



## Physico-Chemical Analysis Of Fish Farming Ponds Of Darbhanga, Bihar, India

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### Abstract

Safe drinking water is a fundamental human right & basic need of individuals. Water quality is an important criteria for the productivity of a pond. The study was designed to assess the quality of pond water of Dighi Pond & Harahi pond of Darbhanga, Bihar, with reference to physico-chemical parameters including turbidity, conductivity, dissolve O<sub>2</sub>, free CO<sub>2</sub>, PH, potassium, zinc, iron, sodium, chloride and hardness. The results were evaluated and compared with both ponds' water quality. It is found that based on physico-chemical parameters, both ponds' water is not suitable for fish farming.

**Keywords:** Physicochemical parameters; pond water, Dighi pond, Harahi pond, fish farming.

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## INTRODUCTION

In the current scenario, water has a profound influence and quality of the water supplies, and is important in determining the health of persons and whole communities. Safe water is a major concern with reference to public health is closely tied up with the quality of water used. Pond water is also facing pollution like other water bodies [1]. Due to discharge of effluents from various industries, domestic water, land agricultural drainage resulting in the degradation of water quality of pond resources [2]. Sewage nitrate and phosphate passing into aquatic bodies causes eutrophication to undergo algal bloom using these nutrients which increases BOD (Biological oxygen demand). BOD increases the rate of O<sub>2</sub> consumption. BOD is a major cause of water pollution, during decomposition. DO (dissolved oxygen) levels decrease so aquatic limnological parameters have been suggested [4,5] to assess the trophic structure of water bodies. The nutrient enrichment results in diminishing economic, social and recreational values of the pond [6]. Physicochemical analysis of Dighi pond and Harahi pond water bodies was done following the standard methods [7,8,9]. Planktons were sampled with conical plankton net made up of bolting cloth and were counted with the help of plankton counting cells and Identification of plankton were done by observing through the microscope and by using standard keys for plankton identification. Authors have been undertaken to evaluate the water quality of two ponds of Darbhanga, Bihar because these ponds are man made or artificially constructed reservoirs to provide water for irrigation purposes or domestic use. Water quality is very pathetic due to these water bodies practically receiving domestic and drainage water mostly in the rainy season. From the foregoing observation of the physico-chemical parameters, it can be concluded that eutrophication. Low DO high BOD indicates the eutrophic status of the present two water bodies. A relatively higher concentration of chlorides also indicates the unsuitability of the water body for domestic use. However there is a dearth of literature related to the water quality of Darbhanga, District ponds. The present study has been

undertaken to assess the water quality of two representative ponds of Darbhanga Town, Darbhanga Bihar. Dighi is one of the three pond, lying in-between, that together aimed at retaining surplus water of Bagmati and Kamla rivers, thereby protecting from flood to Darbhanga town; these three ponds probably came into being when they were dug for- earth to be used to raise the western side to inhabit this town and source of drinking water, fishes, makhana & other aquatic biota. Indeed a vibrant example of folk- wisdom of superb ecological management during the pre-British period. These constitute a cascading system of drainage, disturbed primarily by railway. So to make Darbhanga free of waterlogging, flood, mosquitos and beauty- needs drainage through these ponds from north to south and eastward across the railway into Kamla with the help of suitable mechanical/hydraulic arrangement.

### Aim of the Study

The aim of present study was to investigate the effect of water quality on pond productivity and trophic status of Dighi pond and Harahi Pond Darbhanga, Bihar. After successful study of water quality of both ponds, to examine the tendency of algal bloom.

### MATERIALS AND METHODS

Water samples of ponds were collected in high grade plastic bottles of 5 liter capacity rinsed with distilled water, and before collection of water samples, they were rinsed thrice with sample water. The water samples were collected from the surface near the margins of the both ponds between 11:00 AM to 3:30PM. After addition of appropriate preservatives like magnesium sulfate, alkali iodide and sulphuric acid at the sampling sites. The collected water samples were transferred to a water testing laboratory, for analysis of various physicochemical parameters. The guidelines given by [10,11] were followed for water sampling, the dissolved oxygen (DO) was fixed at selected sites and above mentioned [10,11] methods were adopted for the analysis of pond water samples. Some selected parameters were

analyzed within 24 hrs. in the research laboratory.

Monthly samples were collected from both ponds of Darbhanga. Physicochemical analysis of water was done following the standard methods [7,8,12]. Planktons were sampled with a conical planktons net made up bolting cloth (No. 21) and were counted with the help of plankton counting cell and identification of plankton were done by observing through the microscope and by using standard keys for plankton identification

## RESULTS AND DISCUSSION

Physicochemical analysis of water of two fish farming ponds has been summarized in Table 1. The concentration of zinc, hardness, PH, turbidity and conductivity were more in Harahi pond. Potassium, Iron and chloride were higher in Dighi pond during the period of investigation (2021-2022) whereas dissolve O<sub>2</sub> and free CO<sub>2</sub> were showing also higher in Dighi pond. Biological quality of water was evaluated in terms of Nygaard's status induces. Nygaards [13] proposed five indices mentioned in Table 2. Nygaard's [13] trophic status indices were based on specific taxon. So Chlorophyceae, Cyanophyceae and compound indices can't be applied in the present study. Physico-chemical parameters in the year 2022 of the study as compared with 2021 showed marked increase indicating that input and nutrients are more in both ponds than its assimilating capacity accord with Odum, [14]. Accumulation of nutrients is the over fertilization of the water body i.e., eutrophication. Increased chloride content of Harahi and collaborating the findings of [15-16]. Hardstedt [20] observed zinc and iron concentration in zooplankton and it may be the higher concentration of iron in Dighi pond be attributed to great abundance of zooplankton (Table 4). *Salmonella sp.* also seen in Harahi pond that causes bladder cancer [21]. So *Salmonella sp.* infected fish consumed, it may be fatal for fish lovers. In the present investigation only two indices proposed by Nygaard's [13] could be applied viz. Euglenophyceae and Bacillariophyceae (Table 2). On the basis of Bacillariophyceae index Dighi pond under oligotrophic status

where Harahi pond indicated mild pollution. Similarly on the basis of Euglenophyceae includes, Dighi pond suffer from mesotrophic and Harahi pond near about to eutrophic status. In this way we come to conclude that both ponds are more towards eutrophy. In summary, zinc, hardness, and conductivity were higher in Harahi pond, while potassium, chloride and iron were higher in Dighi pond during the course of study. In general, Limnological conditions in the fish culture pond in fact affected the development of the different components of the plankton population during the period analyzed. Future studies aiming at evaluating the effect of adequate management of water quality on planktonic population are thus encouraged. Talab Bachao Abhiyan (TBA), an outfit actively engaged in conservation and protection of ponds, the illegal constructions around three ponds – Harahi, Dighi and Ganga Sagar in Mithila, situated in Darbhanga city besides issuing directions to constitute a committee to look into the issues in wake of concerns raised by the TBA that untreated sewage and waste water were being discharged through drainage by Darbhanga junction as well as municipal corporation directly into the Dighi and Harahi pond, due to which flora and fauna of the ponds were severely affected.

Earlier, the curator of Chandradhari Museum, Darbhanga had apprised the railways authorities to stop discharge of untreated wastewater into Dighi and Harahi pond. People visiting museum had earlier lodged a complaint regarding a strong stench emanating from the pond. "The three ponds that exist in a linear position were interconnected to each other and considered an engineering marvel of its time and continue to served its purpose till date. However, owing to complete neglect and rather continuous damage which is being caused by way of encroachment and illegal dumping of garbage and sewage into these ponds, the conditions had worsened"

## CONCLUSION

From the above results and discussion it could be concluded that water quality of the Harahi pond is not suitable for fish culture as

well as domestic purposes. The excessive pollution of both ponds' water is mainly due to the unprotected bank of both ponds, drainage connection, disposal of domestic wastes, and lack of social awareness. People of this region will care for the proper and better upkeeps of both ponds for the purpose of fish farming and greenery. Recent reports also indicate *Salmonella typhi* works as an oncogenic bacteria that alter the human immune system and causes gallbladder cancer. Much more studies specially on Harahi pond are required to explore the other health threatening disease.

## REFERENCES

1. HardstedtRemeo M, Lawmond F. Zinc, copper, and Cadmium in Zooplankton from the Noth- West Mediterranean, Pollut. Bull. 1980; 11 (5):133- 138.
2. Nygaard G. Hydrobiological studies on some Danish ponds & lakes II. The quotient hypothesis and some newer little known phytoplankton Der K Daske. Vindensk, Selak, Biol, SSKR, 1949;7:1-2,93.
3. Gawas AD, Lokhande PB, Mujawar HA. Study of physico-chemical parameters of surface water in the Mahad industries area; Poll. Res. 2006;25:109-11.
4. Odum EP. Fundamentals of Ecology W.B Saunders and Philadelphia; 1971.
5. Sharma, K.O, Gole PK, Gopal B. Limnological studies of polluted freshwater physico-chemical characteristics. Int J. Ecol. Environ, Sci. 1978;4:89-105.
6. Thilago A, Subhasini S, Shobhana S, Logan K. Studies On nutrient content of Ooty Lake with special reference to pollution. Nature Environment and pollution Technology 2005;4(2):299-302.
7. Gautam, AC. Ecology and pollution of mountain water. Ashish Publishing House, NewDelhi. 1990;4-13.
8. Trivedy RK AND Goel PK. Chemical & Biological methods for water pollution studies, Environments publication Kerad, India;1986.
9. Sawyer CN Basic concept of eutrophication, jour. Water pol. Contr. Fed. 1996;38:137-144.
10. APHA. Standard methods for the Examination of water and wastewater; 9<sup>th</sup> edition Public Health Association, Washington DC;1995.
11. Chatterjee C, Raziuddin M. Assessment of physicochemical and microbiological status of river Nunia in relation to its impact on public health. Journal of Environment and Pollution. 2001;3:267-270.
12. Zafar AR. Taxonomy of lakes, Hydrobiologia, 1959;3:287-299.
13. Ansari AA, Khan FA. Studies on the role of selected nutrient sources in the eutrophication of freshwater ecosystems. Nature Environment and Pollution Technology. 2006;5(1)47-52
14. Sarkar R, Ghosh AR, Modal NK. Comparative study of physico-chemicals of status and diversity of microphytes and zooplankton of two urban ponds of Chandannagar, WB, India. Appl. Water Sci.2020;16,64.
15. Sajitha V, Vijayamma SA. Study of physico-chemical parameters and ponds water quality assessment by using water quality index at Athiyannoor panchayat Kerala, India Emer. Live sic Res. 2016;2:46-51
16. Krishnamurthy SR, Bharti SG. Evaluation of water pollution in the river kali near dandeli (NORTH Kanara District) Karnataka state. India poll. Res. 1995;14(1):93-96
17. WHO Guidelines for drinking water quality. Geneva;194.
18. APHA. Standard methods for the examination of water & water, 18<sup>th</sup> Ed. Washington DC;1992.
19. Kanth MK, Singh SK, Kashyap A, Gupta VK, Shalini S, Kumari S, Kumari R, Puja k. Bacteriological Assessment of drinking water supplied inside the Government Schools of Patna District Bihar, India. American Journal of Environmental Protection. 2018;6(1):10-13.
20. APHA. Standard methods for examination of water and wastewater. Sixteenth American public Health Association, Washington, DC;1985

21. Upadhyaya A, Pal D, Awanish K, use of *Salmonella typhi* induced Oncogenesis In gallbladder cancer; -Co-relation & progression, Advances in cancer Biology –Metastasis, 4(2022),100032

22. Shachi K, Prasad N.K, Kumar S, water quality of two carp culture aging ponds of LNMU Campus, Darbhanga, Bihar, UPJOZ,2020(41):11;98-101

(a)Map of India



(b)Map of Bihar

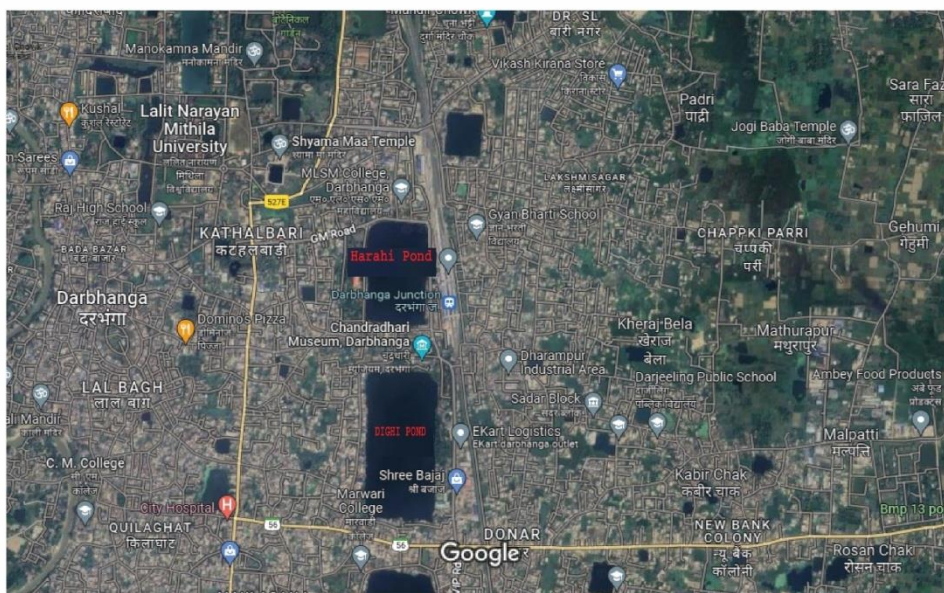




**Fig. 1. Pollution of Harahi Pokhar Pond with floating animal carcass**



**Fig. 2. Dighi pond at a glance**



**(Satellite Image of Dighi and Harahi Ponds, Darbhanga, Bihar )**

**Table 1. Physico-chemical analysis of the Dighi pond and Harahi pond, Darbhanga, Bihar, (Mean value)**

SI.	Parameters	Dighi pond 2021	Dighi pond 2022	Harahi pond 2021	Harahi pond 2022
1.	Hardness (Mg/L)	62	62.5	62.5	63
2.	Chlorides (Mg/L)	62.27	55.67	44.22	52.23
3.	Iron (Mg/L)	0.24	0.17	0.2	0.12
4.	Turbidity	18.7	19	20.6	20.6
5.	Conductivity	0.34	0.34	0.48	0.48
6.	Dissolve O <sub>2</sub> (ppm)	6.9	6.4	6.0	6.1
7.	Free Co <sub>2</sub> (ppm)	30	32	28.6	28.7
8.	PH	5.3	5.7	6.36	6.6
9.	Sodium (Mg/L)	5.2	5.9	5.26	5.89
10.	Potassium (Mg/L)	6.10	6.2	5.80	6.0
11.	Zinc (Mg/L)	0.091	0.092	2.6	2.7

**Table 2. Nygaards trophic status indices (1949) Index of Dighi pond and Harahi pond, Darbhanga, Bihar**

	Dighi pond 2021	Dighi pond 2022	Harahi pond 2021	Harahi pond 2022
Bacillariophyceae	0-0.43	0-1.4	0.21	0.22
Euglenophyta	0-0.12	0.1	0.43	0.3
Cyanophycean	0-0.43	0.1-0.3	.....	....
Chlorophyceae	0-0.14	0.1-6	.....	....
Compound	0.01-1	1.2-2.5	.....	.....

**Table 3. Phytoplankton diversity of the Dighi pond and Harahi pond LNMU campus, Darbhanga, Bihar**

Zooplanktons	Dighi pond 2021	Dighi pond 2022	Harahi pond 2021	Harahi pond 2022
Chlorophyceae	4	3	4	5
Bacillariophyceae	2	3	4	4
Cyanophyceae	2	2	3	2

**Table 4. Zooplankton of Dighi pond and Harahi pond Darbhanga, Bihar**

Zooplanktons	Dighi pond 2021	Dighi pond 2022	Harahi pond 2021	Harahi pond 2022
Rotifers	4	4	5	5
Cladocera	3	4	4	5
Copepods	2	01	2	01