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Aquatic environment characteristics of Kosi and Sharda rivers of Uttarakhand

Archana Naganyal[1], Amita Saxena[2]
[1-2] Department of Fisheries Resource Management, CFSc, GBPUA&T, Pantnagar, Uttarakhand, India

Abstract
The present study was carried out in Kosi and Sharda Rivers of Kumaun, of Uttarakhand. The various water quality parameters such as nitrate, phosphate, total hardness, TDS and alkalinity were analyzed from the period of November 2015 to April 2016. The nitrate and Phosphate increased in the spring months due to the higher phytoplanktonic production. Total hardness and alkalinity were higher during winter. Studied were indicated that both river water were suitable for aquatic organism, such as fishes. Water parameters levels indicated the moderate quality of water. Thus present study concludes that river water was not polluted; all the results are within permissible limit when compared with safe water quality standards.

Keywords: aquatic environment, Kosi and Sharda Rivers, Uttarakhand

Introduction
Water is an important natural resource on earth. It is necessary for all living organisms, biological system, public health, food production and profitable growth (Shafiq *et al*., 2013) [12]. Water can be achieved from different sources, among which are streams, ponds, lakes, rivers, springs, rain and wells (Okonko *et al*., 2008) [9]. Drinking water is an essential feature in guaranteeing public health, the protection of environment and sustainable growth (Rajini *et al*., 2010) [10]. The water quality parameters are greatly changing through interaction with the environment. All freshwater systems are interconnected through the hydrological cycle from the atmosphere to the sea. Thus, the water contains a continuum, with different phases ranging from rainwater to marine water.

Materials and Method
Study Area
Kosi River
The area under study is the basin of river Kosi, which pass through district Rampur, Uttar Pradesh. It is located between longitudes 78°54″ to 69°28″ E and latitude 28°25″ to 29°10″ N. It covers 2,367 Km2 areas. The people of this area work mainly in agriculture and industries in nearest places. The Kosi River water is used for agriculture, domestic use, and drinking purposes.

Sharda River
Tanakpur HEP (Hydroelectric Project) is a run of the river scheme on the Sharda River (Mahakali River in Nepal) located near the town of Tanakpur in the district of Champawat. It has a Barrage across the Sharda River for diverting river flows into a 6.2 km long power channel of 566 m³/s capacity for utilisation down stream of Banbassa Barrage. The project is designed to produce 460 million units of power on 90% availability.of 24 m head available between the Barrage at Tanakpur and the existing Sharda canal i.e. 0.6 km.

Estimation of Water quality parameters of rivers
Rivers water qualities were assessed by regular sampling throughout the study period for estimation of parameters.

Nitrate –nitrogen
The standard method was used to determine the level of nitrate nitrogen in the sample spectrophotometrically at 560 nm (APHA, 2012).

Phosphate-phosphorus
The standard method was used to determine the level of phosphate-phosphorus in the sample spectrophotometrically at 560 nm (APHA, 2012).

Total Hardness
The standard method was used to determine the level of harness in the sample (APHA, 2012).

Total Dissolved Solid (TDS)
HANNA' electrical conductivity meter was used to determine the total dissolved solid in water.

Total alkalinity
Alkalinity is the capacity to neutralize the acids shifting the pH values towards the alkaline side. It is composed of carbonate (CO_3^2-) and bicarbonate (HCO_3-). Water having the alkalinity over 100ppm is highly productive system and higher value of alkalinity i.e. more than 300 mg/l leads to eutrophication.
Total alkalinity is assessed titrimetrically by phenolphthalein and methyl orange as indicator APHA, (2012).
Calculations:

Phenolphthalein alkalinity ($CaCO_3$ mg/l)

$$= \frac{A \times N \times 50{,}000}{\text{ml of sample}}$$

Where, A= ml of 0.02N H_2SO_4 used for titration
N= normality of acid H_2SO_4

Methyl orange alkalinity ($CaCO_3$ mg/l)

$$= \frac{B \times N \times 50{,}000}{\text{ml of sample}}$$

Where, = ml titrant used for sample to develop pink colour
N= normality of acid H_2SO_4

Total alkalinity (mg/l)

= Phenolphthalein Alkalinity + Methyl Orange Alkalinity

Result and Discussion

The physico-chemical parameters of the water normally undergo seasonal and daily fluctuation but not always adhere to a general pattern with regard to different aquatic system.

Nitrate is the highly oxidized form of nitrogen compound usually present in natural waters. The nitrate exhibited the regular trend of variation in both the river water. In Kosi River minimum and maximum value ranged between 0.008 mg/l and 0.023 mg/l. The minimum and maximum value ranged between 0.006 and 0.015 mg/l in Sharda River. Nitrate low values recording in the winter months and high values in spring season. This may be due to the higher phytoplanktonic production, decaying macrophytes and concentration of nutrients owing to the evaporation of reservoir water with subsequent increase in nitrate value. Decrease in nitrate content during winter months was probably due to its utilization as nutrient by the algal community as growth of algae particularly in the winter months. Nitrate occurs naturally and due to its solubility, its mobility in groundwater is very high and hence due its well known adverse effects on health examine the nitrate is very important (Nas and Ali 2006) [8]. In drinking water the prescribed limit of nitrate concentration suggested by BIS is 45 mg/l. The excess of nitrate in bottle-fed infant causes 'Blue-Baby' disease (Knobeloch *et al.* 2000) [6].

The phosphate level ranged from 0.025 mg/l to 0.042 mg/l in Kosi River and 0.016 mg/l to 0.031 mg/l in Sharda River. The low concentration of phosphate affects the growth of aquatic flora as it is very essential plant nutrient. The concentration of phosphate was more in spring during which the blooms of algae were observed, while minimum value in winter months was possibly due to its immediate utilization by the overgrowth of phytoplankton. Joshi *et al.* (2009) [5] observed total phosphate was highest in monsoon season and lowest in winter season.

The degree of hardness ranged from 95 to 113 mg/l in Sharda River and 73 to 98 mg/l in Kosi River. Hardness in the river water was lowest in April (73 mg/l) in Kosi River and highest in February (113 mg/l) in Sharda River. Total hardness showed the desirable limit as per Indian standard (ICMR 1996) [4]. As per Indian standards maximum permissible limit for total hardness is 600 mg/l. Total hardness show minimum during spring to a maximum during winter. The present study is also similar to Ajmat *et al.* (1985) [1], who reported the hardness of river Kali-nadi is highest during summer.

TDS value ranged from 155 to 291 mg/l from River Kosi and 109 to 152 mg/l from River Sharda. The result shows that the TDS value minimum in winter and maximum in autumn in Kosi River and in Sharda River the Maximum value in spring and minimum in winter season. The permissible limit of TDS is up to 500 mg/ l (EPA, 2011) [2]. Kumar *et al.* 2014 [7] observed the similar report in the values of TDS were recorded seasonally in monsoon TDS was maximum and minimum in winter.

The alkalinity varied between 60 mg/l and 89 mg/l in Kosi River and 78 mg/l and 100 mg/l in Sharda river. The alkalinity of water is its capacity to neutralize acids. In the present study the maximum concentration of alkalinity 100 mg/l was recorded in the month of January in Sharda River and minimum concentration 60 mg/l was recorded in the month of April. Selakoti & Rao (2015) [11] observed the maximum concentration of alkalinity was observed in the month of December and minimum concentration was recorded in the month of August in spring fed Kosi River, similar findings was also observed by Gangwar *et al.* (2012) [3].

Table 1: Monthly variation in water quality parameters of Kosi and Sharda River during the study period November (15) to April (16)

Parameter	Nitrate		Phosphate		Total Hardness		TDS		Alkalinity	
	Kosi	Sharda	Kosi	Sharda	Kosi	Sharda	Kosi	Sharda	Kosi	Sharda
November	0.023	0.015	0.042	0.031	75	99	291	146	69	81
December	0.016	0.009	0.0 33	0.026	87	105	257	134	77	88
January	0.008	0.006	0.028	0.021	98	109.5	198	109	89	100
February	0.019	0.010	0.025	0.016	95	113	155	125	87	95
March	0.012	0.006	0.031	0.020	89	99	170	128	71	86
April	0.019	0.009	0.039	0.025	73	95	179	152	60	78

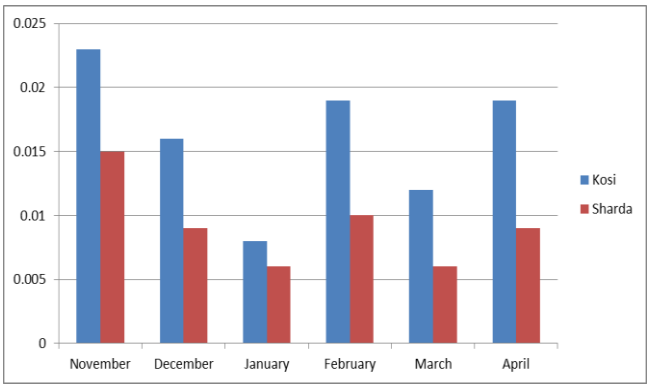

Fig 1: Monthly variation in Nitrates during the study period in Kosi and Sharda River

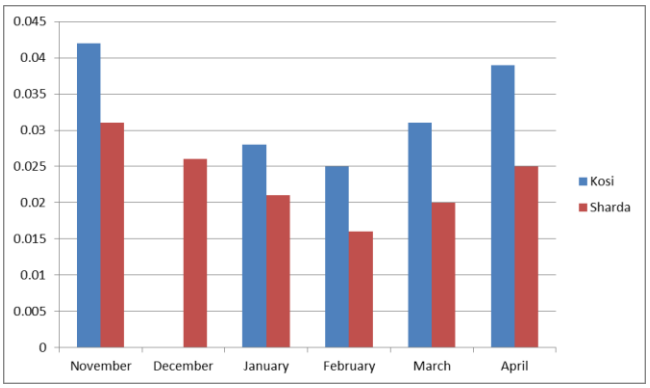

Fig 2: Monthly variation in Phosphate during the study period in Kosi and Sharda River

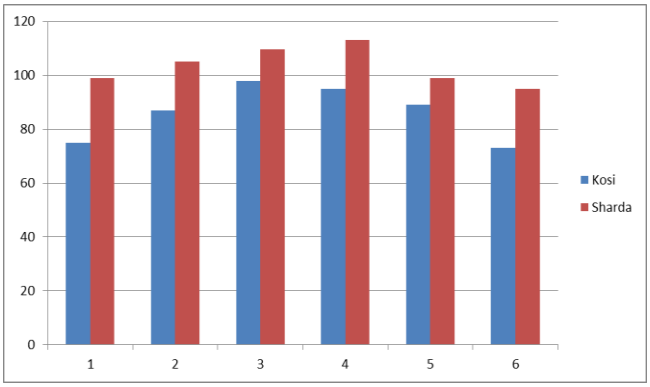

Fig 3: Monthly variation in Total Hardness during the study period in Kosi and Sharda River

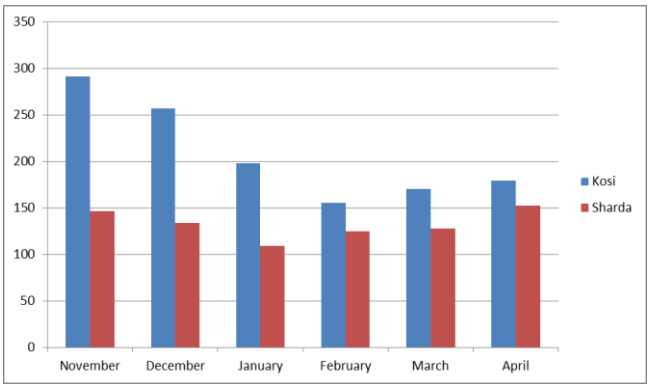

Fig 4: Monthly variation in Total Dissolved Solids during the study period in Kosi and Sharda River

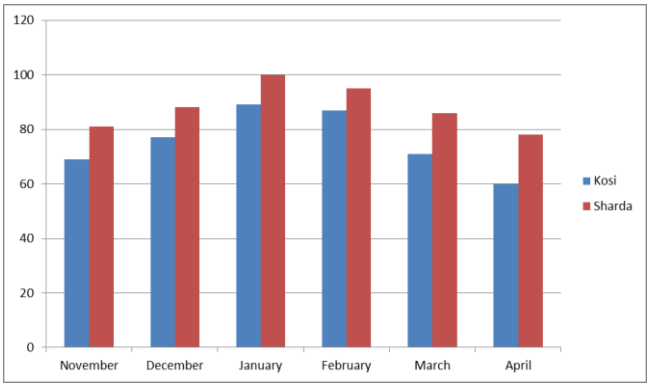

Fig 5: Monthly variation in Alkalinity during the study period in Kosi and Sharda River

Conclusion

Physico-chemical analysis is very important to evaluate the quality of water for its better utilization. It is also useful in to identify the complex processes, interaction between the environmental and biological processes in the water. All the water quality parameters showed significant seasonal variation. The analyzed results showed that the parameters namely nitrate, phosphate, total hardness, TDS and alkalinity are within permissible limits when compared with safe water quality standards; physicochemical parameters levels indicate the moderate quality of the river water. Present study concluded that the river water was not polluted. Thus Kosi and Sharda River were not polluted in respect to physicochemical assessment.

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