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Research paper

Seasonal analysis of Physico-chemical factors and Fish Culture in Bada Taal Pond of Shahdol, M.P. India

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Abstract: The present work deals with the seasonal variations in some significant Physico-chemical parameters and Biological analysis of the fish Pond of Shahdol Madhya Pradesh. Selected standard classical methods were used with an objective to find out the present condition for its better utilization. The data collected in different seasons i.e. summer, winter and rainy during the study revealed that the analyzed parameters were within permissible limit for fish culture and the stocking should be made as per the productivity of the water. By increasing the carrying capacity of the water bodies, there is good scope to increase the production of fishes.

Keywords: Physico-chemical analysis, Fish culture, Biological factors.

Introduction:

Freshwater resources that have undergone physico-chemical analysis are dispersed throughout the district and are being used for extensive or semi-intensive fish culture, providing some income to the producers. Over the past few years, there have been a lot more dams, reservoirs, tanks, and other structures built. The current requirement employing scientific methods is the development of fisheries in these fresh water resources. The type and quantity of aquatic life that can exist in a body of water depends on both its abiotic and biotic characteristics. Water plays a special significance in nature, not just for humans but also for the many different organisms that live there. The meteorological, geochemical, geo structural, and pollution conditions are what define the physical and chemical characteristics of freshwater bodies. It is crucial to understand the physico-chemical elements affecting the biological productivity in fresh water bodies in order to properly use them for fish production. The quality of aquatic life that can survive in a pond is entirely reliant on the pond's water quality. Numerous research have been conducted in this area in recent years, but there is little data available on the physico-chemical and biological properties of the current water bodies. As a result, the current work is an effort to investigate in detail certain significant Physical, Chemical, and Biological factors of the fish pond in order to advise necessary actions for the best fish growing techniques in the Bada Taal Pond of Shahdol, Madhya Pradesh.

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Materials and Methods:

The Shahdol district is the northeastern part of Madhya Pradesh. It lies between latitude 23017'47"N and longitude 81021'21"E. The total geographical area is 5671 km². The population is 908148 people. The Shards are rich in vast resources of forests and minerals. It is bordered by Satna and Sidhi districts to the north, Koria district to the east, Anuppur district to the south and Umaria district to the west. There is plenty of spring water that gushes out from the top of the slope. The average precipitation in Shahdol district is 85.11% and the temperature is 13.6 °C. Various trades such as hunting, gathering, fishing, plowing, and shift farming are carried out in the Shahdol district and are the main occupations of the tribe. Regardless of their dominant lifestyle, they collect and consume large and small forest products.

Bada Taal Fish ponds was randomly selected for the study and was under Fish Farming Practices. Monthly sampling was conducted from June 2015 to May 2016 in the pond and various abiotic (temperature, clarity, pH, dissolved oxygen, free CO_2, total alkalinity, biological oxygen demand), and biological parameters were examined. Physico-chemical parameters analysis of water samples was performed according to APHA (1998). To estimate plankton populations, samples were collected using 1-liter beakers. Wrap silk No. Twenty-five (0.064mm mesh) plankton samples were obtained, supplemented with 24% formalin and stored for further study. The collected data were classified into three categories. Comparison of seasonal changes in summer (February to May), rain (June to September), and winter (October to January) was made (Ahluwalia, 1999, Dwivedi and Pandey 2002).

In this study, water temperature range. 24.80°C to 32.51°C. It was highest in summer, relatively low during monsoons, and lowest in winter. Kannan and Job (1980) also found similar results to those observed in the current study indicating that the temperature range is suitable for aquaculture (APHA, 1998).

Results and Discussion:

The fish Pond of Shahdol is perennial, non-drainable, utilized for bathing, washing clothes and utensils. The physicochemical analysis made in various seasons in this pond have been shown in the Table 1.

Table 1: Physico-chemical and Biological Parameters of Bada Taal Pond, Shahdol, Madhya Pradesh.

S.No.	Parameters	Summer	Rainy	Winter
1.	Temperature (°C)	32.51	28.58	24.80
2.	pH	7.39	6.42	7.35
3.	Transparency (cm.)	30.91	24.7	32.85
4.	DO (ppm.)	5.57	6.48	6.78
5.	CO_2 (ppm.)	5.48	4.78	4.69
6.	Alkalinity (ppm.)	139.1	94.8	157.3
7.	Hardness (ppm.)	181.3	100.4	179.3
8.	Electrical Conductivity	305.7	189.7	263.8
9.	TDS (ppm)	520.5	571.1	469.5
10.	BOD (at 25°C)	2.798	2.410	2.410
11.	Plankton (ml.)	0.2	0.5	0.2

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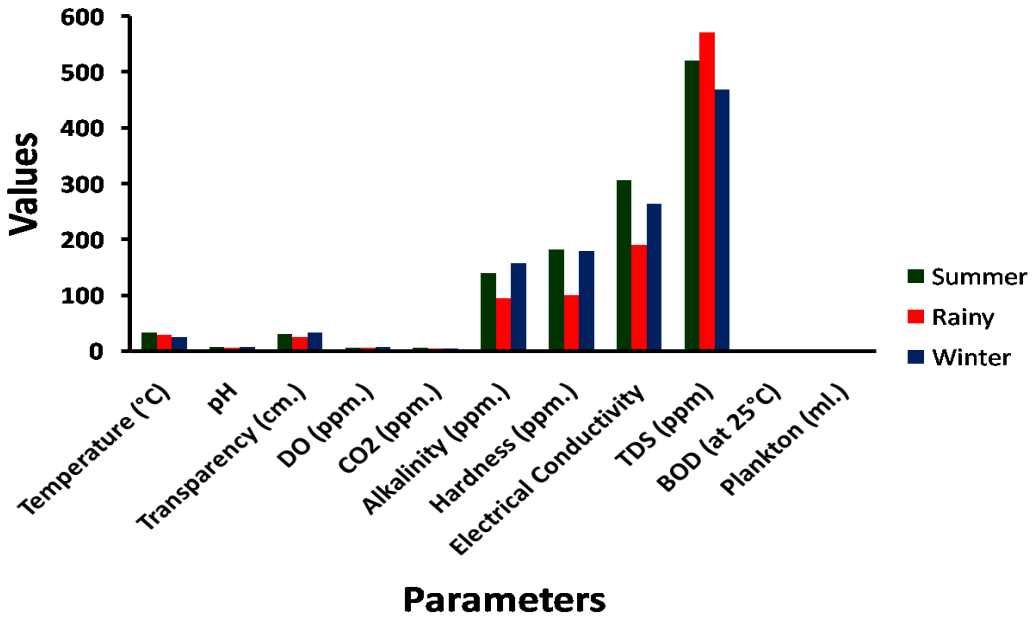

Figure 1: Physico-chemical and Biological Parameters of Bada Taal Pond, Shahdol,, Madhya Pradesh.

Temperature: Temperature is having very important role in aquatic environment and considered as an important factor in controlling the functioning of aquatic body. The highest temperature was recorded in summer with 32.51 Celsius and the lowest 24.80 Celsius in winter.

pH: pH is the limiting factor and serves as an indicator of the general state of the environment. The pH of the pond showed an alkaline trend. The highest was 7.39 in April and the lowest was 7.35 in October. The data show that the pH drops during the wet season and rises during the summer. The pH of the aquatic environment for a key chemical parameter that predicts the suitability of fish for aquaculture. Alkaline pH is suitable for aquaculture (Jhingran, 1982). The pH was high where the cloths where washed, and low where the cow manure was discarded.

Transparency: Water Transparency is a key factor controlling energy relationships at different nutrient levels. During the study period, clarity results ranged from 32.85 cm to 24.70 cm. Low in summer and high in winter. In the summer, there is a lot of plankton, so the transparency is low. Maximum transparency was recorded in winter, due to sedimentation of suspended solids (Chaurasia and Adoni, 1985). Clarity plays an important role in nutrient conversion and is also an indicator of water productivity. Plankton availability affects water clarity. The water clarity in the rainy season was lower than that in winter and summer, probably because plankton was not sufficiently diluted during the rainy season.

Dissolve oxygen: Oxygen content is important for the direct needs of many organisms, affects the solubility of many nutrients, and influences the periodicity of aquatic ecosystems. Jhingran (1982) explained that the oxygen content of tropical waters is low given their high temperatures. The results of this study

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showed that the highest peak of dissolved oxygen was recorded in winter, i.e. 6.78 ppm, lowest in wet season, i.e. 5.57 ppm. The observed dissolved oxygen minimum in summer may be due to excessively high air temperatures, which reduced the solubility of oxygen. The higher the temperature, the faster the decomposition rate and the lower the oxygen content. The results of this study are similar to those of other workers (Prasad et al., 1985).

Carbon dioxide: Ordinary water receives carbon dioxide from various source, like, (1) Atmosphere. (2) respiration of plants and animals; (3) Bacterial decomposition of organic matter. (4) Incoming groundwater. Carbon dioxide correlates with pH values. Increasing carbon dioxide lowers the pH (acidic). CO_2 varied from 5.48 to 4.69 ppm. The maximum free CO_2 was observed during the summer season and the minimum during the winter season. The concentration of free carbon dioxide depends on the rate of respiration and photosynthesis of organisms (plants and animals). More photosynthesis uses more carbon dioxide.

Alkalinity: Alkalinity is a function of bicarbonate and carbonate. These salts are hydrolyzed in solution to produce hydroxyl ions. It is also used as a measure of water productivity (Jhingran, 1982; Hulyal and Kaliwal, 2011). Natural water bodies in the tropics typically exhibit wide variations in total alkalinity values, depending on geography and season. In this study, total alkalinity ranged from 157.3 ppm to 94.80 ppm. It gradually decreases from July to September and increases in October. The highest seasonal values were recorded in the rainy season and the lowest values in the summer. The increase in total alkalinity during the wet season was due to water influx and dissolution of calcium carbonate ions into the water column (Padma and Periakali, 1999). Decomposition of plants, other organisms, and organic waste may also be one of the reasons for the increased carbonate and bicarbonate levels and increased alkalinity (Jain et al. 1997).

Hardness: Water hardness is mainly caused by Ca++ and Mg++ salts in the form of carbonates and sulfates. In the current study, total water hardness varied seasonally between 181.30- 100.40ppm, with the highest values measured in the summer and the lowest values measured in the rainy season. Similar observations have been made by various researchers (Kumar, 1995; Naik and Purohit, 1996). Hulyal and Kaliwal (2011) found that values are higher in summer and lower in winter. They are attributed to reduced water content and increased evaporation rates at high temperatures. According to hardness, water is classified as soft water (0-75 mgl-1), medium water (75-150 mgl-1), hard water (189.3-102.3 mgl-1), from 300 mgl-1 to very high water classified as hard. Observations show that the current pond water looks hard.

Electrical conductivity: The electrical conductivity of water depends on the type and concentration of ionic-rich salts, pollution status, nutrient levels, some domestic sewage, and other organic matter in the water (Ahluwalia, 1999). The electrical conductivity range in this study was between 305.7 and 189.7. The electrical conductivity values showed a clear seasonal variation, with a maximum in the rainy season and a minimum in the winter. Similar results were observed by different workers (Hulyal and Kaliwal, 2011).

Total dissolved solids: Water is a universal solvent in which numerous salts are dissolved that greatly influence its physicochemical properties. Total dissolved solids peaked at 571.1 ppm in wet season and troughed in winter 469.5ppm. The higher TDS for rain may be due to the addition of domestic sewage, litter, sewage, etc. to natural surface water bodies.

Biological Oxygen Demand: BOD is defined as the amount of dissolved oxygen

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required by the microorganism in water for aerobic decomposition of organic. It is considered as a crucial parameter in the aquatic ecosystem for determining the pollution The results of the current study's observations indicated that BOD levels peaked during the rainy season at 2.798 ppm and declined to 2.41 ppm during the winter. The BOD was highest during the late summer/early wet season on a seasonal basis. The existence of various bacteria in water bodies that speed up their metabolic processes with the increase in concentration of organic matter as a result of municipal and domestic waste pouring into the pond with runoff may be the cause of high BOD during the late summer/early rainy season. Additionally, it is claimed that the addition of organic wastes and increased bacterial activity contributed to the higher BOD readings during wet seasons. By accelerating the rate of oxidation, high temperatures do have a significant impact. Unpolluted water has a BOD of less than 1 ppm, moderately polluted water has a BOD of 2–9 ppm, and seriously polluted water has a BOD of more than 10 ppm. The BOD in the current investigation reveals that the pond is considerably contaminated over various seasons.

Plankton: The concentration of plankton varied from 0.2 to 0.5 milliliters of water which is low in the summer season and low in the winter season. The commercial fish culture is found to be lower as reported by Jhingran, 1982.

Conclusion:

Current observations of various parameters indicated that physicochemical and biological parameters were within acceptable limits for fish farming, except for plankton concentration. This may be due to over-rearing of plankton-fed organisms. It is recommended that pond filling should be based on the natural productivity of the water or additional feeding (if possible) to achieve better production. Our research emphasizes the involvement and education of local people, as safe disposal of waste water is essential. The BOD analysis of the pond falls into the moderately polluted category. This should be resolved in the future to improve productivity.

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