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Physico-Chemical analysis and sustainable diversity of fishes of Ghordaur pokhar of Hajipur in North Bihar (India)

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Abstract- In the present project at a pond named Ghordaur Pokhara, a comprehensive study was conducted on the physicochemical characteristics and sustainable diversity for fish. The pond is situated on the side of Hajipur Patna main road in the city and because of this it is of utmost importance. Various types of fish including *Pangasius* are cultivated in this pond. The study of various physicochemical parameters such as temperature, pH, turbidity, total hardness, total alkalinity, BOD, COD, etc., were completed throughout year i.e. January to December 2020. The study was also done seasonally such as summer season, rainy season and winter season. The result shows that the pond water is not much suitable for fish rearing.

Key words: Physico-Chemical analysis, temperature, pH, turbidity, total hardness, total alkalinity, BOD, COD

INTRODUCTION

Hajipur city is an important city of North Bihar; this city is the city connecting northern Bihar with Patna, the capital of Bihar. Study of physico-chemical characteristics was an essential requirement for successful fish rearing in Ghordaur pond of Hajipur. With the rapid pace of urbanization and industrialization of Hajipur in Bihar, the aquatic ecosystem affecting the fauna of the water bodies has been severely destroyed.[1] Fresh water has become heavily polluted due to over-exploitation and influx of various pollutants. Ghordaur Talab is a perennial pond located near Ramashish Chowk in Hajipur city. Hajipur is the headquarters of Vaishali district of northern Bihar in India. Vaishali district is located in the Gandak Kamala Interfluvial Zone and lies between about 25.29 to 26.1 N and 85'4 to 85' 3E longitude and latitude. Ghordaur Talab is surrounded by unplanned residential and commercial construction on three sides and Hajipur Patna main road on one side. Pond water gets polluted mainly due to discharge of water effluents, sewage effluents, solid wastes, detergents, pesticides etc. Domestic discharge, detergent solid waste etc. are also received in good quantity in Ghordaur pond. There is a direct or indirect threat to the physico-chemistry of the pond which ultimately affects the fish culture in this pond. The productivity of fish in this pond has decreased over the years. Therefore, the need of the hour is to study the physico-chemical characteristics of the pond in detail so that the fish productivity can be increased to the desired trophic level.

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MATERIAL & METHODS

An in-depth observation was carried out in every month of the calendar year starting from January to

December 2020. The pond water was sampled and analyzed every month of the year. Sampling was done on the 2nd of every month. Water was collected in a plastic bottle using the mixed sampling method. The water collected in his laboratory was analyzed using ISO certified methods.

Table 1

Physic-chemical parameters of water	Method
Ph	Employed
Turbidity	pH meter
Total hardness	Secchi disc
Alkalinity	Titration method
Total dissolved solids	By titration method
Chloride	By TDS meter
Fluoride	Titration method
Sulphate	Titration method
Calcium	Titration method
BOD	Titration method
COD	Titration method

RESULT & DISCUSSION

PH

The pH of the water is one of the important factors affecting the sustainable diversity of fish in Ghordaur pond. The pH of Ghordaur pond was alkaline throughout the year. The range of pH was 7.1 to 7.5, respectively. The maximum pH was recorded in the months of June and August and the minimum was 7.1 in December. Seasonal fluctuations in its average value were also observed. The mean value for summer and rainy season was observed to be 7.5. A decrease in the pH value was recorded during the winter season.

According to Goel *et al.* (1986)[2], seasonal fluctuations are considered good for the buffering capacity. Nandan and Patel (1992)[3] were of the view that higher pH is responsible for algal blooms and higher photosynthetic activity which in turn leads to increased O_2 supply to pond organisms.

TURBIDITY

The suspended dirt and particles in the water obstruct the penetration of light into the water of the Ghordaur pond due to which the photosynthetic process gets reduced. Therefore it is considered as a limiting factor for fish farming in natural water bodies. In the study of Ghordaur pond, the turbidity ranged from 0.2 to 0.5 N.T.U. If we look at the weather, the highest turbidity was recorded during the rainy season. The rainy season is followed by the summer season and the winter season at its lowest level.

TOTAL DISSOLVED SOLID

Water being a good solvent dissolves many mineral salts of metals, electrolytes as well as impurities. Inorganic salt sand among dissolved solids There are some small amounts of organic matter. In the present project of Ghordaur pond the maximum TDS was 668mg/lt in the month of November and the minimum was 650mg/lt in February. According to Verma *et al.* (2012)[4] and Priyanka *et al.* (2013)[5], the higher value of TDS in the rainy season may be due to the excess of domestic waste, garbage and sewage etc. The increase in TDS leads to an increase in the nutrient status of the water body due to eutrophication.[1,6]

TOTAL HARDNESS

The total hardness limit of Ghordaur pond in the study was 271.5 mg/l in January and 279.5 mg/l in September. Huliyal and Koliwal (2011)[7] also found higher hardiness in summer and lowest in winter season. The highest level of hardness in the rainy season is due to the highest flux of carbonate and sulfate-containing impurities. Kiran (2010)[8] classified water according to the degree of hardness. The water of the present pond was moderately hard.

ALKALINITY

Alkalinity is the sum total of bicarbonates and carbonates of calcium, magnesium, potassium and sodium in natural water. The alkalinity in the present Ghordaur Pond study ranged from 250.0 mg/l to 251.9 mg/l respectively. The ideal alkalinity value for fish farming is 50-300 mg/lt as per the guidelines of water quality management. In the present study of this pond, the range of alkalinity was high which is not good for fish farming.

CHLORIDE

The chloride value in Ghordaur Pond ranged from 190.7 mg/lt to 193.6 mg/lt. The added value of chloride was due to the contamination created by humans and animals in different ways. It was not suitable for cultivation of major carp like Catla, Rohu, Grass carp etc: 3.7 Fluoride The fluoride range was from 0.3mg/lt to 0.5mg/lt respectively.

FLUORIDE

Fluoride ions act as an enzymatic poison by inhibiting enzyme activity and ultimately inhibiting metabolic processes such as glycolysis and protein synthesis. Fluoride exposure increases with time and water temperature and decreases with increasing body size and water content of calcium and chloride. The fluoride in this puddle ranged from 0.3 to 0.4.

SULFATE

In the present-day Ghordaur Pond, sulphate is released mainly from household waste from the houses built on the banks of the pond. The sulfate range was in the range of 56.3 mg/l (February) to 57.9 mg/l (September and October).

BOD

Biological oxygen demand is a good indicator of pollution in a water body. It is measured by the amount of O_2 taken up by the microorganism during the decomposition of organic waste aerobically in water. In the present Ghordaur Pokhar the BOD was high throughout the months or seasons of the year. This may be due to sewage ingestion, defecation and washing etc. The high range of BOD is not ideal for fish, especially the stagnation of carp. Jain and Dhanija (2000)[9] considered BOD to be an important parameter to establish the pollution status. Prasanna Kumari *et al.* (2003)[10] reported that the higher BOD in the rainy season was due to organic waste input and increased bacterial activities.

COD

Chemical Oxygen Demand COD is a measure of all organic and inorganic substances in a water body including the Ghordaur Pond of Hajipur. It is an indicator of both sewage and industrial pollution. In the present study COD is very high in all the seasons of the year which has a deleterious effect on the fish production in the pond.

CONCLUSION

The physicochemical characteristics of a water body vary over time in a number of ways, including natural and artificial factors. In the present study of Ghordaur Pond, temperature, pH, TDS, alkalinity, hardness, BOD and COD pose a threat to the survival of fishes. Consumption of fish from this dilapidated puddle eventually causes many diseases for the local residents of the city. Therefore, it is extremely important to take some remedial steps to maintain the physicochemical and biological aspect of Ghordaur Pond for good quality.

Table 2-

Parameter	March	April	May	June	Avg.	July	Aug	Sep	Oct	Avg.	Nov	Dec	Jan	Feb	Avg.
	Summer Season					Rainy Season					Winter Season				
PH	7.3	7.5	7.5	7.5	7.5	7.4	7.5	7.5	7.5	7.5	7.4	7.1	7.3	7.2	7.2
Turbidity	0.3	0.4	0.5	0.5	0.4	0.5	0.5	0.5	0.4	0.4	0.3	0.3	0.2	0.2	0.2
TDS	655	661	660	662	659	665	670	671	672	669	668	664	662	650	658
Total Hardness	277.3	277.5	278.9	278.5	278	278.9	279.2	279.5	279.2	279.2	278.0	278.1	271.5	276.2	275.9
Alkalinity	251.5	251.5	251.8	251.5	251.5	251.8	252.2	252.5	252.5	252.2	251.8	251.5	250.2	250.5	250
Chloride	191.1	190.1	191.2	191.6	191.2	192.1	191.1	192.2	191.8	192	191.5	191.2	191.1	191.5	191.3
Fluoride	0.4	0.4	0.4	0.5	0.4	0.4	0.4	0.4	0.4	0.4	0.3	0.3	0.3	0.3	0.3
Calcium	54.1	55.5	56.9	56.7	55.8	56.3	57.2	57.5	56.8	56.9	57.3	57.2	53.5	53.7	55.4
Iron	0.2	0.4	0.5	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.3	0.2	0.3	0.3
Sulphate	56.4	57.2	57.5	57.2	57.2	57.5	57.5	57.8	57.9	57.8	57.5	57.1	56.5	56.3	56.8
BOD	8	86	88	91	86	91	105	110	91	99	81	90	88	82	85
COD	282	285	285	288	285	288	308	315	288	299	281	285	280	285	282

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