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Study on Water Characteristics for Network Analysis in a Pond

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ABSTRACT: Despite the continuous decrease in water table, pond water is a good medium for the aquatic organisms to survive. Water quality parameters were analysed and estimated seasonally. Range of different parameters was found as P^H -7-8, Temperature- $18^{\circ}C - 32^{\circ}C$, Electrical Conductivity – 300 – 410 ms/cm, Transparency – 16.6 – 31 cm, D.O – 4.5 – 7.9 mg/l, B.O.D. – 4.6 – 6.5 mg/l, Ca – 48.01 -104.08 mg/l, Mg – 196.4 – 245.3 mg/l, Phosphate – 0.5 – 1, Nitrates – 0 – 1 mg/l, Total hardness – 200 – 252 mg/l, TDS –220 – 260 mg/l, Turbidity – 25 - 40 NTU, Chlorine content – 17.4 – 56.8 mg/l. In combination with biomass estimation of the organism of different trophic levels, these parameters are to be employed for network analysis of the pond by applying EWE (Ecopath with Ecosim Version 6.5)

I. INTRODUCTION

India is how known to be facing water scarcity since a few years back. Water is the most essential constituent for the living beings and is a boon for the aquatic Ecosystem. Bihar comprises a huge number of Ponds which contains planktons and organisms of different trophic levels along with the fishes. Water quality affects all the organisms living in and around the pond. The water quality changes day by day and also seasons wise.

II. MATERIAL AND METHODS

STUDY AREA

A pond named Mora Talab was selected for further investigation. It is located in $25^{\circ}15'01.9''$ N $85^{\circ}31'02.8''$ E in Bihar Sharif ,Nalanda district.

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Water sample was collected from 'Mora Talab' Bihar Sharif at seasonal intervals from December 2017 to August 2018 during winter, summer and monsoon seasons in clean spotless plastic bottles. Closed bottle was inserted in the water and the cap was opened thereafter filling the bottle, cap was closed inside the water. P^H , Temperature, Transparency, Turbidity were estimated on the spot by using P^H paper, Thermometer, artificial Sechhi disk and Turbidity tube respectively. Conductivity was measured by Conductometer, TDS by TDS meter, D.O. by titration, total hardness, Ca, Mg by using EDTA by Titration, chlorine content by Titration method, Nitrate by Nitrate test reagent kit and Phosphate by Phosphate test reagent kit.

III. RESULT AND DISCUSSION

P^H is a negative logarithm of concentration of Hydrogen ion in a dilute solution. Photosynthesis by green aquatic plants uses H_2 and increases P^H . Similarly respiration and decomposition lower P^H (Menthum, 2000). Too much low or high P^H may have adverse effect on the aquatic organisms. Pond water P^H was ranged from 7 – 8 which means it is neither more acidic nor more basic. It was found highest range in summer and lowest range in monsoon. Hence, is suitable for the organisms.

IV. TEMPERATURE

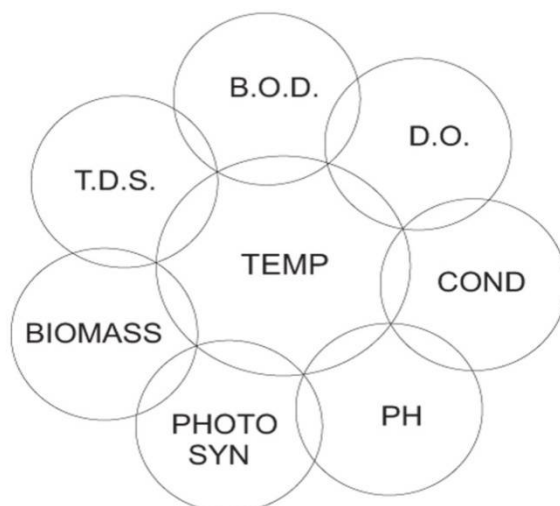
Temperature is a measurement of average kinetic energy of atoms and molecules. It is the factor which influence the other water parameters. A/C to J.R.Brett it is defined as abiotic master function due to its effect on aquatic organism.

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The range of Temperature was 18°C-32°C. It is found highest in summer season hence decreases D.O. and photosynthesis rate too and increases B.O.D.. During the rainy season since temperature was found lowest so D.O. increases and B.O.D. decreases. It also affects the biomass of the organisms. (Hemlata, 2013)

V. CONDUCTIVITY

It is a measure of water's capability to pass electrical flow. The more ions that are present, the higher the Conductivity of water. Likewise the fewer ions that are in the water, the less conductive it is. Conductivity is an early indicator of change in water system (A.K Shrestha, 2017). A sudden increase or decrease can indicate pollution. Agricultural run off or a sewage leak may increase Conductivity due to additional chloride, phosphate and nitrate ions. Addition of oil spill or other organic compounds decreases conductivity as they don't break down into ions. The range of Conductivity was 0.7-0.9 Mohs/cm. The EC was recorded maximum during monsoon season and minimum during summer season.

D.O

It refers to the level of free, non-compound Oxygen present in water. It is produced as a waste product of photosynthesis from phytoplankton. Bacteria and fungi require D.O. for the decomposition of dead and decaying material. Higher decomposed materials indicate the lower level of D.O.

1. D.O. decreases if temperature increases.
2. D.O. decreases exponentially as salt level increases.
3. D.O. increases due to increased pressure.

It affects growth, survival, behaviour and physiology of aquatic organisms. The obtained range of D.O. of the pond water found 2.5 – 5.2 mg/l. It was found highest in monsoon and lowest in summer.

TRANSPARENCY

It tells, how much water is transparent. This is the indication of the purity of water. Less transparent water shows the level of pollution, quantity of algal blooms, presence of oily materials, Phosphates, Nitrates, Chloride contents, Ca, Mg. Transparency range of pond water was found 26.6-31.7 cm. and is light green in colour. Hence is suitable for the aquaculture.

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B.O.D.

Biochemical oxygen demand which represents the quantity of oxygen consumed by the microbes during aerobic processes of decomposition of organic material (W.Rice, 2005). Increased level of B.O.D shows decreased level of D.O as oxygen is being consumed. Decrease in D.O level may create problem in the survival of the organisms. The obtained range of B.O.D was 4.6 – 6.5 mg/l. The value of B.O.D was found greatest in summer and lowest in monsoon season. Optimum range of B.O.D for fish activity is 3 – 6 mg/l. Hence it is safe for fish population.

TDS

Total dissolved solids, represent the presence of Potassium, Chloride and Sodium, Some toxic substances like dead, Arsenic, Nitrates, Cadmium and some others may also dissolved in water and have long-term effects. Value of Potassium, Chloride shows short term effects and can be rectified or modified. It comprises inorganic salts and small amount of organic matters also.

The estimated value of TDS was 220 – 260 mg/l. Due to the addition of effluents by rain water its highest value was found during rainy season. High TDS may affect the aesthetic quantity of water.

TOTAL HARDNESS

It is parameter which describes the effect of dissolved minerals, calcium and magnesium. It determines the purpose of pond water whether is suitable for industrial or domestic. During the summer season, due to higher rate of evaporation Total hardness value was found more. The present study shows the value of Total hardness was 244.41 – 349.38 mg/l.

CALCIUM

The calculate range was 48.01 – 104.08 mg/l. It was highest in summer and lowest in monsoon. It is important in molting process of Crustaceans. It also helps in the formation of bone and scales of fishes.

MAGNESIUM

It is absorbed in the form of Mg^{2+} by aquatic livings. Plants may loose colour due to lack of Magnesium. The found range was 196.4 – 245.30 mg/l. Highest in summer and lowest in monsoon season.

TURBIDITY

It is a measure of the degree to which the water loses its Transparency due to the presence of suspended particulates. The more suspended particulates, the higher the turbidity. It is an expression of the amount of light that is scattered by material in the water (Mann, 2007) when a light is shined through water sample. The higher the intensity of scattered light, the higher the Turbidity. Its range was 25 – 40 NTU. The highest value is found during monsoon as the surrounding land may washed into the pond.

PHOSPHATE

Phosphate are the chemical compounds containing Phosphorus. It is also found in animal bones. Lower level of Phosphate limits the algae growth. A large proportion of Phosphate passes through and be released in the fish waste. The range of Phosphate was 0.5 – 1 mg/l. It was found maximum in rainy season might due to the addition of mineral and organic nutrients.

NITRATE

Nitrates are compounds made from 1 part Nitrogen and 3 parts Oxygen. Nitrates are the final product from the breakdown of Ammonia released by fish. Nitrate is not especially harmful to freshwater fish but is a potent plant fertilizer. The obtained range of nitrate was 0 – 1 mg/l.

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CHLORINE CONTENT

Chloride ion in the environment can come from the Sodium chloride or from other Chloride salts such as Potassium chloride, Calcium chloride. High Chloride concentration in freshwater can harm aquatic organism as it may interfere osmoregulation. Fishes are less sensitive to Chloride exposure than small free-floating planktonic Crustaceans. The estimated range of chlorine was found 17.4 – 56.8 mg/l. It was found highest during summer season and lowest during rainy season.

Table no. 1

Sl. No.	Water quality parameter	Season		
		Winter	Summer	Monsoon
1.	PH	7	8	7
2.	Temp (°C)	18	32	23
3.	Conductivity (mohs/cm)	0.8	0.7	0.9
4.	Transparency (cm)	29.2	31.7	26.6
5.	D.O. (mg/l)	3.0	2.5	5.2
6.	B.O.D. (mg/l)	6.0	6.5	4.6
7.	T.D.S (mg/l)	245	220	260
8.	Total hardness (mg/l)	300	349.38	244.41
9.	Calcium (mg/l)	99.5	104.08	48.01
10.	Magnesium (mg/l)	201.5	245.30	196.40
11.	Turbidity (NTU)	36	25	40
12.	Phosphate (mg/l)	0.5	0.5	1
13.	Nitrate (mg/l)	0	0	1
14.	Chlorine (mg/l)	48.3	56.8	17.4

VI. CONCLUSION

By the view of utilization of water we conclude that it is precious for the human purposes and by the view of ecosystem functions, is mandatory for the aquatic organisms. Due to the lack of sources of water, Pond water can become a good medium for the aquatic ecosystem. The study shows pollution free, good quality and healthy environment of aquatic ecosystem. It is also suitable for ecological productivity and fish productivity.

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