



(RESEARCH ARTICLE)



Physico-chemical Analysis of some major ponds in relation to fish production of district Kaushambi Uttar Pradesh

Yogesh Mishra *

Department of Zoology Bhavan's Mehta Mahavidyalaya Bharwari Kuashambi Uttar Pradesh, India.

GSC Biological and Pharmaceutical Sciences, 2023, 23(01), 174–178

Publication history: Received on 10 March 2023; revised on 17 April 2023; accepted on 19 April 2023

Article DOI: <https://doi.org/10.30574/gscbps.2023.23.1.0163>

Abstract

Present study is aimed to explore the physico-chemical characteristics of four major ponds of district Kaushambi. There are many ponds in district Kaushambi. Most of the ponds have been devastated due to anthropogenic activities. The ponds which are selected for the study are three from Ichhna village and one from Saraiakil village in Nevada block of tehsil-Chail in Kaushambi. The three ponds from Ichhna village are Telan, Potaniha and Khewkhar and one pond from Saraiakil village are selected. The physico-chemical parameters are water transparency, temperature, dissolved oxygen, ph., Free CO₂, alkalinity and total solids etc. The study was conducted during the month of March 2021 to February 2022. It was noted to have alkaline water throughout the year. The biodiversity and the production of fish depend upon the physico-chemical characteristics of the ponds.

Keywords: Anthropogenic activities; Physico-chemical parameters; Biodiversity; Alkalinity Transparency.

1. Introduction

Inland fish production has been carried out through ponds and tanks in different regions of district Kaushambi. It is situated in between Ganga and Yamuna rivers. Agriculture is the main source of income of the district. The water resources of the district are rivers, canals, lakes, ponds and tanks. The major sources of irrigation are canals and tube wells. The ponds and tanks are the major resources of inland fish production. There were about 8000 ponds found in the government record of district but about 200 ponds have been missed now. The areas of the most of the ponds are now reduced and they are occupied by the residents of there. Farming is also taken in most of the ponds. Most of the ponds and tanks in the district reflect their attitude for inland fish production. About 95% of unorganised labour is dwelling in fishing sector. Fish farmers are inefficient in the application of resources. The imperfect condition of input markets and low output prices hampered efficient utilisation of production inputs. (Inoni OE, 2007). Fishes are dependent on physico-chemical parameters. Any change of parameters may affect the growth, development and maturity of the fish (Jhingran, 1985). Phytoplankton and zooplankton together constitutes the natural fish food. High plankton counts indicate high fish production potential (ICAR 2011). The demand of fish is increasing day by day in Kaushambi district. It motivates producers to produce more from their impounded land resources. As per FAO report around 90 percent of fish production is expected to be destined for human consumption. This would happen because of rising income and urbanisation linked with the expansion of fish production and improved distribution channels. World food fish consumption in 2030 is projected to be 20 percent higher than in 2016.

* Corresponding author: Yogesh Mishra.

2. Material and Methods

The present study was carried out on some selected ponds of Kaushambi district. The ponds which are selected for study is situated in Chail tehsil of district Kaushambi, Uttar Pradesh. District Kaushambi is surrounded by 4 districts, Pratapgarh in the north, Prayagraj in the east, Chitrakoot in the south and Fatehpur in the west. The total geographical area of the district is 1903.17 sq. km (Fig-1). Kaushambi is located at $25^{\circ}21'39.7908''\text{N}$ $81^{\circ}24'11.4048''\text{E}$ with altitude of Mean Sea Level- 81.08 meter. Water samples were collected from 4 ponds sites. The samples were collected in clean and dried bottles and in all the three seasons—summer (March to June), monsoon (July to October) and winter (November to February) during 2021-22. Two ponds Telan and Potaniha are selected for littoral and Khewkhar and Saraiakil are selected for limnetic sites. The samples collected from different ponds are brought to laboratory for examination. A standard method suggested by American public health association (APHA 2006) was used for water analysis (Table-1).



Figure 1 Tehsil- Chail in district-Kaushambi



Figure 2 A pond in Ichhna village

Table 1 Names, depth range and site types

Name of ponds	Depth range (meters)	Site types
Telan	1.0-1.5	Littoral
Potaniha	1.5-2.0	Littoral
Khewkhar	2.0-2.5	Limnetic
Saraiakil	2.5-3.0	Limnetic

Table 2 Meteorological data of Kaushambi district for 2021-22

S.no.	Month	Min. temp. °C	Max. temp. °C	Rainfall (mm.)	Min. humidity %	Max. humidity %
1	March	16.0	32.0	12.5	34	85
2	April	18.5	38.0	0	30	82
3	May	22.6	42.0	17.6	37	72
4	June	26.0	42.8	72.3	38	75
5	July	25.0	32.8	75.6	65	82
6	August	25.8	32.0	65.2	70	90
7	September	24.8	31.5	30.5	65	92
8	October	19.0	31.8	0	64	94
9	November	12.6	28.9	0	65	85
10	December	8.2	24.5	0	58	84
11	January	5.6	24.0	14.6	48	87
12	February	9.5	28.5	0	42	84

3. Results and discussion

The temperature has an important role in deciding the environmental conditions of the area. It has a key role in deciding the biotic features of the water body. The temperature varied from 5.6°C-42.8°C. The highest temperature was noted in June and lowest in January during 2021-22 in district Kaushambi. Rainfall is very important in the district Kaushambi because most of the farmers are dependent on the rain to fill their ponds. The rainfall ranges from 12.5mm-75.6mm in 2021-22. The humidity ranges from 30% - 94%. The minimum humidity was noticed in April and maximum in October month (Indian Meteorological Department Report 2021-22 Govt. of India and U.P.).

The physico-chemical characteristics of water depend on the meteorological conditions of the area. The temperature and turbidity play an important role in the pond productivity. Dissolved minerals, gases and pH decide the quality of the pond water. It was found that no significant differences in the variability of physico-chemical factors between surface and bottom water. The transparency of water ranges from 19.5 cm to 32.5 cm. Its high value in summer and low in monsoon was noted. The high transparency in summer was due to low depth of water, high intensity of sunlight and precipitation of turbidity. The transparency influences the photosynthesis, growth and primary productivity of the pond (Table-3).

The mean values of water temperatures varied from 20°C-28.5°C. The water temperature has shown variation with seasons and sites. The temperature has an important tool in deciding the biotic features of the water body. The higher temperature in tropical waters is considered to be beneficial for higher productivity. The growth of carps was found optimum in the temperature range of 23°C- 30°C. The dissolved oxygen is the most important and critical parameter

requiring continuous monitoring in aquaculture production system APHA (1985) has considered this parameter as the key test to understand water pollution and degree of eutrophication. This is due to the fact that fish aerobic metabolism requires dissolved oxygen (Timmons et al. 2001). The dissolved oxygen content ranged from 5.0 to 6.8 mg/l in 2021-22. Dissolved oxygen was higher during summer months and lower during winter months. Bhowmic (1968), Jana (1973) and Chakraborty (1980) had recorded fluctuations of content in their experimental ponds at West Bengal. The pH value of different ponds varied between 7.2 to 8.2. It was shown that ponds had alkaline water throughout study period. Nees 1946 and Banerjia (1967) observed the variation in water pH from 7.1 to 8.0 as optimum for fish production. The high PH in summer and low PH in winter is recorded during the study period. The free CO₂ content varied from 5.4 to 6.4 mg/l. The highest was noted in summer and lowest in winter. Sometimes the free CO₂ is absent in the ponds. It was due to its utilisation by algae during photosynthesis or presence of carbonates in water (Manjare et al. 2010). The total dissolved solids was recorded a moderate to high range during the study period. TDS consists of nutrients and minerals like magnesium, calcium, nitrogen, sulphate and phosphate etc. It was recorded with a wide range of 210 to 280 during the study period. The highest value was recorded in winter and lowest in summer. The total alkalinity of ponds varied from 110-180 mg/l it was minimum during winter and maximum during summer season. The range of alkalinity was found due to greater dissociation of carbonic acid at high temperature however low alkalinity indicates scarcity of carbonates. The total alkalinity was maintained by liming and fertilisers by fish farmers it was because the climatic factors such as temperature and rainfall do not fulfil the need. The alkalinity less than 100mg/l is not suitable for fish culture (Scroeder 1980, Banerjea 1967). The chemical oxygen demand (COD) measures amount of organic compounds in water. It determines organic pollutants of water in ponds. The COD was found minimum in monsoon and maximum in summer. It was varied from 24.0 to 25.5mg/l during the study period (Table-3). The quality of pond depends on the physical, chemical and biological characteristics of water (Latha N, R Mohan 2010 and S.E. Sinde 2011). Biochemical oxygen demand (BOD) was varied from 15.0 to 20.2 mg/l in the pond water. It was minimum in winter and maximum in summer (Table-3). The quality of an ecosystem depends on the physico-chemical characteristics and biological diversity of the system (Tiwari and Chauhan 2006).

The high values of transparency, temperature and pH were the most valuable parameters that has affected phytoplanktons and zooplanktons quantitatively and qualitatively. These factors usually govern the seasonal growth and distribution of biotic communities in ponds. Species composition of zooplanktons and phytoplanktons were comparatively higher during summer as compared to rainy and winter seasons at all sampling sites of ponds.

Table 3 Mean seasonal values of physico-chemical parameters during 2020-21

S.No.	Parameters	Summer Season	Monsoon Season	Winter Season
1.	Transparency (cm)	32.5	19.5	28.5
2.	Temperature °C	28.5	24.0	20.0
3.	D/O (mg/l)	6.8	5.2	5.0
4.	PH	8.2	7.5	7.2
5.	CO ₂ (mg/l)	6.4	6.0	5.4
6.	Total Solids (mg/l)	250.0	325.0	315.0
7.	Total Alkalinity (mg/l)	95.4	90.2	88.0
8.	COD (mg/l)	25.5	22.2	24.0
9.	BOD (mg/l)	20.2	18.0	15.0

Fishes being the highest consumer had been taken as the measure for secondary production in the present study. The fishes which were caught from the ponds are Catla catla, Labeo rohita (Rohu), Cyprinus carpio (common carp), Hypophthalmichthys molitrix (silver carp), Ctenopharyngodon idella (grass carp) and some local large and small fishes. The local fishes are singhi, padhan, kaalbasu etc. The average fish productivity was found to be 30 quintal per hectare during 2021-22. The maximum catch was found in the month of October and November and minimum in the month of March and April. The fishes are mainly caught two times in a year, one in the month of July-August and the other in March-April. In the summer months, when the temperature increases the production of fishes also increases. This shows that temperature affects the growth of fishes. In the winter season the fish catch was decreased due to low temperature. Therefore, the ponds showed the moderate to high range of fish productivity. It indicates that the

limnology of present water body is still quite suitable for extension of aquaculture and fisheries based on fresh water systems (Dept. Of Fisheries District Kaushambi U.P.) (Table 3).

4. Conclusion

The study of physico-chemical factors of four ponds of tehsil-Chail Kaushambi U.P. has confirmed that there were no significant differences between surface and bottom water. The high values of transparency, temperature and pH have affected the seasonal growth of phytoplanktons, zooplanktons and other biotic communities. The climatic conditions, physico-chemical factors and quality of soil decide the productivity of the ponds. The findings of the ponds indicate that the water quality have very good potential for fish culture. The study has shown that the small ponds of villages have greater power of high yield if they are scientifically managed. The study has noticed the need to protect and conserve these small water bodies at the rural level. Hence the policy makers, fish biologists and planners need to take immediate action and to help fish farmers to make strategies for fish culture enhancement programs.

Compliance with ethical standards

Acknowledgments

The author express his gratitude to Mr Sunil Singh, senior fishery officer district Kaushambi for their sophisticated guidance to carry out the present research work.

Statement of informed consent

Informed consent was obtained from all individual participants included in the study.

References

- [1] Inoni OE. Allocative Efficiency in Pond Fish Production in Delta State Nigeria: A Production Function Approach. *Agriculture Tropical Et Subtropica* (2007), 40(4):127-134.
- [2] Jhingran ,VG., *Fish and Fisheries of India* , Hindustan Publishing Corporation Delhi India.
- [3] ICAR. (2011). *Handbook of Fisheries and Aquaculture*, ICAR pub., New Delhi, 5,43-45.
- [4] Food and Agriculture Organisation (FAO) (2016): *The state of world ? sheries and aquaculture 2016*, Rome: FAO
- [5] APHA. (1985). *standard methods for the examination of water and waste water 21st ed.* American public health association, APHA, AWWA, WPCF Washington, D.C.
- [6] Bhowmick, M.L, *Environmental factors affecting fish food in freshwater fisheries Kalyani, West Bengal.* Doctoral Thesis, Univ. Of Kalyani,238 p (1980)
- [7] Jana, B.B., *Seasonal periodicity of plankton in a freshwater pond in West Bengal, India.*Int. Revue.ges. Hydrobiol., 58(1): 127-143 (1973).
- [8] Chakraborty, P., *Studies on hydrobiology of some freshwater fisheries*, Ph.D Thesis, Univ.Of Burdwan (1980).
- [9] Nees, J., *Development and status of pond fertilisation in central Europe.* Trans. Amer.Fish Soc.76: 335-358 (1946).
- [10] Banerjee, S.M., *Water quality and soil condition of fish ponds in some states of India inrelation to fish production.* Indian journal of fisheries, 14: 115-144 (1967).
- [11] Manjare, S.A. , Vhanalakar, S.A.,& D.V.Muley., *Water quality assessment of VadgaonTank of Kolhapur (Maharastra), with special reference to zooplankton.* International Journal of Advanced Biotechnology and Research. 1(2): 91-92.
- [12] Scroeder , G.L., *Fish farming in manure loaded ponds.* ICLARM-SEARCA conference in Integrated agriculture farming systems. ICLARM Proceedings,4: 73-86 (1980).
- [13] Latha N. Ramchandran Mohan (2010) , *Studies on Enviro-ecological status of Kommaghatta Lake of Bangalore, Karnataka.* India Hydrobiology. 12(2):126-129.
- [14] Tiwari Ashish and S.V.S. Chauhan. *Seasonal phytoplanktonic diversity of Kitham lake,Agra.* J.Environ. Biolo.,27: 35-38 (2006).