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Studies on Physicochemical Status of Two Ponds in Chapra District

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ABSTRACT

Physicochemical characteristics of two ponds at Chapra district were studied. The investigation was focused on the determination of water quality parameters such as temperature, pH, DO, alkalinity, nitrite, nitrate and other factors showing that the water quality of these ponds comply with suitability of growth of some fishes.

Keywords: Abiotic, biotic, interaction, pond ecology

INTRODUCTION

An ecosystem has two major components as abiotic and biotic which are interdependent. The chief abiotic factors are light, temperature pH, DO and basic inorganic and organic compounds. The biotic factors comprise flora and fauna along with aquatic microbes. Since, both these components mutually influence and interact with each other; a thorough understanding of an ecosystem is not possible without analyzing these factors.

In India, several studies have been made to understand the physicochemical properties of lakes, reservoirs and ponds (Jain et al, 1996; Mohanraj et *al*, 2000; Sah et *al*, 2000). However, much information is needed especially with reference to specific water bodies of small dimensions. George (1961, 1962) has studied the physicochemical characteristics of shallow ponds at Delhi. Studies of fish ponds at Seoni, Madhya Pradesh, have been made by Verma (1967), whereas Khatri (1985) has investigated Idduki reservoirs, Kerala.

In the present investigation an attempt has been made to assess the variation in physico-chemical parameters of two ponds at Chapra district of Bihar.

MATERIALS AND METHODS

Two ponds as Old pond (Pond-1) and New pond (Pond-2) were selected in the present study. Both the ponds are perennial having an area of about 0.5 Acre (Pond-1) and 0.85 Acre (Pond-2), receive rain water and are not used for general purposes. Monthly collections of water samples were made between 9.0 A.M. and 11.0 A.M. during the period from July 2018 to January 2019.

Detailed ecological observations were made on these ponds from the time of accumulation of rain water i.e., from July to the period till the fishes were taken out from the ponds. The physicochemical analysis of the water samples was done as per standard procedures given by APHA (1998).

RESULTS

The physicochemical parameters and their monthly fluctuations are presented in Tables 1 and 2.

Temperature alters the rate of metabolic processes. It has a considerable effect on the growth of fishes and is a key factor in controlling planktonic species. In the present study the temperature showed a fluctuation (Table 1 and Table 2).

In the present study, turbidity caused in post monsoon season was mostly due to more plankton production. Transparency values in both the ponds showed major fluctuations (14.8 cm to29.9 cm). In the present investigation, low dissolved oxygen was mostly observed in July, December and January, and there was no significant correlation between dissolved oxygen and growth rate of major carps except Pond-1 which showed a negative correlation.

The pH is one of the most important factors that serve as an index for pollution. The pH of both the ponds ranged from 6.9 to 8.10 in all the seasons.

In the present study, free CO_2 concentration at many occasions was recorded high (above 8.0mg/L). This study showed total alkalinity as 128.0-223.0mg/L in Pond-1 and 32-117 mg/L in Pond-2, which affects fish growth positively. A positive correlation was found between total alkalinity and growth of the major carps, but it was significant only with some species in Pond-2.

In this study, the chloride ranged between 12.9 to 18.1 ppm in both the ponds. In present investigation nitrate nitrogen could not be studied. As high was the nitrogen, in the pond water, the greater the quantity of contamination or sewage pollution. Nitrate nitrogen usually occurs in relatively small concentration in unpolluted fresh water.

Table 1: Physicochemical analysis of pond 1

Parameters	Jul	Aug	Sep	Oct	Nov	Dec	Jan
Air Temp(0C)	31.2	30	31.42	29.2	25.7	24.2	20.8
Water Temp (0C)	29.6	29.8	30	28	24	22	19
Transparency (cm)	16	21	18	13.62	12.15	19.80	21
PH units	8	7.45	7.35	8.10	7.70	7.61	7.40
DO	3	7.40	6.60	7.64	6.50	3.60	3.90
Free CO2	8.80	8.00	-	-	-	9.40	-
Carbonate	-	-	2.00	6.45	7.70	1.90	-
Bicarbonate	124	138	125	162	125	152	220
Alkalinity	128	139	127	169	130	154	223
Chloride	22	27	36.50	52	38.20	29	38
Cond (µmhos/cm)	148	154	390	502	412	352	466
Nitrite	.031	.019	.022	.042	.032	.066	-
Nitrate	0.52	0.12	0.10	0.60	0.29	0.60	-
Phosphate	-	.112	-	.40	.160	.60	.10
Calcium	36	30	24	23	30	32	38

Table 2: Physicochemical analysis of pond 2

Parameters	Jul	Aug	Sep	Oct	Nov	Dec	Jan
Air Temp(0C)	26.5	28	29	27	26	27	28
Water Temp (0C)	25	26.5	27	25.5	24.5	25	26
Transparency (cm)	4.9	6.2	5.1	3.4	3.9	5.9	6.2
PH units	7.1	6.4	7.4	7.2	7.7	7.9	7.5
DO	6.8	11.7	8.2	6.3	4.9	5.8	6.1
Free CO2	87.4	152.3	108.7	80	63	67	72
Carbonate	7	-	3	5	4	4.2	4.5
Bicarbonate	18	57	54	61	23	4.8	4.2
Alkalinity	100	102	114	117	82	62	32
Chloride	-	0.03	0.08	0.05	0.07	0.08	0.09
Cond (µmhos/cm)	0.100	0.230	0.200	0.275	174	178	152
Nitrite	Trace	0.470	0.201	0.272	0.059	0.61	0.09
Nitrate	17.2	-	-	-	-	0.269	0.10
Phosphate	-	-	-	-	0.65	0.45	0.35
Calcium	-	-	-	-	14.9	15.8	18.2

In the present study, in both ponds the phosphate content was quite high, ranging from traces to 0.65 mg/L (Pond-2) and from 0.10-0.16 mg/L (Pond-1), which shows a good production and fish growth. In the present investigation, Pond No. 1 may be regarded as 'rich' in its calcium content (25.0-46.5ppm) while Pond No. 2 may be regarded as 'medium' in its calcium content (12.5-18.3 ppm).

DISCUSSIONS

An understanding of the Physical and chemical characteristics is essential for all living processes depending on these factors in aquatic environments. In the Indian context, Ponds occupy the first place among the freshwater studies. Information on the physical, chemical and biological factors are inter dependent, is not fully understood in Indian ponds which warrants further investigations of these features so as to achieve full understanding of the subject and considering this, the present study was carried out. In India where considerable limnological diversity exists, it is surprising that the ponds and lakes of northern India have not been described. There is scarcity of studies about growth pattern on tropical ponds (Basavrajappa et *al*, 2014). The fish production from these waters could considerably be increased if their hydro-biological conditions are better understood.

The temperature affects plankton population in Freshwater ecosystem and water temperature values must be follow seasonal, spatial and temporal variation within ponds age and water depth is well appreciated in this study and such variation has also been reported by Devidas et *al* (2006), Ranjan et *al* (2007) and others. Collins (1970) has observed that catfish production is poor when water temperature is below 20°C. Khan (1972) showed a positive correlation between temperature and fish growth rate at 5% level.

In the present investigation a negative correlation was observed, which was significant in Pond-1. In both the ponds the water temperature at the surface followed more or less similar to that of the air and the amplitude was only a degree or two less. Basavrajappa et *al* (2014) has reported about result in a pond in kerala with marked seasonal variations in temperature during the study period. The seasonal temperature difference is influenced considerably by meteorological factors, such as air temperature, humidity, wind and solar radiation. In rainy season there is a considerable fall in temperature which is due to reduced solar radiation, low air temperature and fast wind action.

This study also indicated an inverse relationship between phytoplankton and transparency in both the pond which is also consistent with the finding of Mishra and Saxena (1998). The transparency range showed that water bodies remain moderately turbid. Turbidity due to profusion of plankton is an induction of ponds high fertility, but caused by silt or mud beyond limit, is harmful to fish food organisms (Jhingran, 1982).

The oxygen content of the water bodies is one of the important parameters in the assessment of water quality, and its presence is essential in aquatic ecosystems to keep organisms in balance. It also affects the solubility and availability of many nutrients and controls the productivity of ecosystems. The decrease in DO and its relationship with fish growth may be due to its utilization in the decomposition of organic matter as shown by Doudoroff & Shumway (1970) and Hannan (1979).

The change in pH may be due to high phytoplankton productivity as also reported by Gonzalez et *al* (2004). Valladolid et al. (1954) observed that among the physico-chemical factors, a pH between 7.3 and 8.4 is suitable for growth of fishes. In the present investigation, a positive correlation of water pH with growth rate of fishes was recorded in both the ponds but correlation values were significant in Pond-1.

Chow (1958) opined that free CO_2 ranging from 3.0 to 4.0 mg/L affects the fish breath with difficulty and the fishes die if exposed to 30.0 mg/L. Similar views have also been given by Devi (1993), Kumar et al (1996) and Mishra et al (1999).

Total alkalinity of waters affects the growth of fishes and other organisms profoundly. Such reports have also been given by Michael (1969) and Khan (1972).

The chloride range is more and with major variation in pond 1 rather than pond 1. It is therefore logical to say that these ponds receive anthropogenic contamination in small quantity. Singh (1999) studied the seasonal variations in the chloride content of several tropical fresh water bodies and reported a decrease in chloride contents in monsoon season.

According to Mishra and Saxena (1993) the most concentrated source of nitrate are domestic and industrial waste waters. Rainfall is supposed to be responsible for increasing the nitrate in water as Basheer et *al* (1991) reported that concentration increment during monsoon months in pond is cause of nitrogen intake from drainage and surface run off. In the present study, no such relationship could be observed.

Arvind and Singh (1998) reported that in most of the seasonal ponds nitrate nitrogen had its minimum or lower values in July. In most of the ponds, they found maximum nitrate-nitrogen in October when the volume of the water

is reduced or concentrated.

Phosphate is one of the major nutrients responsible for biological productivity. Like phosphate, nitrite is also important nutrient in aquatic ecosystem. A positive correlation was recorded, which was significant in Pond-2. On the other hand no significant correlation was found between nitrate content of the water and fish growth.

The content of calcium ions is important variable in fresh water and also one on which can be based a division with which faunistic differences correspond (Ahmad and Sarkar, 1998). For many years calcium was not thought to be of absolute requirement for algae, but it is now certain that, where it is required, the amount is small (Alam et *al*, 1989). The calcium ion undoubtedly plays a part in the maintenance of cytoplasmic membrane.

CONCLUSIONS

The fish growth showed negative relation to Temperature, however, positively co-related to pH, alkalinity, specific conductivity, calcium, phosphate, nitrite and nitrate content in both the ponds. There is also non-significant relation with carbon dioxide. A negative correlation was found between temperature and fish growth.

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REFERENCES

APHA (1998): Standard Methods for Examination of Water and Wastewater, 20th ed. American Public Health Association, Washington DC.

Arvind Kumar and Singh RNR (1998): Biodiversity and pollution status of Masanjore Reservoir (South Bihar) in relation to certain abiotic factors. *Ecol Env and Cons* 4 (3): 139-144.

Basavarajappa SH, Raju NS, Hosmani SP (2014): Limnology: A critical review. *Current World Environment*, 9 (3): 741-759.

Chow T (1958): Study of water quality in the fish pond of Hongkong. *Hongkong Univ Fish J*, 2: 7-28.

Collins RA (1970): Cage culture of catfish in reservoir. Lake Proc. 24th Ann. Conf, 24: 489-496.

Devidas K, Puttaiah ET, Kiran BR and Kumara Vijaya (2006): Status of water quality in Ayanur tank near Shimoga district, Karanataka. *Nat Env Poll Tech*, 5(2): 257-260.

Devi OI (1993): Distribution, Primary Production and Nutrient Status of Macrophytic Communities in Waithou Lake, Manipur. Ph.D. Thesis, Manipur University, Imphal.

Doudoroff P and Shumway (1970): Dissolved oxygen requirement of freshwater fishes. FAO, United Nation Fish Tech. Paper, 86: 29p.

Gonzalez EJ, Ortaz M, Panherrera C and Infante A (2004): Physical and chemical factors of a hypertrophic reservoir permanently stratified. *Hydrobiologia*, 552: 301-310.

Hanan HH (1979): Chemical modification in reservoir regulated stream. In: The Ecology of Regulated Stream, Plenum Publication.

Jain SM, Sharma M and Thakur R (1996): Seasonal variations in physico-chemical parameters of Halali reservoir of Vidisha district. *J Ecobiol*, 8: 181-188.

Jhingran VG (1990): Fish and fisheries of India. 2nd ed, Hindustan publishing corporation (India), Delhi.

Khan RA (1972): Studies on the biology of some important major carps. Ph.D. Thesis, AMU, Aligarh.

Khatri TC (1985): Physico-chemical features of Idduki reservoir, Kerala during premonsoon period. *Env and Ecol*, 3: 134-137.

Kumar A, Gupta HP and Singh DK (1996): Impact of sewage pollution on chemistry and primary productivity of two freshwater bodies in Santhal Paragna, Bihar. *Ind J Ecol*, 23: 86-92.

Michael RG (1969): Seasonal trends in physico-chemical factors and plankton of a freshwater fish pond and their role in fish culture. *Hydrobiologia*, 31(1): 37-59.

Mishra SR and Saksena DN (1990): Seasonal abundance of planktonic fauna of waste water from industrial complex at Birla Nagar (Gwalior) India. *Acta Hydrochem et Hydrobiol*, 14(3): 17-21.

Mishra AP, Borah BK and Sharma M (1999): Limnological investigation of freshwater tributary. *J Freshwater Biol*, 11:1-5.

Mohanraj R, Sathish Kumar M, Azeez PA and Sivakumar R (2000): Pollution status of wetlands in urban Coimbtore, India. *Bull Env Contam Toxicol*, 64: 638-643.

Ranjan Gautam, Singh NP and Singh RB (2007): Physico-chemical characteristics of Ghariyarwa pond of Birganj, Nepal in relation to growth of phytoplankton. *Nat Env Poll Tech*, 6(4): 629-632.

Sah JP, Sah SK, Acharya P, Pant D and Lance VA (2000): Assessment of water pollution in the Narayani river, Nepal. *International J Ecol and Env Sc*, 26: 235-252.

Villadolid DVP, Panganiban and Megla TG (1954): The role of pH in pond fertilization. Ind-Pak. Fish Conf. Proc., Sect. II, II 5: 109-111

Verma M (1967): Diurnal variation in a fish pond in seoni, India. *Hydrobiologia*, 30: 129-137.