Ilkogretim Online - Elementary Education Online, 2018; Vol 17 (Issue 2): pp. 1155-1164
http://ilkogretim-online.org

Statistical Analysis Of Physio-Chemical Properties Of Water Of Demow River And Its Importances Of Phytoplanktons And Zooplanktons Of Dhemaji District, Assam

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ABSTRACT

The present study deals with the water quality analysis assessment and its importance of phytoplanktons and zooplanktons of Dimow River of Dhemaji District of Assam It is one of the tributary in Dhemaji district that debouches into the Dihang River that travels only about 2.5 km. Total 17 taxa of phytoplanktons and 18 taxa of zooplanktons were recorded during the entire course of the study period.

Keywords: Dimow River, limnology, phytoplanktons, zooplanktons, variations, correlation matrix, Dhemaji.

Introduction

Dimow is a Medium-sized village in Sissiborgaon tehsil, Dhemaji district, Assam and situated at a distance of 48 km from its district headquarters Dhemaji and 16 km from nearest town Silapathar It is one of the tributary in Dhemaji district that debouches into the Dihang River that travels only about 2.5 km. through Assam before joining with Silley River along its right bank. Remi river originating in West Siang District and Miku Korong that travels from north in Arunachal Pradesh combine to take the name Silley and travels

downstream along south east. Dimow River travels 38 km. through Arunachal Pradesh and 10 km. through Assam and combines with river Dihang in Assam. Agriculture is the main profession for most of the people in the village.

Limnology , Greek word limne (marsh, pond, lake) and Latin limnaea (thing pertaining to a marsh) often concerned with both natural and man-made is regarded as a division of ecology or environmental science that covers the biological, chemical, physical, geological and other attributes of all inland water. Limnology provides improved understanding of Lake and other aquatic ecosystem dynamics and information lead to sound management policies (Wetzel, 2003; Cole & Weihe, 2015).

Limnology defines the study of lakes and open reservoirs (Marcus, 1959). It also defined the study of freshwater systems and also limited to the study of physical and chemical elements (Strom, 1929). However, limnology involves the study of all inland aquatic ecosystems and including the biological aspects (Strom, 1929;). It also sometimes considered synonymous with freshwater ecology. Thus, it recognize as a distinction based on the fact that it is not limited to freshwater systems.

Limnology is also defined as, "the study of the structural and functional interrelationships of organisms of inland waters as their active physical, chemical, and biotic environments which affect them"(Cole & Weihe, 2015). Limnological characteristics of various water bodies play an important role in the diversity of aquatic organism (Munawar, 1970; Allen & Vaughn, 2011; Salman & Nassar, 2014). The distribution of phytoplanktons and zooplanktons varies based on the physico -chemical characteristics of aquatic system (Kalyoncu, 2009). Moreover the distribution of phytoplanktons and zooplanktons and dynamics changes are related to the climatic variation. The major threats of freshwater species across the hotspot are increasing sternness of droughts, hydrological alterations following construction of dams, over-abstraction of surface and ground waters, water pollution and invasive species which tend to spread rapidly throughout catchments such that it confined to a small area management actions restricted to limited parts of a catchment will often fail to address these terrorization (Barrios et al., 2014).

The population status, physiology, behavior or the level of contamination with elements or compound can indicate the state of contamination status of the ecosystem (Druart et al., 2011). Compared to the other studies very few investigators have carried out in monitoring and assessment of water quality in India (Sarwade et al., 2015).

The water quality should be assessed by the use of physical, chemical and biological parameters in order to supply a complete spectrum of information. Benthic macro-invertebrates comprise an important part of aquatic organisms in aquatic environments.

The aquatic organisms are bare to anthropogenic disturbance as well as natural changes in their habitats which are to be responded in various ways. It has been reported that the toxicity of most substances is influenced by such factors as temperature, turbidity, DO, pH, CO_2 and water hardness (Williams, 1970). Researchers have studied the ecology of different groups of phytoplanktons and zooplanktons; little information is available about the aquatic ecology of this region.

With a view to above, it has been proposed to study the water quality assessment its importances of phytoplanktons and zooplanktons of Dhemaji District, Assam.

MATERIALS AND METHODS

The statistical analysis such as average, standard deviation, correlation- coefficient, regression etc. was done by following Bailey, (1994). The correlation-cofficient between the different hydrological parameters and biological parameters was determined as per the following formula Biswas, (1993).

The physico-chemical parameters include air temperature, water temperature, current flow, dissolved oxygen, free carbon dioxide, total alkalinity, pH, conductivity, depth and hardness. The whole analysis was done carefully by a single investigator six months. The approved formula was strictly followed by the investigator.

Results and Discussion

Table 1: Variations of physico-chemical parameters of Dimow River Jan 2019 to Jun 2019

Sl. No	Season					
	Limnology	Jan	Feb	Mar	Apr	May	Jun
1	Air temperature (˚C)	24.50	28.00	29.50	30.12	32.31	33.34
2	Water temperature (˚C)	22.00	28.50	32.50	29.12	31.21	30.22
3	Current flow (m/s)	0.22	0.21	0.24	0.26	0.31	0.21
4	Dissolved oxygen (mg/L)	3.84	5.62	5.27	5.99	6.23	6.26
5	Free carbon dioxide (mg/L)	3.48	3.55	3.54	3.55	3.26	3.85
6	Alkalinity (mg/L)	24.86	21.87	18.95	22.25	19.67	20.00
7	pH	6.60	7.20	7.30	7.22	7.12	7.36
8	Conductivity (μscm^{-1})	75.50	59.00	54.50	55.34	52.26	53.31

9	Depth (m)	1.01	1.55	1.85	2.32	3.85	3.23
10	Hardness (mg/L)	48.65	56.61	75.61	65.22	68.57	75.87

Phytoplanktons and Zooplanktons were categorized as common, abundant and occasional based on captured and re-captured method (Table 3 and 4).

Table 2: Correlation matrix of Limnological parameters of Dimow River

	AT	**WT**	**Depth**	**W.Current**	**pH**	**DO**	**FCO_2**	**Alka**	**Hard**	**Cond**
AT	1									
WT	0.93	1								
Depth	0.72	0.74	1							
W.Current	0.05	-0.04	-0.03	1						
pH	0.92	0.90	0.60	0.30	1					
DO	0.26	0.32	0.53	-0.26	0.13	1				
FCO_2	0.21	0.13	0.38	0.01	0.32	-0.21	1			
Alka	-0.93	-0.91	-0.86	0.11	-0.90	-0.33	-0.39	1		
Hard	0.82	0.90	0.93	-0.11	0.73	0.44	0.23	-0.86	1	
Cond	-0.68	-0.68	-0.87	0.24	-0.62	-0.53	-0.57	0.85	-0.83	1

* AT= Air Temperature, WT= Water Temperature, W. Current= Water Current, DO=Dissolved Oxygen, FCO_2= Free Carbon dioxide, Alka= Alkalinity, Hard= Hardness, Cond= Conductivity

Phytoplanktons

Chlorophycaeae (green algae), Myxophyceae (blue green algae) and Bacillariophyceae (diatoms) were the common phytoplankton communities that are found in the study area. List of Phytoplankton recorded from different study site of the selected beels are given below in Table 3. Total 17 taxa were recorded during the entire course of the study. There were not many differences in the qualitative diversity of phytoplankton either at different site or during different seasons. Highest density was recorded during the montn of May and lowest during February at all sites from where sampling was done.

Table 3: List of Phytoplanktons recorded from the study site

Sl.	Study site

No.	Dimow River						
	Season						
	Chlorophycaeae	Jan	Feb	Mar	Apr	May	Jun
1	Chlorococcus species	+	+++	+	++	+++	++
2	Volvox species	++	+++	++	++	++	+++
3	Eudorina species	+	++	+	++	++	++
4	Spirogyra species	+	+++	++	+	++	+++
5	Hydrodictyon species	+	+	++	++	+++	++
6	Cosmarium species	+	+	++	+	++	++
7	Chlorella valgaris	++	+++	+	+	++	+
	Myxophyceae	Jan	Feb	Mar	Apr	May	Jun
8	Oscillatoria species	+	+	+	++	+	++
9	Anabaena species	++	+++	+	+	++	+
10	Nostoc species	++	+++	+	+++	+	++
11	Phormidium species	+	++	+	++	+	++
	Bacillariophyceae	Jan	Feb	Mar	Apr	May	Jun
12	Diatomella species	+++	+	++	++	+++	++
13	Synedra species	++	++	++	+	++	++
14	Pinnularia species	++	+	+	+	++	+
15	Fragilaria species	++	+++	+	++	+	++
16	Gomphonema species	+	+	++	++	+	+
17	Nitzschia species	+	+	++	++	+	+

++: common, +++: abundance, + occasional,

Zooplanktons

Protozoa, Rotifera, Cladocera and Copepoda were the main zooplankton found in the study site. Total eighteen taxa were recorded during the entire study period (2019) which is

listed in Table 4. Among them, Daphnia and Cyclops species are found to be common in all the study area. Other species are found occasionally.

Table 4: List of Zooplanktons recorded from of the study site

Sl. No.	Study site						
	Dimow River						
	Season						
	Protozoa	Jan	Feb	Mar	Apr	May	Jun
1	Centropyxix ecornis	+	++	+	++	+	++
2	Arcella megaston1a	++	++	+	+	++	+
3	Arcella discoides	+	++	+	++	+	+
4	DifJlugia lebes	+	++	-	-	+	+
5	Centropyxis arcelloides	+	+	++	+	++	+
	Rotifera	Jan	Feb	Mar	Apr	May	Jun
6	Brachionus plicatus	+	++	+	+	++	+
7	Brachionus caudatus	-	+	+	++	+	+
8	Brachionus forjlcula	+	++	+	++	+	+
9	Brachionus angularis	+	+	-	+	++	+
10	Conochilus unicornis	+	++	+	++	+++	+
11	Hexarthra species	+	+	+	+	++	+
12	Macrochaetus species	+	+	++	+	++	+
13	Polyarthra species	+	++	+	+	++	++
	Cladocera	Jan	Feb	Mar	Apr	May	Jun
14	Daphnia carinata	+++	+	+	++	++	+++
15	Chydorus sphaericus	++	++	+	+	++	++
16	Alona species		+	++	+	++	+

17	Diaphanosoma species	+	+	+	++	+	++
18	Daphnia species	++	++	+++	++	+++	+++
19	Bosmina longirostris	-	+	-	+	+	++
	Copepoda	Jan	Feb	Mar	Apr	May	Jun
20	Diaptomus species	+	+++	++	++	+++	+
21	Mesocyclops edex	+	+	+	++	+	+
22	Cyclops species	++	+++	+	++	+	+

++: common, +++: abundance, + occasional, -: absent

The importance of physico-chemical parameters in freshwater bionetwork is particularly important for aquatic organism because it influences the composition and category of the living organism in the system (Patil et al., 2012).

The various factors obtained from the analysis indicate that the parameters responsible for water quality variations are mainly related to the temperature (Varol & Sen, 2009). The atmospheric temperature and water temperature plays a very crucial role in the environment for the normal growth and development of the phytoplankton and zooplankton in an ecosystem as it indicate the water quality that regulates a wide range of biological processes in a river system. It plays a significant role in the productivity of an aquatic habitat along with the growth, maturation and development of aquatic organisms. It also depends upon climate, sunlight and depth. Seasonal variation in temperature of a water body has a great bearing upon its productivity. It is considered as an important physical factor that influences chemical changes in water and living organism (Stumm & Morgan, 2012). No significance difference was observed on the overall population density in the water bodies under study. Current flow plays a great significance role for maintenance of ecological services in the riverine ecosystem (Arthington et al., 2010). It determines the quantity and quality of food supply rates and intra and inter-specific interaction of the aquatic organism. It influences the composition of algal growth and diatoms and also influenced by gravity as the water moves from upwards to downwards to reduce its potential energy (Chambers et al., 1991). In the study area it was observed that the water current was maximum in the May which decreases in January. The reason regarding these is due to the steep gradient of the river. Dissolved oxygen content below 1ppm indicates poor population of aquatic organism of a river. The free carbon dioxide content of the study site varies monthly. The total alkalinity range in between 20 to 100

mg/L is considered as optimal for primary and secondary production in aquatic ecosystem (Stickney, 1979). The limnological parameters like conductivity and ammonia along with the substratum are considered as most important environmental factors to species abundance and distribution (Tongnunui & Beamish, 2009). Increase in pH depends upon the rate of increase in the photosynthetic activity. This might be due to the photosynthetic algae that consume CO_2 dissolved in the water (Driche et al., 2008) which can be compared to the result found in the study area. Specific electrical conductivity depends upon the quantities and ionic state of dissolved substance. Different species of submerged macrophytes are likely differ in their shade tolerance and their responses to water depth are likely species specific (Le Bagousse-Pinguet et al., 2012). During the study period the depth value range from 0.45 m to 3.85 m in the sampling station which plays an important role in abundance of aquatic organisms. During the study period it was observed that the hardness of the river range in between 48.65 mg/L and 75.87mg/L.

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