



## Studies on DIEL Fluctuations in Physico-Chemical parameters of Glacial fed Mountainous Goriganga River in Kumaun Himalaya, Uttarakhand, India

Ashok Kumar

Department of Zoology, Kumaun University, Soban Singh Jeena Campus Almora (Uttarakhand) 263601, INDIA

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### Abstract

*DIEL Fluctuations in physico-chemical parameters of glacial fed mountainous Goriganga River in Kumaun Himalaya were recorded at Jauljibi (about 600m above the sea level and 187km from University Campus) where Goriganga joins Kaliganga and then defines Indo-Nepal boundary. In the present study a positive relationship between water temperature and dissolved oxygen was observed. Free carbondioxide (CO<sub>2</sub>) was completely absent throughout the study period i.e. for 24 hours. Moreover, there were no definite relationships between water temperature, carbondioxide (CO<sub>2</sub>) and total alkalinity.*

**Keywords:** Diurnal, fluctuations, physico-chemicals, glacial fed, goriganga, Kumaun Himalaya, Uttarakhand.

### Introduction

The Himalayan ecosystem is one of the most important and most threatened of the life support systems on earth. In the shadow of Himalaya live more than 150 million people, some of them are the poorest in the world. The rivers which arise in the Himalayas and flows down in to Gangetic plains, support agriculture and sustain these people. Among many large rivers, the Goriganga River is lying in Munsiyari Tehsil of the Pithoragarh District, part of Uttarakhand state in north India, falls between the latitudes 29° 45' to 36° 36' N and longitudes 79° 59' to 80° 45'.

The Goriganga river originates from a dual source in a glacier near south of Untadhura ridge feeding the eastern branch and another glacier near Milam (3600 msl) just north east of Nanda Devi, feeding the western branch. The total catchment area of the river is about 2230 sq.km. Out of which 346 sq.km. is snow bound<sup>1</sup> and the whole stretch of river is 100 km. and the Goriganga River runs through the entire length of the valley. Considerable investigations have been made on the DIEL variations in physico-chemicals of various fresh water bodies, i.e. lakes, ponds, reservoirs and rivers<sup>2-12</sup>. Being glacial fed and very much far from University Campus, no such work has so far been done on this glacial fed mountainous Goriganga river of Kumaun Himalaya. Hence the present venture is an attempt to study the DIEL fluctuations in physico-chemical parameters of glacial fed mountainous Goriganga river.

### Material and Methods

After the preliminary survey of the Goriganga river, the spot was selected keeping in mind its accessible position at night for the study of DIEL fluctuations. The study was made at Jauljibi-600msl. In order to investigate the DIEL fluctuations in physico-chemical parameters of glacial fed Goriganga river, the

surface water samples were collected at 4 hour interval for a period of 24 hours from 6 a.m. on the 24<sup>th</sup> of December-2007 to 2 a.m. on 25<sup>th</sup> December-2007, when the weather was clear both during day and night. Most of the analysis were made on the spot.

The physico-chemical parameters like ambient temperature, water temperature, dissolved oxygen, free carbondioxide, pH, carbonate, bicarbonate and total alkalinity were estimated by using standard methods<sup>13-17</sup>.

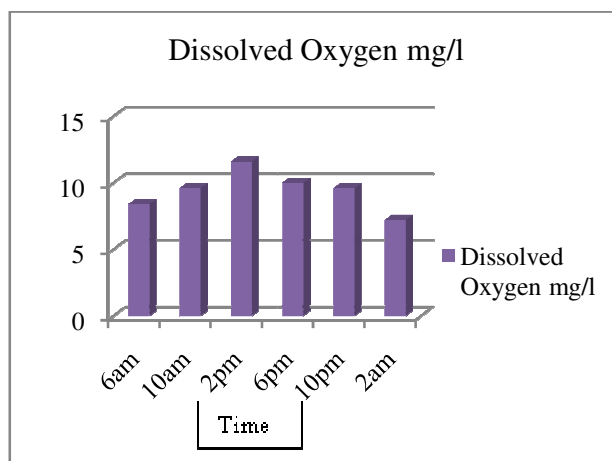
### Results and Discussion

DIEL fluctuations in physico-chemical parameters of glacial fed mountainous Goriganga river recorded for 24 hours are tabulated in table 1. For the analysis of DIEL fluctuations in physico-chemicals, water samples were collected at the interval of 4 hours starting from 6 a.m. of 24<sup>th</sup> of December-2007 to 2 a.m. of 25<sup>th</sup> of December-2007. Well marked DIEL variations have been recorded in most of the physico-chemical parameters.

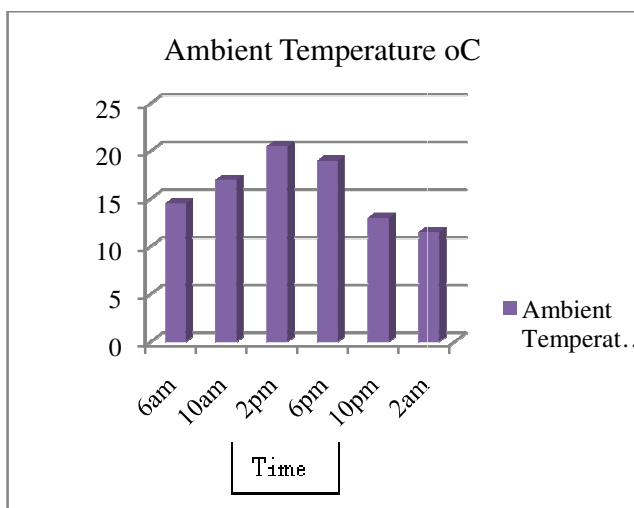
Atmospheric and water temperature varied between 11.5<sup>o</sup>C to 20.5<sup>o</sup>C and 8.5<sup>o</sup>C to 13.5<sup>o</sup>C. The maximum atmospheric temperature 20.5<sup>o</sup>C was recorded during the day hours at 2p.m. and relatively minimum atmospheric temperature 11.5<sup>o</sup>C was recorded during the night hours at 2 a.m. figure 1. Surface water temperature followed the similar trend. The maximum water temperature 13.5<sup>o</sup>C was again recorded during the day hours at 2 a.m. whereas minimum water temperature 8.5<sup>o</sup>C was recorded during the night hours at 2 a.m. figure 2.

Dissolved oxygen is the most important factor that supports aquatic life and self purification capacity of water body in high altitude rivers. Dissolved oxygen is the most important gas produced during photosynthesis by plankton and higher aquatic plants in an aquatic environment. It is thus, considered as an

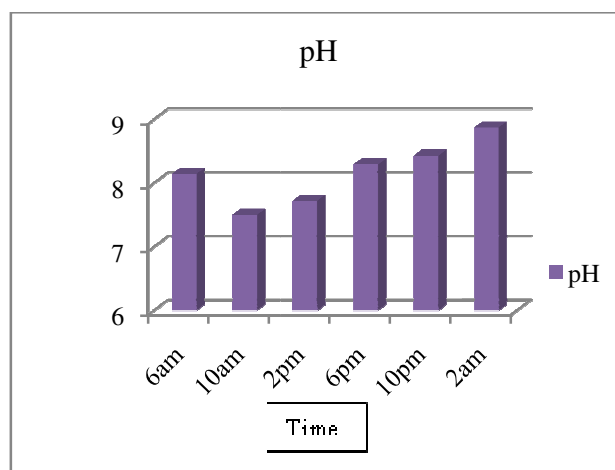
index functioning of biological and physical processes. The dissolved oxygen fluctuated between 7.2mg/l to 11.6mg/l in the present study figure 3. Maximum value of dissolved oxygen 11.6mg/l was recorded during the day hours at 2 pm when the water temperature was 13.5°C and minimum dissolved oxygen was recorded during the night hours at 2 am when the water temperature was 7.2°C. It was observed that a positive relationship was observed between water temperature and dissolved oxygen during day and night hours. Similar findings have been reported for Yamuna river<sup>18</sup>, for pond water<sup>19</sup>, for Nayar water, a tributary of river Ganga. The present study further confirms the view of Singh et.al.<sup>20</sup> that increase in dissolved oxygen during the day hours may be due to the photosynthetic activity of the autotrophs and decrease during night hours might be due to the respiratory activity of the heterotrophs.



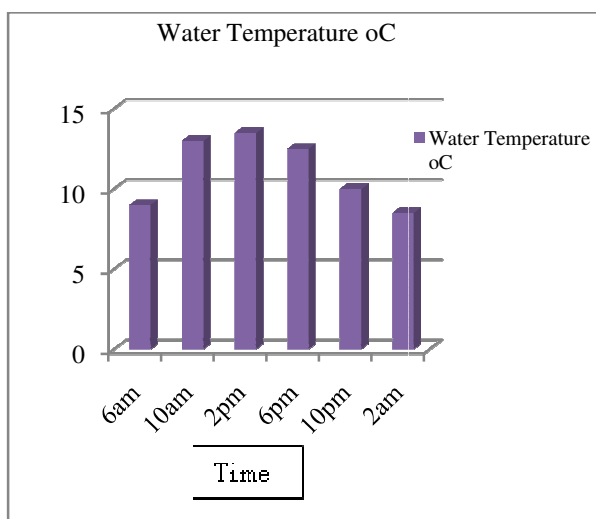
**Figure-3**  
**DIEL Fluctuation in Dissolved Oxygen**



**Figure-1**  
**DIEL Fluctuation in Ambient Temperature**



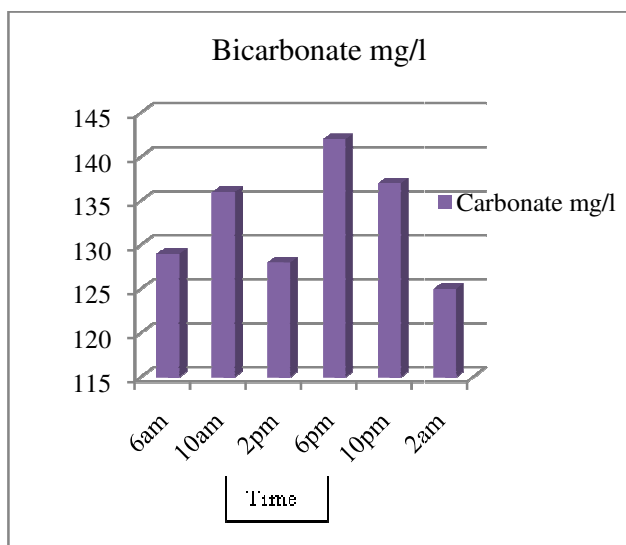
**Figure-4**  
**DIEL Fluctuation in pH**



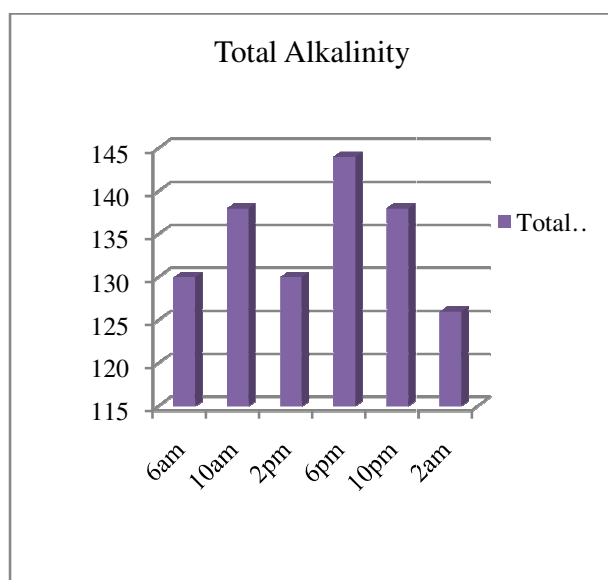
**Figure-2**  
**DIEL Fluctuation in water Temperature**

Hydrogen ion concentration expressed in terms of pH depends upon the amount of carbonate and free CO<sub>2</sub> tension in the water. It is an important indicator that shows the acidic or alkaline nature of water. It is therefore, considered as an index of acidic and alkaline and neutral nature of water. In the present study pH of water remained alkaline and fluctuated from 7.5 to 8.87 figure 4. However, there was no significant differences between the pH values recorded for 24 hours.

Free CO<sub>2</sub> was completely absent throughout the 24 hours: Carbonates remained below the detection limit, therefore no clear cut pattern was discernible for the parameter. The bicarbonate fluctuated between 125mg/l to 142mg/l figure 5. Maximum concentration of bicarbonate 142mg/l was recorded at 6pm where as minimum value of bicarbonate 125mg/l was recorded at 2am. The values of total alkalinity ranged from 126mg/l to 144mg/l figure 6. Further no definite relation of water temperature could be observed with the carbonate, bicarbonate and total alkalinity.



**Figure-5**  
DIEL Fluctuation in Bicarbonate



**Figure-6**  
DIEL Fluctuation in Total Alkalinity

## Conclusion

From the result, it may be concluded that some physico-chemical parameters of glacial fed mountainous Goriganga river under investigation for DIEL fluctuations exhibit DIEL pattern of fluctuation to some extent which are controlled by complex interaction of various environmental factors operating in the system e.g., light hours, photosynthetic activity, community respiration of aquatic biota present in the water. All these physico-chemical parameters also control each other and in turn influence the DIEL pattern of plankton.

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**Table-1**  
DIEL fluctuations in physico-chemicals of glacial fed mountainous Goriganga river

Date	Time	Ambient Temperature °C	Water Temperature °C	Dissolved Oxygen (DO) mg/l	Free CO <sub>2</sub> mg/l	pH	Carbonate mg/l	Bicarbonate mg/l	Total alkalinity mg/l
24-12-2014	6 a.m.	14.5	9.0	8.4	Nil	8.14	1	129	130
	10 a.m.	17.0	13.0	9.6	Nil	7.5	2	136	138
	2 p.m.	20.5	13.0	11.6	Nil	7.72	2	128	130
	6 p.m.	19.0	12.5	10.0	Nil	8.29	2	142	144
	10p.m.	13.0	10.0	9.6	Nil	8.43	1	137	138
25-12-2007	2 a.m.	11.5	8.5	7.2	Nil	8.87	1	125	126

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