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STUDIES ON SOME ASPECTS OF LIMNOLOGICAL PARAMETERS OF A FISH AT DARBHANGA, BIHAR

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ABSTRACT :

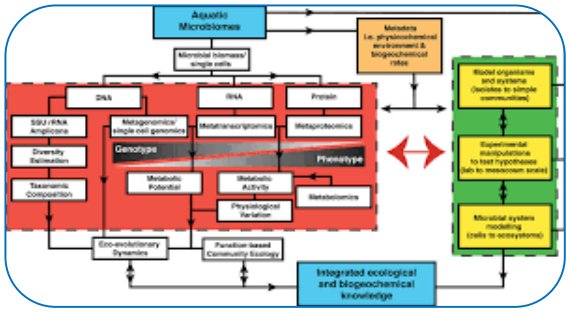
For human life, pure water is necessary. The provision of high-quality water is an important aspect of disease prevention and quality of life enhancement. The various physicochemical water parameters such as, temperature, electric conductivity (EC), total suspended solid (TSS), total dissolved substance (TDS), turbidity, pH, alkalinity , hardness, chloride , sulphate, nitrate, fluoride, dissolve oxygen (DO), chemical oxygen (COD), the need for Biochemical Oxygen (BOD), nitrate and phosphate are therefore needed. There have also been examinations of biological parameters such as planktons. Results of the analysis have shown a minor pollution of Bihar's pond water.

KEYWORDS : *Physicochemical properties Limnology, Plancton.*

INTRODUCTION

The term 'Lime' is derived from the Greek term; o-logy=Study, the Greek word 'Lime' = lake means the study of limnology, the physical phénoms of the pond or lake life is derived. Hutchinson (1967) states that the study of limnology involves a comprehensive sequence of geological, chemical and biological events, which operate in a pond, lake or stream together and are mutually dependent.. To determine its ecological value, the physical and biological conditions of the water body may be used. Freshwater ecosystems, such as lakes, pools, ponds, ponds are known as lentic (still) whereas rushing water as lotic (flowing) is known as the rivers, mountain rivers and dams.The word 'pond' refers to a relatively shallow body, typically of water less than a lake, which contains sewage or organic waste in the earthen basin. The existence of steady water, natural habitat for aquatic plants and animals, is one of the most significant characteristics of the lake. Many invertebrates feed on rotting plants, which in turn provide food for aquatic organisms and fish. Pond water is useful for fish farms[32] (Prakash and Srivastava, 2019) [36] but it is also affecting agricultural activities in relation to freshwater (Mandal and Singh, 2020).

Many staff have researched lentic water bodies in India's limitological parameters (Singh, 1983, Goel, et al., 1986, Singh, 1990, Abbasi et al., 1996, Ansari and Prakash, 2000; Kumar et al . , 2015a, 2015b, Prakash et al . , 2015a, 2015b, Singh and Verma, 2016, Verma, 2019b, 2016a, 2016b, 2018, 2020, Singh and Singh, 2020)[2, 1,11,6,33,23,24,25]. This bog, however, was researched for various parameters by Verma (2016a, 2016b, 201a, 2017b and 2018), [27, 28] but it was the first systemic analysis on plankton. This study has been carried out to analyse the limnological properties of the Bihar Dharbhanga Plankton Team



The degree to which light is absorbed or dispersed by suspended particles in water is determined by turbidity. After all suspended matter has been

resolved, maximum turbidity was recorded during monsoon months and minimum during the post-monsoon and winter. In these water systems there was statistically a strong and substantial association between turbidity and transparency (as the turbidity in percent T is otherwise the inverse relationship).

Surface water temperature varied depending on air temperature. In each of these water bodies, their importance is the highest in summer and the lowest in winter. The statistical association between air and water temperatures was very significant and positive.

The successful photosynthesis and the maximum conversion of CO2 to stable carbonates could not have been used to record CO2 in any of these ponds.

These ponds are primarily assisted by fi-om biogenic sources and organic substances fi-om in sulphur-sulphide containing catchment area. They ranged from 27.50 to 120.00 mg / L. These water cells are graded as hard water with high biological productivity based on the sulphate presence and total alkalinity in Moyle (1949).

MATERIAL AND METHODS

The samples were collected periodically within 30 days in a single year from June 2006, in the present study for the physicochemical analysis of water, in clean polyethylene containers. In the Laboratories and as per normal methods of water and waste water examinations[40], and as per Workbook on Limnology[41], the physicochemical parameters such as pH, stiffness, total alkalinity, DO, BOD and COD, turbidity , conductivity, total nitrogen , phosphate and nitrate were examined.

There was monthly research on the fish population in the lake. Fishes have been gathered with gill-nets every month. After fishes from India[42] and fish science and indian fish fisheries[43], fish were identified. Fishes were identified.

Table 1: Annual range (mg / l, otherwise mentioned) of certain physicochemical parameters.

S.No	Parameters	Annual Range
1.	pH	7.12-7.56
2.	Dissolved Oxygen	4-10.65
3.	Hardness	2-16.25
4.	Total Alkalinity	58-123
5.	B.O.D.	5.17-10.50
6.	C.O.D.	0.85-3.1
7.	Total Nitrogen	2.5-5.22
8.	Turbidity	0.4-1.17 NTU
9.	Phosphate	4.20-16.55
10.	Nitrate	2.64-12.57

From each point in the Dharbhanga, Bihar, plankton samples were collected using a plancton net (mesh, 0.04 mm). A 50 ml sample was obtained by passed five litres of water through the plankton net. In a container, 10 % buffered formalin was immediately retained. In a binocular microscope, the Sedgewick rafter was used to count 10 x 0.25 magnified plankton. (S-R cells). APHA (1992) key was used to classify plankton's taxa to genus level. Then abundance of plankton with a 1992 Rahman Formula was estimated.

$$V = \frac{A \times 1000 \times C}{V \times F \times L}$$

Where,
N= No. of plankton cells per liter
A= Total no. of plankton counted
C= Volume of final concentrate of samples in ml
V= Volume of a field in cubic millimeter

F= Number of the fields counted
L= Volume of original water in liter the average number of plankton was recorded and expressed numerically per liter of water (cells/l).

Statistical Analysis

Data for determination of significance and contrast between means ± SD (standard deviation) were analysed for variance (One Way ANOVA) and Turkeys' test. SPSS was used to measure the statistical analyses.

Results and Discussion

Physico-chemical parameters (Table2): We elaborate and analyse the effects of the parameter wise achieved.

Water temperature: Water temperature not only has a high biological efficiency but also affects aquatic organisms' physiological activities. The water temperature of pond in monsoon ranged from 30.4 to 34.0C, in winter from 18.5 -2.0C and in summer from 24.8 to 33.0C. The water temperature range is adaptable for Indian large and exotic carp cultivation (Jhingran, 1988)[9]

Table 2: seasonal variation in Dharbhanga, Bihar pond's physicochemicalproperties

Parameters	Monsoon Season	Winter season	Summer Season
Temp (^{0}C)	30.4-34.5	18.5-22.4	24.8-33.8
Transparency (cm)	61.5-85.4	145.2-153.8	92.4-135.5
pH	7.7-8.9	8.4-8.7	7.5-8.2
DO(mg/l)	8.5-10.7	9.8-10.2	7.7-9.8
FCO_2	8.4-15.2	4.8-5.4	5.0-14.5
Total Alkalinity (mg/L)	99.6-117.8	96.4-107.2	132.0-145.5
Total Hardness (mg/L)	78.0-88.0	92.0-98.0	104.0-117.0
Nitrate (mg/L)	0.34-0.82	0.23-0.42	0.17-0.36
Phosphate (mg/L)	0.07-0.12	0.05-0.09	0.07-0.08

Transparency

The mean depth at which Sachhi discs disappear and reappear from the open water surface is called water transparency. It proportionally adjusts to the water turbidity (Water Transparency monitors energy at different food chain trophic levels (Kumari and Jha, 2015)[11]. Water Transparency monitors energy exchange at different food chain levels. Over the different seasons, apparent improvements were noted in pond water transparency. In winter, low in summer, and lowest in rainy months, maximum transparency was observed. The sedimentation of suspended matter (Chaurasia and Adoni, 1985) can be attributed to a maximum transparency recorded during winter months[5].

pH

The pH is an indication that the aquatic system is environmentally friendly. The pH of pond water ranged from 7,5 to 8,9, which is sufficient for aquatic life (Singh, 1990)[24]. The decreasing pH values during summer are related with the dissociation between H+ and HCO3 ions of carbonic acid (formed by the surplus free carbon dioxide). In the summer, these H+ ions decreased water pH. The fact that photosynthetic activity dominates the respiratory activity of the biota is a symbol of the alkaline range of pond water.

Dissolved Oxygen (DO)

Any water body's DO is an important parameter because it is a water productivity measure. The water body's oxygen concentration depends on the temperature, photosynthesis and breathing in the group. The range of DO (7.7-10.7 mg / L) indicates that water in the pond was oxygened during the whole season. During the winter season, the highest dissolved oxygen was due to the small temperature that allows more oxygen to be retained.Hazelwood and Parker (1961)[7] suggested the low atmospheric and photosynthetic operation of highest oxygen dissolved in winter. Due to high temperature and rapid oxidation of organic matter, oxygen depletions during summer months may be due. The year-round concentration of dissolved oxygen above 5.0 mg / L suggests that the lake is very active (Ansari and Prakash 2000).

Free Carbon dioxide

Free carbon dioxide is normally obtained by the ambient sources, biotic breathing and organic matter decomposition by saprophites in a water body. Concentration of FCO_2

The monsoon pond was maximum and in winter the pond was small. Due to the low depth, greater intensity and longer period of sun light and consequently higher heating budget in the ecosystem, the occurrence of high concentrations of free carbon dioxide during monsoon can be correlated with rapid decomposition of organic matter in sediments. The results currently being developed are similar to Kumar et al . (2015) [11].

Total Alkalinity

Alkalinity is directly related to water bodies 'production as it controls water bodies' pH and free carbon dioxide. Alkalinity is usually caused in natural water by calcium and magnesium carbonates and bicarbonates. In summer, in moonsoon and in winter the overall alkalinity was low. Welch (1952)[39] states that free carbon dioxide, produced by organic decomposition in the sediments, in direct contact with overlying bicarbonates in bottom carbonates. There are therefore (96.4-145.5mg / L) of total alkalinity which indicate a hard water form and high fish production (Singh, 1983; Singh, 1990; Ansari and Prakash, 2000)[2,23,24]. This range is indicative of high peach production.

Total Hardness

Hardness of water primarily depends on water salts, mainly carbonates and sulphate, of calcium and magnesium ions (Wadia, 1961)[38]. The marine environment is an indicator of fertility. As a natural separating point for soft to hard water, Moyle (1946)[14] suggested 40 ppm of hardness. The total hardness of 78-117 mg / L shows that water from the pond is ideal for fish growing(Jhingran, 1988)[9]. Summer was the highest hardness and winter was the lowest. Due to reduction of water level, volume and higher evaporation rate, the peak value of total hardening during summer can be attributed to this analysis. Again, this result shows that water in the pond is moderately difficult. As it is soft to up to 75 mg / L water is moderately hard to be handled with 75-150 mg / L, and hard and above this, 150-300 mg / L (Kiran,2010)[10].

Nitrate

Nitrate is the most chemically stable form available. For algal blooms in the water body, high nitrate concentration is responsible. The principal sources of nitrates in the water body are surface runoff, decayed vegetations and animal matter. The water's nitrate levels varied from 0.17 to 0.82 mg / L. Its highest concentration in the post-monsoon season was observed.

Phosphate

In preserving aquatic productivity, phosphate is regarded as the most essential nutrient material. These are necessary for organisms and nutrients to grow, which restrict the primary water body

productivity. The phosphate content in the present study ranged from 0.05 to 0.12 mg / L. In the winter it was minimal and in summer it was maximum. Low content in the phosphate in winter and high in the summer or after monsoon can be caused by low organic composition in the summer (Prakash, 2001b)[17].

Natural water bodies such as, lakes and ponds are supplied from agricultural rivers, sewerage waste and decomposed organic matter with their own nitrate, and phosphate supply. They bring cellular nitrogen and phosphorus as algas and other micro-organisms die and settle down at the bottom of every water body. These nutrients are released during decomposition and then available for aquatic flora growth. The pond falls into a medium to high active community with respect to its nutrient status[4].

Table3: Seasonal variation in Planktonic Population (Units /L) of Dharbanga, Bihar Pond.

Parameters	Monsoon Season	Winter season	Summer Season	Total	%age
Phytoplankton					
Chloro-phyceae	537	398	497	1432	31.91
Cyaono-phyceae	502	523	654	1679	37.41
Bacillariophyceae	403	398	393	1194	26.60
Euglenophyceae	53	51	79	183	408
Total Phytoplankton	1525	1370	1623	4488	-
Zooplankton					
Rotifera	650	617	595	1862	37.93
Cladocera	543	317	519	1379	28.09
Copepods	504	214	416	1134	23.10
Ciliates	195	98	241	534	10.88
Total Zooplankton	1592	1246	1771	4909	-

Productivity of Plankton (Table. 3)

16 plantoplankton species have been identified in this analysis. Of those 6, the Colastrum, Colosterum, Crucidia and Ulothrix are Chlorophyceae (Coelastrum, Scenedesmus).

5 to bacillariophyceae (Synedra, Navicula, Cymbella, Pinnularia and Asterionella); Chlorella);4 Cyanophyceae (Anabasa, Spirulina, Cloecapsa, and Euglenophyceae, Euglena) 1 and Euglenophyceae. Besides these 16 species, zooplankton species have been discovered. Rotifer (Asplanchna, Brachina, Keratella, Notholca, Polyarthra, and Lecana) is of these 6 species;;5 Cladocerans and 2 Ciliates (Cyclopsis, Bosminopsis, Chydorus, Daphnia and Sida) and Copepod (Cyclops, Diaptomus and Nauplius larves). The freshwater plants in East Uttar Pradesh (Prakash, 2001a; Prakash et al . , 2002 and Sinha et al . 2002) were the largest number of these species [2,16,26]. The presence of 23 phytoplankton species and 20 zooplankton species indicates the biodiversity of the pond.

Phytophylplankton dominated by the yearly periodical cyanophyceae 37.41% (31.91%) and Chlorophyceae (31.91%) of the total phytoplankton.Bacillariophyceas (26.60%) and Bacillariophyceae (4.08%). The current study reported maximum phytoplankton density (1623 Units / L), and minimal phytoplankton density (1370 Units / L) in winter. The annual zooplankton productivity reveals 37,93% of the total zooplankton dominated by Rotifers, led by Cladocerans, Copepod (23,10%), Ciliates and (10,88%). Their annual productivity is shown to have predominated. In this study the maximum zooplankton density in summer (1771 units / L) and in winter (1246 units / L) were recorded. The results were published. The Ansari and Prakash[12], Prakash(2001a)[16] and Sinha et al.(2002)[26] have also made similar observations.

CONCLUSION

Dharbhanga, Bihar's limnological status shows that it is also conducive to better fishing and organic development. Nevertheless, certain steps to protect the lake from contamination from tourists must be taken by the government. In addition, the long-term impacts of growing access to visitors for picnics should be examined.

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