

## International Journal of Innovative Research in Science, Engineering and Technology

(A High Impact Factor, Monthly, Peer Reviewed Journal)

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Vol. 6, Issue 10, October 2017

# Abiotic Characteristics of Bhakra-Yamuna Link canals in the Narwana Region of Haryana

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**ABSTRACT:** Abiotic characteristics was analysed at different sites ( $S_1$ ,  $S_2$ , and  $S_3$ ) on Bhakra-Yamuna Link canals for a period of one year (January-December, 2013). Site  $S_1$  lies on Sirsa branch of Western Yamuna Canal, site  $S_2$  on Barwala link canal and site  $S_3$  on Sirsa branch after junction with Barwala link canal in Narwana region of Haryana. Relatively high values of width, water current, electrical conductivity, TDS, turbidity, BOD, total alkalinity, total hardness, chlorides, nitrates, o-phosphates and ammonia were recorded at site  $S_3$  as compared to site  $S_2$  on linking with site  $S_1$ .

**KEYWORDS:** Hydrological characteristics, Bhakra-Yamuna Link canals.

### I. INTRODUCTION

Aquatic ecosystem is the most diverse ecosystem in the world. The first life originated in the water and first organisms were also aquatic where water was the principal external as well as internal medium for organisms. An aquatic ecosystem includes rivers, streams, ponds and lakes, oceans and bays. Rivers have been the most important fresh water resources and most of the developmental activities are still dependent on them. In order to make an organised use of river water, extensive canal network is used to transport to remote places for requirement of growing urbanization, industrialisation, irrigation and public water supply. As a result, the water quality of canals has become a subject of concern in recent past.

Water quality is extremely important because constant access to good quality water is necessary for life as well as economy (Kumar and Chopra, 2012). A regular monitoring of water quality with reference to the physicochemical parameters are essential for every aquaculture practice. This also improves the existing conditions for the conservation of the precious water resources (Imnatoshi and Ahmed, 2012). Present study is intended to study the effect of linking on various hydrological parameters of Bhakra-Yamuna link canals in Narwana region of Haryana.

### II. MATERIAL AND METHOD

For the present study, three sampling sites ( $S_1$ ,  $S_2$ , and  $S_3$ ) were selected on Bhakra-Yamuna link canals (Fig.1). Site  $S_1$  lies on Sirsa branch of Western Yamuna Canal (Longitude 29°63'N and latitude 76 °17'E), site  $S_2$  on Barwala link canal (Longitude 29°61'N and latitude 76 °15'E) and site  $S_3$  (Longitude 29°59'N and latitude 76 °14'E) on Sirsa branch after junction with Barwala link canal at Dhakal head in Narwana region of Haryana (Fig. 1). Surface water samples were collected monthly from January, 2013 to December, 2013 from all selected sites, in triplicate, in polythene bottles. Physicochemical parameters like temperature, depth, width, water current, pH, fixation of dissolved oxygen were determined on the spot, whereas, other parameters were analysed in the laboratory according to standard procedures (APHA, 1998 and Garg *et al.*, 2002) within 3 to 4 days, during which samples were kept in cold storage.

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(A)



(B)



(C)



(D)

**Fig.1. Photograph of canals at sampling sites (S<sub>1</sub>, S<sub>2</sub> and S<sub>3</sub>).**

### III. RESULT AND DISCUSSION

Monthly variations in the values of various physicochemical parameters at all selected sites are shown in Table. Temperature is one of the important among the external factors which profound influence and direct or indirect effect on biota of an ecosystem. Most important effect of temperature is the decrease of oxygen solubility as the temperature increases (Basu et al., 2010). During present study, mean water temperature at study sites varied from 20.0 to 23.12 °C (Fig.2B). Temperature ranging between 13.5°C to 32°C is reported suitable for the development of planktonic organism (Kamat, 2000; Gaikwad et al., 2008). The maximum depth (16.05±0.018ft) was recorded in August at site S<sub>2</sub> and minimum depth was (4.15±0.03ft) recorded in November at site S<sub>1</sub> (Fig.2C).

Maximum flow of water in selected canal system was observed in the rainy season at sites S<sub>3</sub>, but lower flow was observed in postmonsoon at site S<sub>1</sub> (Fig.2E). According to the Central Pollution Control Board (CPCB, 2000), Yamuna River carries almost 80% of total annual flow during monsoon period and reduces significantly during non-monsoon period. Bhatnagar *et al.*, 2009 have also observed significant difference between flow rate in monsoon and nonmonsoon seasons in Western Yamuna canal at Yamunanagar. Flow rate of water bodies generally depends upon the amount of water available and on its depth (Saksena *et al.*, 2008). Mean value of pH at all the selected sites was alkaline and within the limits as recommended by ICMR (1975) and WHO (2001) (Fig. 2F). According to Khaiwal *et al.* (2003) alkaline pH is considered to be good for promoting high productivity. Alkaline pH was also observed by

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Bhandari *et al.*, (2010) in Gurgaon canal, Sharma *et al.*, (2011) in Mughal canal, Verma *et al.*, (2012) in canals of Allahabad.

Relatively high values of conductivity was recorded at site S<sub>1</sub> (276±1.22 to 385±3.24mgL<sup>-1</sup>) and site S<sub>3</sub> (237±3.24 to 318±2.24mgL<sup>-1</sup>) as compared to site S<sub>2</sub> (217±0.70 to 293±0.54mgL<sup>-1</sup>) (Fig.2G). The values of total dissolved solids were fluctuated between 158±0.81 to 289±2.89mgL<sup>-1</sup> at site S<sub>1</sub>, 124±1.87 to 163±6.16mgL<sup>-1</sup> at site S<sub>2</sub> and 132±0.70 to 209±3.74mgL<sup>-1</sup> at site S<sub>3</sub> (Fig.2H). The maximum 289±2.89mgL<sup>-1</sup> was recorded in July at site S<sub>3</sub> and minimum 124±1.87mgL<sup>-1</sup> in January at site S<sub>2</sub>. Turbidity shows a gradual increase from January to July and then decrease up to December at all selected sites (Fig. 3A). High value of TDS, conductivity and turbidity in July could be related to increase in the water current, load of soluble salts, mud and increase in surface runoff. Similar results were also reported by Smitha *et al.*, 2013, Gurumayum *et al.*, 2002.

Maximum values of free CO<sub>2</sub> (10.00±0.08 mgL<sup>-1</sup>) were observed in the month of August at site S<sub>1</sub> (Fig. 3B). The pH, alkanity and free CO<sub>2</sub> are interrelated in aquatic ecosystem. Most of the free CO<sub>2</sub> in water comes from the decomposition of organic matter and from respiration of organisms. During present study, dissolved oxygen was high at site S<sub>1</sub> as compared to site S<sub>2</sub> and site S<sub>3</sub> (Fig. 3C). The maximum value of DO 11.04±0.13mgL<sup>-1</sup> at temperature 14° C was recorded in January at site S<sub>1</sub> and it is due to higher solubility at low temperature. Khaiwal *et al.*, 2003 and Bhatnagar *et al.*, 2009 noted the similar thing in river Yamuna and Western Yamuna canal. Comparatively high values of alkalinity and total hardness were recorded at site S<sub>1</sub> than site S<sub>2</sub> and S<sub>3</sub>, however, these values did not exceed prescribed permissible limits as recommended by WHO (2001) (Fig. 3D and E).

In the study period, the value of BOD was recorded from 1.96± to 3.12±mg L<sup>-1</sup> at site S<sub>1</sub>, 0.67±0.08 to 2.05±0.14mgL<sup>-1</sup> at site S<sub>2</sub> and 0.73±0.13 to 2.07±0.91mgL<sup>-1</sup> at site S<sub>3</sub> (Fig. 3F). The maximum value of BOD was recorded in May –June at all sites. This was due to high rate of decomposition of organic matter at high temperature and slow water current (Sanap *et al.* 2006). Excess of Chloride in inland water are usually taken as index of pollution and high values of chloride is troublesome in irrigation water and also harmful to aquatic life. A low value of chloride concentration at site S<sub>2</sub> reflects that there was no organic waste of animal origin pollution. At site S<sub>1</sub> and S<sub>3</sub>, mean values of chloride were high during winter and low during monsoon season (Fig.4A. Jindal and Sharma, 2011; Patra *et al.*, 2011 also observed minimum values of chlorides during monsoon could be attributed to dilution effect of heavy rains. However, Kalwale *et al.*, 2012 reported low level of chloride in summer season as compared to rainy season and occupying the intermediate position in winter season.

Concentration of available o-phosphate was low at site S<sub>2</sub> ranging from 0.03±0.01 mgL<sup>-1</sup> to 0.16±0.10 mgL<sup>-1</sup> (Fig. 4B). However, o-phosphate concentration at site S<sub>3</sub> was increased when it receive water from site S<sub>1</sub> and decreased when water supply from canal at site S<sub>1</sub> closed (summer season). The phosphate levels remains high at site S<sub>1</sub> as compare to site S<sub>2</sub> and S<sub>3</sub> and ranging from 0.21±0.02 mgL<sup>-1</sup> to 0.58±0.09 mgL<sup>-1</sup> being, maximum in the month of July and minimum in the month of September (Fig.). High phosphate concentration in July may be due to increased decomposition at high temperature which was in accordance with the findings of Kaushik *et al.*, 1991 and Bhatnagar *et al.*, 2009.

During present investigation highest values of nitrate i.e. 0.66±0.07 mgL<sup>-1</sup> was recorded at site S<sub>1</sub> in monsoon season (Fig. 4C). The reason for the increase in nitrate content in the rainy season was due to the contributions from agriculture runoff filled with fertilizers and waste effluents. Similar finding has been reported by Kumar *et al.*, 2011 and Kaur and Kaur, 2014. Nitrate concentration remained low at site S<sub>2</sub> during study period and varied from 0.05±0.01 mgL<sup>-1</sup> to 0.18±0.02 mgL<sup>-1</sup>. At site S<sub>3</sub>, nitrate content show decreasing trend on comparison to site S<sub>1</sub> and increasing trend on comparison to site S<sub>2</sub> (Fig. 4A).

Relatively high values of ammonia concentration were recorded at site S<sub>1</sub> than site S<sub>2</sub> and S<sub>3</sub> (Fig. 4D). Bhatnagar *et al.*, 2009 also reported high level of ammonia in Western Yamuna Canal thus canal at site S<sub>1</sub> receive water with high ammonia from their source. Ammonia concentration remained low at site S<sub>2</sub> and ranged from 0.02±0.007 mgL<sup>-1</sup> to 0.16±0.02 mgL<sup>-1</sup>. At site S<sub>3</sub> ammonia concentration showed decreasing trend from site S<sub>1</sub> due to addition of fresh water (water with low ammonia concentration) from site S<sub>2</sub>.

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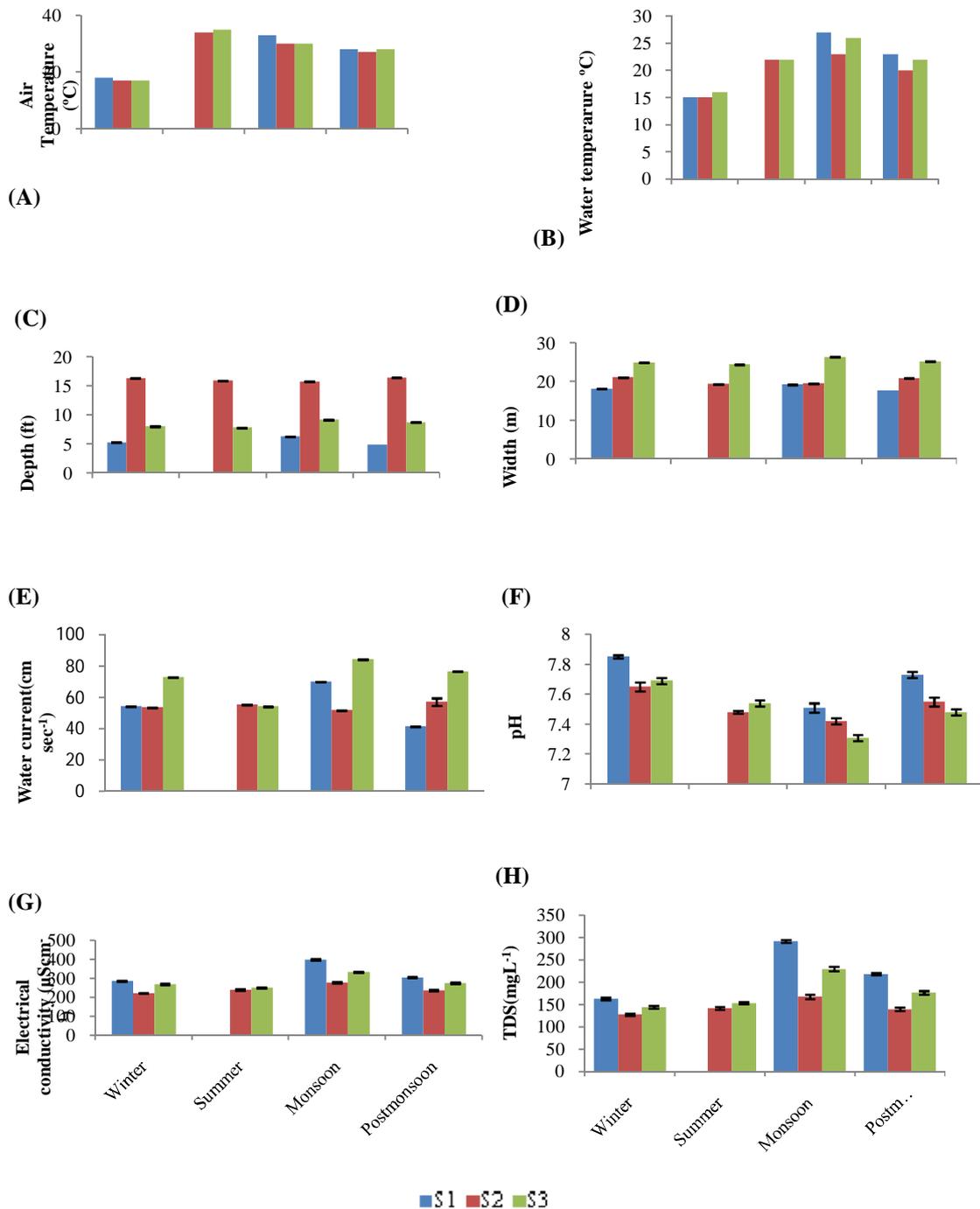


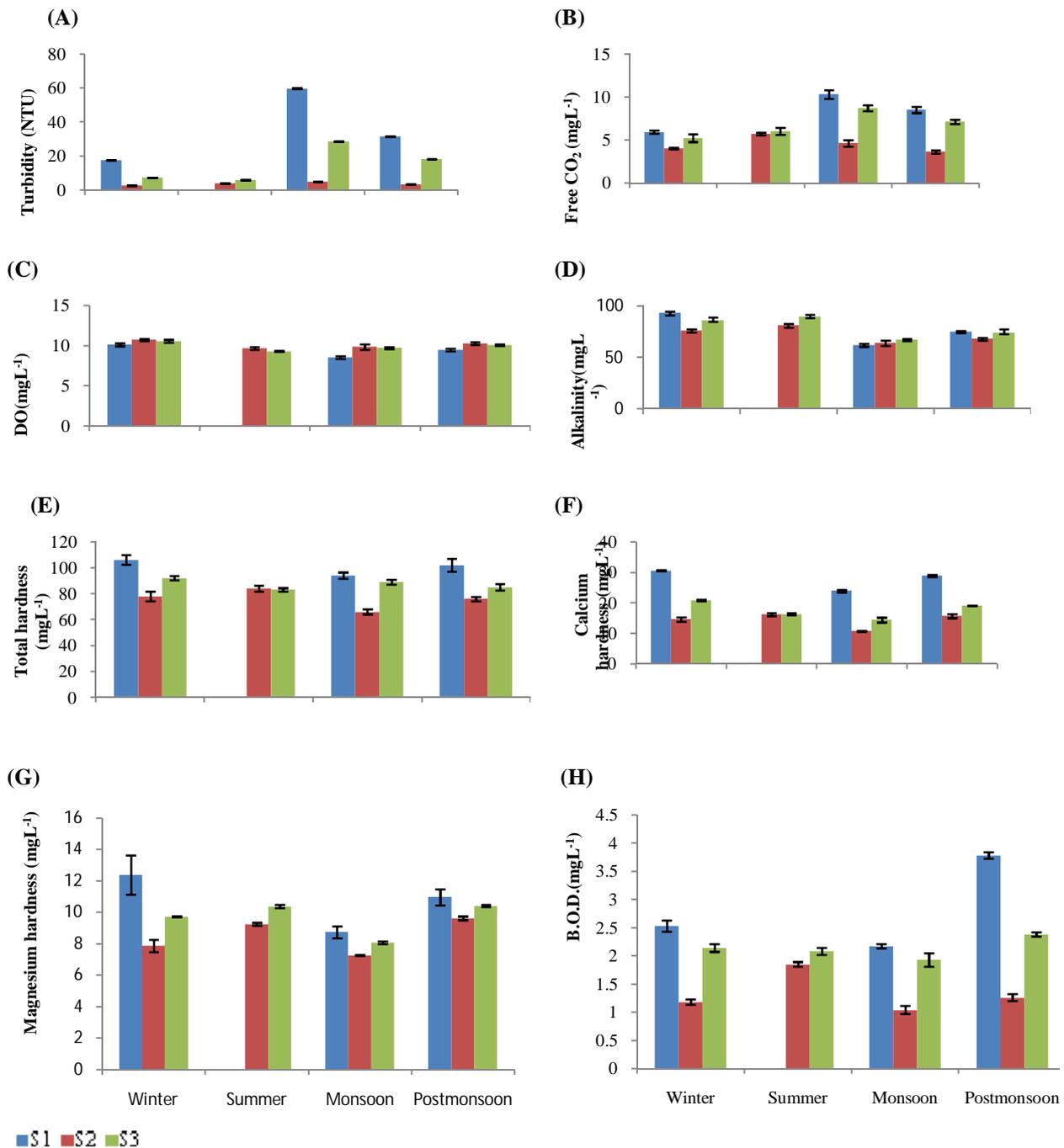
Fig. 2: Comparison of monthly variation in some of the abiotic parameters recorded at study sites from January to December, 2013.

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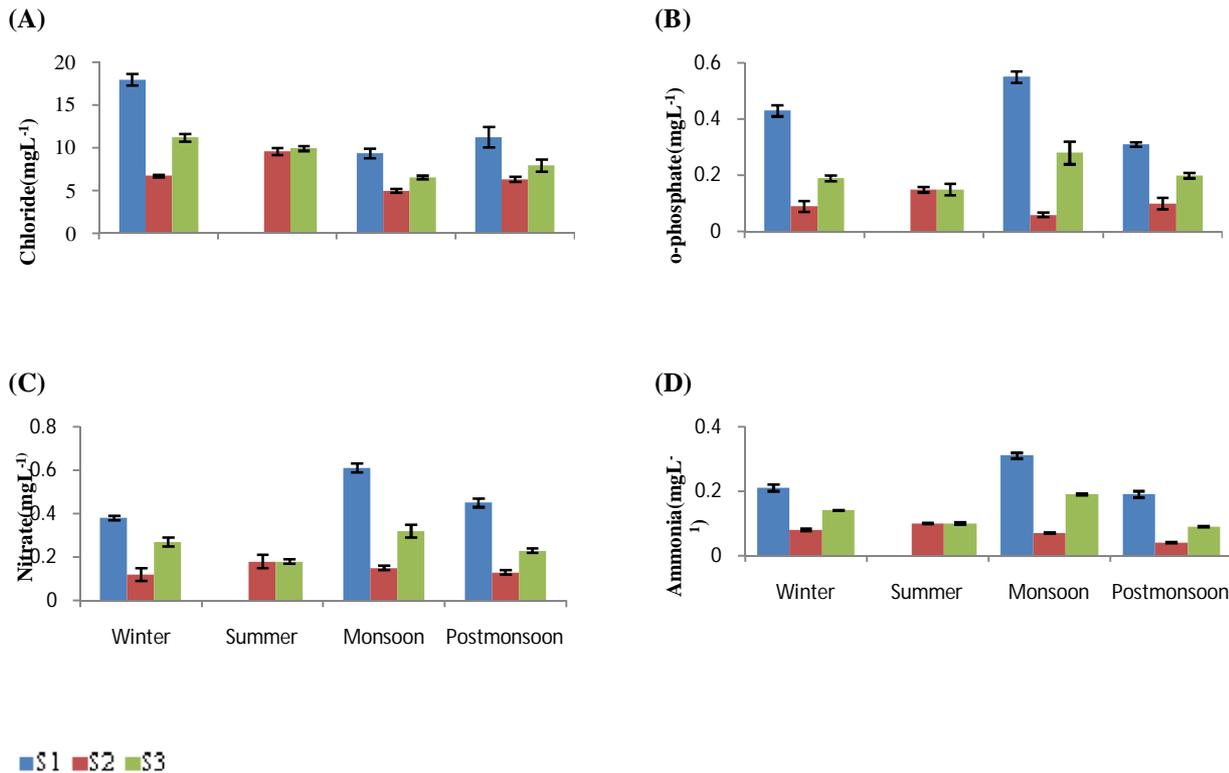
**Fig. 3: Comparison of monthly variation in some of the abiotic parameters recorded at study sites from January to December, 2013.**

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**Fig. 4: Comparison of monthly variation in some of the abiotic parameters recorded at study sites from January to December, 2013.**

## IV. CONCLUSION

Site S<sub>2</sub> was characterised by low temperature, low conductivity, TDS and high oxygen concentration and depth. High water current, conductivity, TDS, alkalinity, hardness, biochemical oxygen demand, phosphate, nitrate and ammonia concentration recorded at site S<sub>1</sub> and S<sub>3</sub> as compare to site S<sub>2</sub>.

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