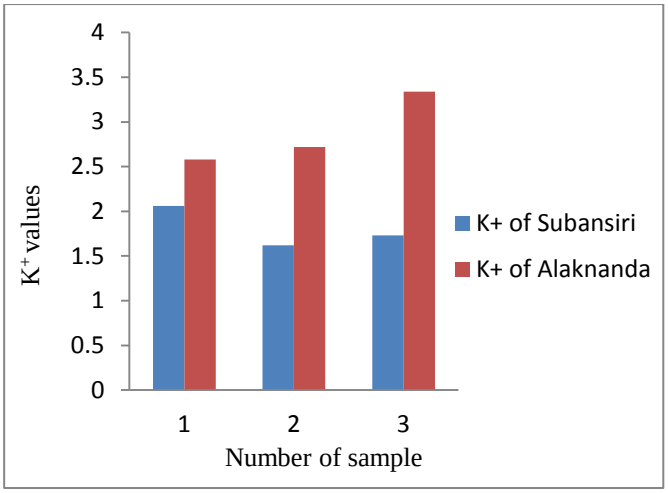

Figure 10: K^+ of the Subansiri and the Alaknanda rivers at selected locations

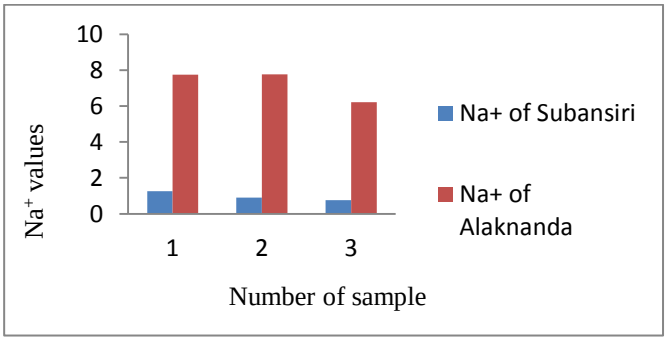

Figure 11: Na^+ of the Subansiri and the Alaknanda rivers at selected locations

Cl- value ranges in between 58.22 - 80.94 mg/l in the Subansiri river while it is found to be comparatively high range in between 93.72 - 139.16 mg/l in the Alaknanda river (Figure 12). WHO (2008) guide lines suggest the permissible limit in ground water is 600 mg/l.

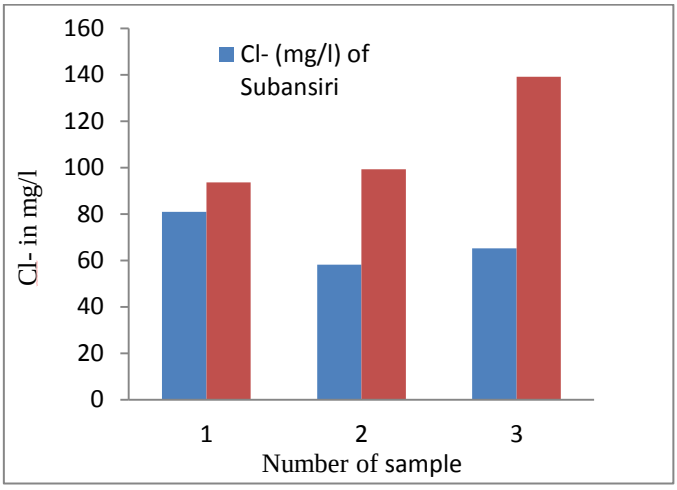

Figure 12: Cl^- (mg/l) of the Subansiri and the Alaknanda rivers at selected locations

$SO4^{--}$ value shows the range in between 32.12 - 34.39 ppm in the Subansiri river while it shows the comparatively lower values in case of the Alaknanda river which ranges in between 9 - 11.03 ppm (Figure 13). The recommended upper limit for sulphate in drinking water is 250 mg/l. The main source of phosphorus in the environment is from soil and rock weathering. Phosphate occurs in traces in much natural water.

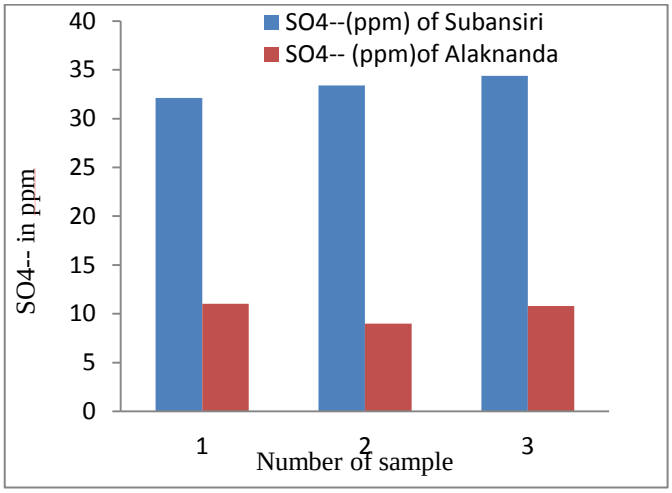

Figure 13: SO_4^{2--} of the Subansiri and the Alaknanda rivers at selected locations

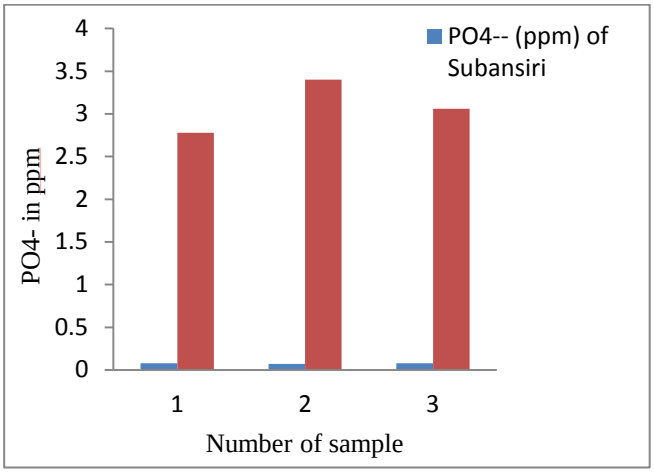

Figure 14: PO_4^{--} of the Subansiri and the Alaknanda rivers at selected locations

PO_4^{--} is observed to be comparatively higher in the Alaknanda river (2.78 - 3.40 ppm) than the Subansiri river (0.07 - 0.08 ppm) (Figure 14). NO_3^- ranges in between 0.11 - 0.88 ppm in case of the Subansiri river while it is 1.56 - 4.56 ppm in the Alaknanda river (Figure 15) indicating anthropogenic activity near the sampling site and flow of nutrients from the watershed. A high level of nitrate (>45 mg/l) in drinking water can cause methenoglobinemia or blue baby syndrome in infants and gastrointestinal cancer in adults (Mc Donald and Key, 1998).

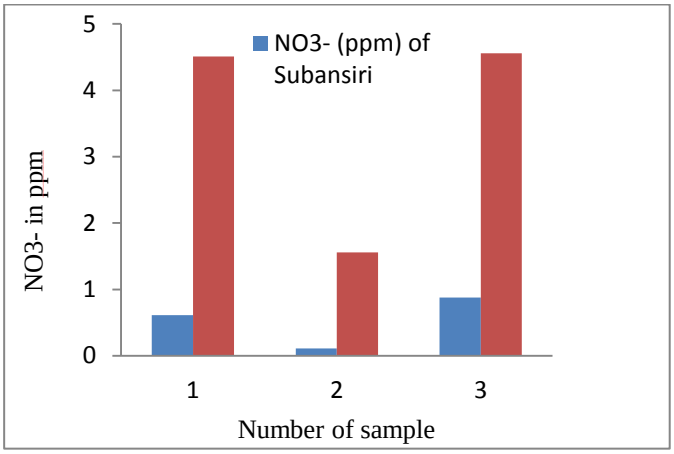

Figure 15: NO_3^- (ppm) of the Subansiri and the Alaknanda rivers at selected locations

IV. CONCLUSION

The water quality parameters show a similar trend in case of the ph and electrical conductivity but most of the other parameters show dissimilarities in both the selected eastern and western Himalayan rivers. The river water of the Subansiri is more turbid which carries high amount of total solid and also debris than the river Alaknanda in the study area. It may be due to the soil texture of the basin or high velocity of the water causing erosion. It is seen that the concentrations of PO4- and NO3- are low in case of the Subansiri but these are in elevated range in case of the river Alaknanda which is due to the agricultural practices and anthropogenic activities (may be constructional activities) in and around the basin area. A study revealed that in the Alaknanda River, Badrinath is most polluted and at the village Mana its pollution level the least (Sati et al., 2011). Thus monitoring of water quality needs urgent attention for the people of the basin and also for management of both the watersheds situated in the opposite ends of the Himalayan arc.

V. REFERENCES

[1] APHA (1995): American Public Health Association Standard Method for the examination of water and waste water, 19th edition, American Public Health Association, Washington DC, USA.

[2] Alternate Hydro Energy Centre, IIT, Roorkee (2011): Assessment of Cumulative Impact of Hydropower Projects in Alaknanda and Bhagirathi Basins, pp. 6-8.

[3] Hem, J. D. (1991): Study and Interpretation of the Chemical Characteristics of Natural Water, 3rd Edition, Scientific Publishers, Jodhpur, pp. 64.

[4] Mc Donald, A.T., and Key, D. (1998): Water resources: issues and strategies. Harlow, UK: Longman Scientific and Technical.

[5] Rao, K. L. (1975): India's Water Wealth, Orient Longman Limited, New Delhi, pp. 59-72.

[6] Sati, Archna, Sood, Anchal, Sharma, Shivesh, Bisht, Sandeep and Kumar, Vivek (2011): Bacterial indicators of faecal pollution and physiochemical assessment of tributaries of Ganges River in Garhwal Himalayas, India, RMZ – Materials and Geoenvironment, Vol. 58, No. 2, pp. 129-142