COMPARISON OF BIOLOGICAL SIGNIFICANT IONS OF RIVER BHAGIRATHI, JALANGI AND CHURNI WITHIN NADIA, WB DURING 2020-2021

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ABSTRACT
Ecology and biodiversity of any river depends on the biologically significant ions like sodium, potassium, calcium, magnesium, chloride, nitrate, phosphate, carbonate, bicarbonate etc. present in river water. In this study four cations and five anions were measured and monitored every month (for the period june 2020 to may 2021) for these three most important rivers of Nadia district, West Bengal, India. These rivers are Jalangi, Churni and Bhagirathi [1],[2]. These nine inorganic ions play important and vital role on the growth of aquatic flora and fauna present in the river. This study clearly helps to understand the background scenario of the rivers ecosystems and one can easily compare the ecological variation present within Jalangi, Churni and Bhagirathi with respect to biologically significant ions.

Keywords: Biological Significant Ions, Churni, Jalangi, Bhagirathi River water

INTRODUCTION
River ecosystem are moving-water ecosystem. Water flows constantly. Due to water currant and turbulence within river land-water interaction or soil-water interaction are very significant factor. These affect the biotic community of the river directly or indirectly [3]. The flow of biologically significant ions within a river ecosystem greatly depends on the concentrations of these studied nine ions in the river water [4-10]. Sodium, potassium, calcium, magnesium are present as bulk metals, these four are the most important metals in the living systems. Calcium ions get precipitated as calcium carbonate depending the temperature, salinity and free carbondioxide present in river water. Magnesium ion is the absolute requirement for photosynthetic pigment like chlorophyll. Few bacteria satisfy their nitrogen requirement through reduction of nitrate ions within river water. Carbonate and bicarbonate ions control the pH and responsible for effective buffering of river water. For the aquatic life, sufficient phosphate ions are required for phosphorylation and energy storage. Chloride ion is the bulk anion for living systems. In literature seasonal variation of ion concentration data is available only for river Jalangi [6]. Seasonal variation of physico-chemical parameters are available in literature for Jalangi and Churni rivers [5,6,7,8]. Some data of physico-chemical parameters are also reported in different parameters of Ganga or Bhagirathi in few literatures [11-13]. In this work, the study period is June 2020 to May 2021.

MATERIALS AND METHODS
Water samples of Churni river were collected from five sampling sites; which are namely Taldaha, Sibnibas, Chandannagar, Kalinarayanpur and Ranaghat. Water samples of Bhagirathi were collected from Nabawip, Santipur, Chakdah (three sampling sites). Samples of Jalangi river were collected from jipjur, taranipur, Chapra, Haranagar, Anandanagar, Ghurni, Krishnagar kadamtala ghat, PWD more (rail bridge), charsambhunagar and Hulorghat (mayapur). All the sampling sites are located within Nadia district, West Bengal, India. The water samples were collected every months during June 2020 to May 2021 randomly from different depths of sampling sites up to 8-10 ft of rivers by the help of expert swimmers. All the water samples were analysed through titremetry and instrumental methods at environmental chemistry laboratory of Barrackpore Rastraguru Surendranath College. Sodium and potassium ions were measured using Systronics India Limited made flame photometer (model 128 µC). Carbonate and bicarbonate ions were measured through titremetric analysis. Calcium, nitrate and chloride ions were measured using Systronics India Limited made ion meter (model no SYS 460) using ion selective electrodes (For Calcium ISE 40 electrode; for nitrate ISE 62 electrode and for chloride ISE 35 electrode). The water samples were collected using sterile plastic
bottles of 1000 ml or 500 ml capacity. Magnesium and phosphate were analysed in outside laboratory (Scientific Research Laboratory, Santoshpur, Kolkata 700032).

RESULTS

Table and Chart 1: Monthly variation of Biological Significant Ions of the studied rivers for the period June 2020 to May 2021.
### Chloride (ppm)

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<tbody>
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<td>10</td>
<td>11</td>
<td>15</td>
<td>20</td>
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<td>19</td>
<td>18</td>
<td>23</td>
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<td>19</td>
</tr>
<tr>
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<td>15</td>
<td>7</td>
<td>17</td>
<td>15</td>
<td>11</td>
<td>15</td>
<td>13</td>
<td>15</td>
<td>15</td>
<td>17</td>
<td>17</td>
<td>15</td>
</tr>
<tr>
<td>Bhagirathi</td>
<td>26</td>
<td>11</td>
<td>11</td>
<td>15</td>
<td>15</td>
<td>21</td>
<td>17</td>
<td>24</td>
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### Nitrate Ion (ppm)

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<tbody>
<tr>
<td>Jalangi</td>
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<td>1.78</td>
<td>3.37</td>
<td>1.77</td>
<td>2.44</td>
<td>0.89</td>
<td>0.53</td>
<td>0.22</td>
<td>0.35</td>
<td>1.15</td>
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<td>0.49</td>
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<tr>
<td>Churni</td>
<td>0.98</td>
<td>2.17</td>
<td>1.02</td>
<td>1.95</td>
<td>2.57</td>
<td>1.99</td>
<td>1.42</td>
<td>0.69</td>
<td>2.92</td>
<td>2.7</td>
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<td>0.92</td>
<td>3.32</td>
<td>2.7</td>
<td>0.93</td>
<td>2.08</td>
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<td>0.75</td>
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### Phosphate Ion (ppm)

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<td>Churni</td>
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<td>0.4</td>
<td>0.52</td>
<td>0.31</td>
<td>0.18</td>
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<td>0.09</td>
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<td>0.28</td>
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<td>0.06</td>
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<td>0.21</td>
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<td>0.25</td>
<td>0.31</td>
<td>0.18</td>
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### CO<sub>3</sub>²⁻ (ppm)

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<td>8.4</td>
<td>6</td>
<td>6</td>
<td>6</td>
<td>4.8</td>
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<tr>
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<td>1.2</td>
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<td>4.8</td>
<td>8.4</td>
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<tr>
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<td>2.4</td>
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<td>2.4</td>
<td>4.8</td>
<td>3.6</td>
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DISCUSSION

During monsoon all the rivers contain low sodium ion concentration (around 10 ppm). During winter and summer Churni river water shows slightly low sodium ion concentration with respect to Jalangi and Bhagirathi. Average potassium concentration and calcium concentration is higher for Churni river. For all these rivers potassium ion and calcium ion concentrations are minimum during rainy season and maximum during winter. However, calcium ion concentration remains low throughout the year for Bhagirathi river compare to Jalangi and Churni river. This is also true for magnesium ion concentration. During July to September magnesium ion remain in low concentration for all the three rivers. For maximum magnesium ion concentrations were found during December 2020 to February 2021. With reference to chloride ion the seasonal variations are less significant specially for the Churni river. However, during monsoon chloride remain in low concentration. The seasonal variation of nitrate ion is quite interesting. For Bhagirathi high nitrate ions were found during mid monsoon, beginning of winter and end of winter. For Jalangi river the variation shows maxima at August 2020 and February 2021. For all these rivers phosphate ion concentration remain below 0.5 ppm throughout the year. However average phosphate concentration for Churni river is greater than Jalangi and Bhagirathi round the year. The carbonate ion and bicarbonate ion concentration data are interestingly very much comparable throughout the year for the rivers Jalangi and Churni. For all these rivers carbonate ion and bicarbonate ion concentrations shows minima during monsoon and maxima during winter. Carbonate concentration level for Bhagirathi is always found low with respect to Jalangi and Churni. Bicarbonate variation is less significant for Bhagirathi and surprisingly it is almost half during November 2020 to May 2021 with reference to bicarbonate ions present in Jalangi and Churni.

CONCLUSION

Sodium ion is related with enzyme activation, water balance etc. within living aquatic flora and fauna. Growth of blue green algae show specific nutritional requirement of sodium ion. Average sodium ion concentration is higher for Jalangi river, so, more blue green algae are found in Jalangi. Potassium ions control the growth and photosynthesis of algae. Potassium ion also control pH, osmotic pressure and stability of proteins within the cells of living biotic community. For algae, submerged aquatic plants and phytoplanktons magnesium ion is an absolute requirement as a constitute of chlorophyll. Magnesium is essential for the formation of enzyme catalase. Since bhagirathi contains low level of
magnesium with respect to jalangi and churni, hence larger number of algae, submerged aquatic plants and phytoplanktons are present in jalangi and churni than bhagirathi. Churni river water source a significant seasonal variation with respect to calcium ion. The seasonal variation of calcium ion in river jalangi is negligible. During winter calcium ion as well as hardness values reaches maxima for all the three rivers. Calcium ion is responsible for enzyme activation, ion transport and specifically skeletal structures like bones, shells etc. of aquatic fauna of the rivers. Calcium ion is associated with biomineralisation i.e., formation of calcium phosphate, calcium carbonate etc. from the river water. Biomineralisation is very important for these three rivers as significant amount of freshwater mussels, fishes, Pilla sp., Turritella sp. along with Clam and Oyster are present within river. In many algae (Chara-sp., Cladophora-sp. etc.) calcium remain deposited as calcite on the walls or in the mucilage. Cladocerans like daphnia require high specific quantity of calcium ion. For all these rivers seasonal variation of chloride ion is similar and almost constant throughout the years accept rainy season. However, the river jalangi and bhagirathi contain more chloride ion than churni. Throught the year nitrate ion concentration remain below four ppm for all these rivers. Some algae utilise the nitrate ion as a source of nitrogen. However, bhagirathi water contain more nitrate than other rivers. Phosphate ion also present in very low concentration (1 ppm) in all these rivers. Algal cells etc. need phosphorous for the formation of phospholipids, nucleic acids and various ester phosphates such as NADP, phosphorylated sugars and ATP. Carbonate and bicarbonate concentrations are maximum during winter whereas minimum during august-september for all the three rivers. Apart from carbondioxide and organic compounds aquatic flora derive the element carbon from carbonate and bicarbonate ions. It should be noted that except monsoon Bhagirathi river water contain low amount of bicarbonate ion (approx 50%) compare to that within jalangi and churni rivers.

ACKNOWLEDGEMENT

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[2]. “Brief History of Nadia” (www.nadia.nic.in)


