Fish Productivity and Physico-Chemical Analysis in Patne river of District Panna, Madhya Pradesh

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Abstract: This study observes the seasonal fluctuations in key physico-chemical parameters and the biological characteristics of fish in the Patne River of Madhya Pradesh, employing standard classical logical methods. The main objective was to assess the current status of the river for its effective utilization. Observations were made across three seasons—summer, winter, and rainy. The findings specify that all the assessed parameters remained within acceptable limits for fish culture. The results further recommend that fish stocking should be planned in accordance with the water's productivity. Moreover, the study highlights significant potential to enhance fish yield by improving the carrying capacity of the water bodies.

Keywords: Fish Productivity, Panna , Physico-chemical analysis.

Introduction

Physico-chemical analysis of fresh water resources is scatted during the district and are under fish culture on widespread or semi-intensive way giving some income to the growers. The number of dams, reservoirs, tanks, etc. has pointedly increased in last few years. The development of fisheries in these fresh water resources is the present need using scientific techniques. The total water bodies in the district is 2526 ha and annual production reported is 2510 mt. There is no limnological study of fish pond has been made to recover the pond productivity. The abiotic and biotic factors of the water impact the quality and quantity of aquatic life enduring there. The role of water in nature is unique not only for human; but, also for the numerous organisms living in the water. The physical and chemical properties of fresh water bodies are considered by the climatic, geochemical, geo morphological and pollution condition. In order to utilize fresh water bodies effectively for fish production, it is very important to study the Physico-Chemical factors inducing the biological productivity in the water bodies **(Sahni and Yadav, 2012**). The quality of aquatic life surviving in the pond is totally dependent on the water quality of the pond. In the recent years several studies have been made in this field (**Yadav et al., 2013)** but not much evidence is available on Physico-Chemical and biological parameters of the present water bodies. Hence the present work is an effort to study the detailed information

on some important Physico-chemical and biological restrictions of the fish pond so that necessary measures could be suggested for the best fish culture practices in the district Panna Madhya Pradesh.

Materials and Methods

The fish site of river has been selected on arbitrary basis for the study which are under fish culture practices. Monthly sampling was done from June 2023 to May 2024 in the river for finding out the various abiotic (temperature, transparency, pH, dissolve oxygen, free CO2, total alkalinity, Biological oxygen demand (BOD) and biotic parameters. The physicochemical analyses of the water samples were done according to APHA (1998). For valuation of planktonic population, samples were collected with the aid of a mug of one litre capacity. 50 litres of water was collected through the plankton net made of bolting silk no. 25 (0.064 mm mesh size) to get the plankton sample and was preserved by adding 24% of formalin for further study. The data collected was grouped in three categories i.e. summer (February-May), Rainy (June-September) and winter (October–January) for judgement of seasonal variations. Ecosystem. (**Wetzel, 1975; Dwivedi and Pandey, 2002; Singh and Mathura, 2005**). In the present study the water temperature range 13.0 °C to 31.7 °C. It was maximum during summer relatively less during monsoon and minimum during winter. **Kannan and Job (1980**) also found similar results as observed in the present study The temperature rages specify the suitability for fish culture (**Jhingran, 1982**) even though the minimum temperature recorded in the month of December (13 °C) is also within the allowable limit of the fish culture.

Results and Discussion

This fish pond is perennial, non-drainable, used for bathing, washing clothes and utensils. The physicochemical analyses made in various seasons in this pond have been shown in the **Table 1**

S.No.	Parameters	Summer	Rainy	Winter
1	Temp ^{0}C	32.7±3.5	31.0 ±	14.0 ±2.0
2	pH	7.9±1.0	7.4 ±1.0	7.3 ±2.0
3	Transparency	21 ±2.0	24±1.0	28±2.0
4	Dissolve oxygen (ppm)	5.3±0.7	7.1±1.0	6.8±1.0
5	Carbon Dioxide (ppm)	21 ±2.0	17 ±2.0	17 ±2.0
6	Alkalinity (ppm)	121±5.0	147 ±12.0	115 ±2.0
7	Hardness (ppm)	181±20.0	229.0 ±20.0	141±15.0
8	Electrical Conductivity	561±12.0	721± 5.0	651±25.0
9	Total dissolve solids (ppm)	695±25.0	740 ± 25.0	653±20.0

10	Biological Oxygen Demand (at 25^0C	2.7 ± 4.0	3.5±2.0	2.9±0.1
11	Plankton ml	0.2 ±0.1	0.1 ±0.2	0.4 ±0.1

pH: pH is a restrictive factor and works as an index of general environmental condition. The pH value of the pond showed alkaline trend. The maximum pH value was in the month of April i.e.7.9 and minimum in the month of October i.e. 7.3. It is obvious from the data that the pH declines during the rainy season and increases during summer. pH status in the aquatic environment on important chemical parameters which envisages about the suitability for the fish culture. The alkaline pH is suitable for fish culture (**Jhingran, 1982**). The pH was more in where there is washing of the cloths and less where the cattle waste is predisposed, but overall, the pH was same and was little alkaline which is most suitable for the fish culture.

Transparency: Water transparency is an important factor that controls the energy association at different trophic levels. The results of transparency ranged between 21cm to28 cm, during the study period. It was low during the summer and higher during the winter season. The transparency was lower in the summer season due to high planktonic population, while it was low in the rainy season because of rise in the suspended matter brought in through surface run off. The maximum transparency was recorded in winter season attributed to the sedimentation of deferred matter (**Chaurasia and Adoni, 1985**). Transparency plays vital role in nutrient transformation and also gives an suggestion of productivity of the water. The availability of the plankton influences the transparency of the water. The water was more translucent in the rainy season in comparison to the winter and summer season may be due to poor diluted plankton in the rainy season.

Dissolve Oxygen: Oxygen content is significant for direct needs of many organisms and affects the solubility of many nutrients and so the periodicity of aquatic ecosystem (**Wetzel, 1983**); **Jhingran (1982**) stated that the oxygen contents in tropical water would be low sighted their high temperature. The results of the present study displayed that highest peak value of dissolved oxygen was recorded during the winter season i.e. 6.8 ppm least in rainy season i.e. 7.1 ppm. The minimum dissolved oxygen has been observed in summer may be due to excessive temperature which reduces the solubility of oxygen. The higher temperature also increases the disintegration rate and the lowers the oxygen. results of the present study are similar to other workers (**Prasad et al 1985**)

Carbon Dioxide: The normal water receives carbon dioxide from various sources i.e. (1) The atmosphere. (2) Respiration of plants and animals. (3) Bacterial decomposition of organic matter. (4) Inflowing ground water. The carbon dioxide bears a correlation with pH. The increase in carbon dioxide decreases pH (acidic). The CO2 varied from 17 to 21 ppm. Maximum free CO2 in was observed in summer season and minimum in the rainy season. The free carbon dioxide concentration depends on the respiration of organism (plants and animals) and photosynthesis rate. In case of more photosynthesis more carbon dioxide will be employed.

Alkalinity: Alkalinity is a purpose of bicarbonate and carbonates. These salts get hydrolysed in solution and produced hydroxyl ion. It is also used as a quantity of productivity of water (**Jhingran, 1982; Hulyal and Kaliwal, 2011**). Natural water bodies in tropics usually show wide range of fluctuations in their total alkalinity value depending upon the geography and season. In the present study the total alkalinity ranged between 115 ppm to 147 ppm. It is gradually decreased from July to September and then increased in the month of October. Seasonally highest value was recorded during rainy and lowest during the summer season. Increases in total alkalinity during rainy season were due to input of water and dissolution of calcium carbonate ion in the water column (**Padma and Periakali, 1999**). The deprivation of plants and other organism and organic waste might also be one of the reasons for the increase in carbonate and bicarbonate thereby the alkalinity (**Jain et al. 1997**).

Hardness: Hardness in water is due to salts of Ca++ and Mg++ mostly in the form of carbonates and sulphates. In the present study the total hardness of water ranged from 141 to 229 ppm seasonally, highest value was noted during summer and lowest during the rainy season. Parallel observations were found by various workers (**Kumar, 1995; Naik and Purohit, 1996). Hulyal and Kaliwal (2011)** found that higher value in summer and lower in winter season. They credited is to decreases in water volume and increases in rate of evaporation at high temperature. The water can be considered according to degree of hardness as soft (0-75 mgl-1) moderately (75-150 mgl-1) hard, hard (150300 mgl-1) and above 300 mgl-1as very hard. On the basis of the observation, the water of the present pond appears to be hard.

Electrical Conductivity: Electrical conductivity of the water depends on the nature and concentration of salts in high ionic concentration, pollution status, trophic levels, some local effluents and other organic matter in water (**Ahluwalia, 1999**). The range of electrical conductivity in the present study was between 561-721. The values of electrical conductivity showed obvious seasonal variation being maximum during rainy and minimum during winter season. Similar results were observed by numerous workers (**Hulyal and Kaliwal, 2011; Ramulu and Benarjee, 2013).**

Total Dissolve Solids: Water is a widespread solvent and has a large number of salts dissolved in it which mainly govern the physico-chemical properties. The maximum value of total dissolved solids was noted in rainy season740 ppm and minimum were recorded in winter season 653 ppm. The high value of TDS during rainy may be due to adding of domestic waste water, garbage and sewage etc. in the natural surface water body.

Biological Oxygen Demand: BOD is dissolved oxygen required by microorganism for aerobic decomposition of organic matter present in water. BOD has measured as an important parameter in aquatic ecosystem to establish the status of pollution. The remark of present study showed that highest value of BOD value during rainy season 3.5ppm and lowers during winter season 2.9 ppm. Seasonally, the BOD was highest during late summer /early rainy season. High BOD during late summer / early rainy season may be due to the occurrence of several microbes in water bodies which accelerate their metabolic activities with the growth in concentration of organic matter in the form of municipal and domestic waste pouring into the pond with run off. It is also stated that the higher values of BOD during rainy was also due to input of organic

wastes and enhanced bacterial activity. High temperatures do play an significant role by increasing rate of oxidation. The BOD of uncontaminated water is less than 1.00 ppm moderately polluted water 2.00-9.00 ppm while heavily polluted water have BOD more than 10.00 ppm. The BOD in different season in the present study indicates pond as moderately polluted.

Plankton: The plankton concentration varied from 0.2 to 0.4 ml/25 l of water. It was more in winter season and low in summer season. The concentration is low for commercial fish culture (**Jhingran, 1982**).

Conclusion Present comment of the different parameters revealed that the physico-chemical and biological parameters are inside the permissible limit for fish culture except the concentration of plankton. It may be due to over stocking or more organisms feeding on plankton. It may be suggested that the stocking of the pond should be done on the basis of the natural productivity of the water or supplementary feeding (if possible) to have better production. Our study gives importance of connection and teaches the local people for safe disposal of sewages is essential. Our analysis for BOD of the ponds falls under moderately polluted group which should be solved in future for better output.

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