Investigation of Seasonal Changes in Water Quality Characteristics of Different Ponds in Dist. Dhar Madhya Pradesh, India

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Abstract:
A vital component of aquatic ecosystems, water quality is impacted by both natural and man-made influences. This study examines the seasonal variation in the water quality attributes of a number of ponds in Madhya Pradesh, India's Dhar district. Finding patterns and connections between several water quality metrics, such as temperature, pH, dissolved oxygen, turbidity, nutrients (nitrates and phosphates), and biological indicators, is the goal of the study. The findings show notable seasonal variations in these parameters, which have consequences for resource management, human health, and local biodiversity.
When water pollution kills farmed species, it can lead to bad water quality and health problems for humans. The quality of the water affects farming, manufacturing, aquaculture, and intake.

Keywords: - Physio-Chemical parameter, Rainy period, Winter period ,Summer period, Ponds ,Health risk

1. Introduction

One of the most significant resources, water makes up about 75% of the earth's crust. It has become a vital product for human development programs, but its quality is in danger due to contamination. The quality of water varies with the seasons, and these seasonal variations can have both beneficial and detrimental effects on the water's quality. The temperature of the water varies with the seasons, as do all other physical and chemical parameters of the water. Environmental safety depends on the monitoring of water quality.
Ponds and other bodies of water are essential elements of the natural environment. They sustain biodiversity, offer habitat for a variety of creatures, and supply water for household and agricultural use. Ponds are essential to the survival of local populations in the Dhar district, which is known for its rich agricultural and cultural traditions. Seasonal variations and continuous human demands, however, pose a threat to these ecosystems' water quality.
In order to add to the body of knowledge regarding regional water management techniques and conservation tactics, this study examines the seasonal variations in the water quality attributes of a few chosen ponds in Dhar. Conserving and protecting the natural ecosystem requires measuring for physico-chemical parameters and examining the quality of the water. Understanding the aquatic system's metabolic measurements is aided by the examination of numerous water quality indices. Understanding the presence and distribution of flora and fauna over time requires knowledge of certain characteristics, including pH, turbidity, temperature, acidity, alkalinity, hardness, nitrates, nitrites, ammonium, phosphates, iron, and fluorine.

2. Study Area:

The Indian state of Madhya Pradesh's western region is home to the Dhar district. The area is home to a number of natural water features, such as ponds utilized for fishing, drinking water, and irrigation. Three different seasons define the climate: a mild winter (October to February), a rainy season (July to September), and a hot summer (March to June). Eight typical ponds are the subject of this study; they were selected for their ecological relevance and ease of access.

3. Methodology

3.1 Sample Collection

Over the course of a year, water samples were taken from each pond in the three primary seasons of summer, rainy season, and winter. To prevent contamination, each sample was collected in a clean container at a depth of roughly 30 cm.

3.2 Parameters Analyzed

The following water quality parameters were analyzed:

- **Temperature:** Measured in situ using a digital thermometer.
- **pH:** Determined using a portable pH meter.
- **Dissolved Oxygen (DO):** Measured using a DO meter.
- **Turbidity:** Analyzed using a turbidity meter.
- **Nutrient Concentrations:** Nitrates were measured using colorimetric methods.

- **Biological Indicators:** Total Coliform and E. coli counts were determined using standard microbiological techniques.
- And many other parameters like color, odor, specific gravity, etc.

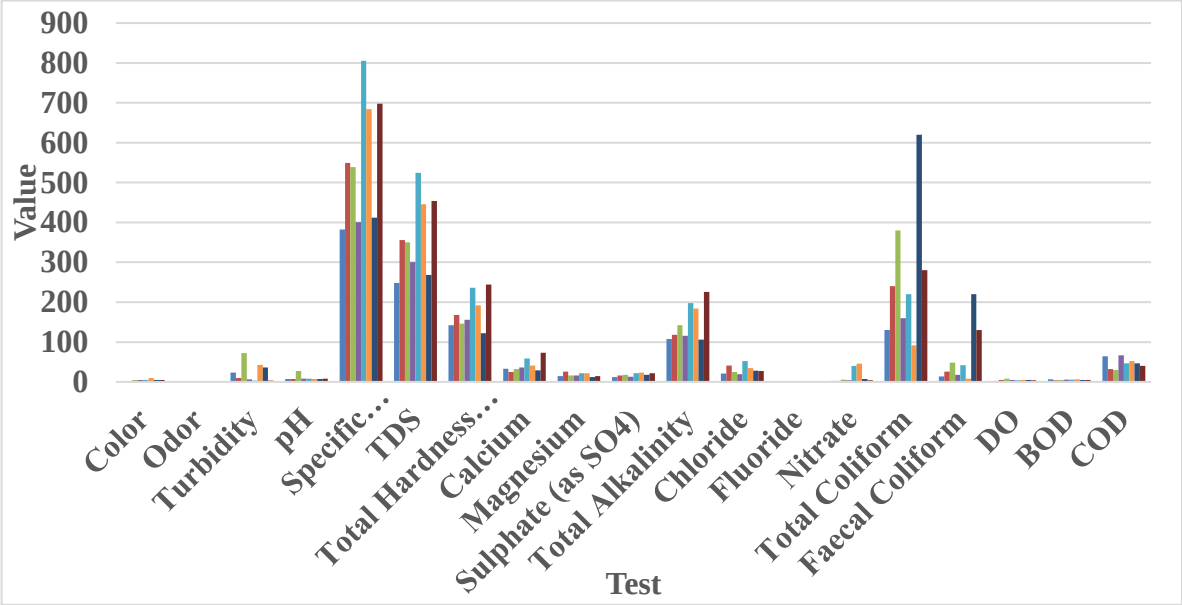
4. Results

4.1. Rainy season result

The physical condition of ponds is directly impacted by rainfall. Temperature variations, water level oscillations, the introduction of organic matter and sediments, an increase in turbidity, and perhaps an effect on light penetration are all consequences of increased precipitation. The dissolved oxygen concentrations in pond water can be affected by a number of factors, including eutrophication, low pH, changes in the solubility of nutrients and dangerous substances, temperature variations, and nutrient levels. Rain can also carry pollutants like pesticides and heavy metals into ponds, posing a threat to aquatic ecosystems and human health. The physical and chemical changes that take place during the rainy season have a significant impact on the biological dynamics in ponds. In 8 ponds we got higher pH value i.e. 27.13 in Devisagar pond, and lowest pH in 7.25 in Munjsagar pond. Turbidity is maximum in Devisagar pond and minimum in Gangmahadev and Dilawara. Calcium range is high in Dilawara (72.8mg/l) to low in Kalbhairav (24.8mg/l). Biological compounds found in maximum amount in Munjsagar, and minimum in Himmatgard.

Table No. 01 Results of Water analysis of 08 pond during rainy season

PARAMETERS	Hatod	Kalbhairav	Devi sagar	Depalpur	Gang mahadev	Himmatgard	Munj sagar	Dilawara
Color	0		5	5	5	10	5	5
Odor	0		0	0	0	0	0	0
Turbidity	23.0	9.8	72.7	6.3	3.5	43.0	36	3.5
pH	7.37	7.61	27.13	7.76	7.95	7.67	7.25	7.94
Specific Conductivity	382	549	539	401	805	684	412	698
TDS	248	356	350	300	524	446	268	454
Total Hardness (as $CaCO_3$)	142	168	146	156	236	192	122	244
Calcium	32.8	24.8	32	36	58.4	40.8	28.8	72.8
Magnesium	14.4	25.4	15.8	15.8	21.6	21.6	12	14.9
Sulphate (as SO_4)	12	16	18	13	22	23	18	22
Total Alkalinity	108	118	142	116	198	184	106	226
Chloride	21	41	25	19	52	35	28	27
Fluoride	0.14	0.42	0.35	0.26	0.25	0.42	0.22	0.17
Nitrate	2.5	2.5	6	4	40	46.0	7.2	4.5
Total Coliform	130	240	380	160	220	92	620	280
Faecal Coliform	14	26	48	18	42	8	220	130
DO	2.6	4.9	8	4.9	3.9	4.8	4.6	4.4
BOD	6.6	3.9	4.8	5.6	5.5	6.2	5.3	5.2
COD	64.3	32	30	67	47	52	46.8	40.2

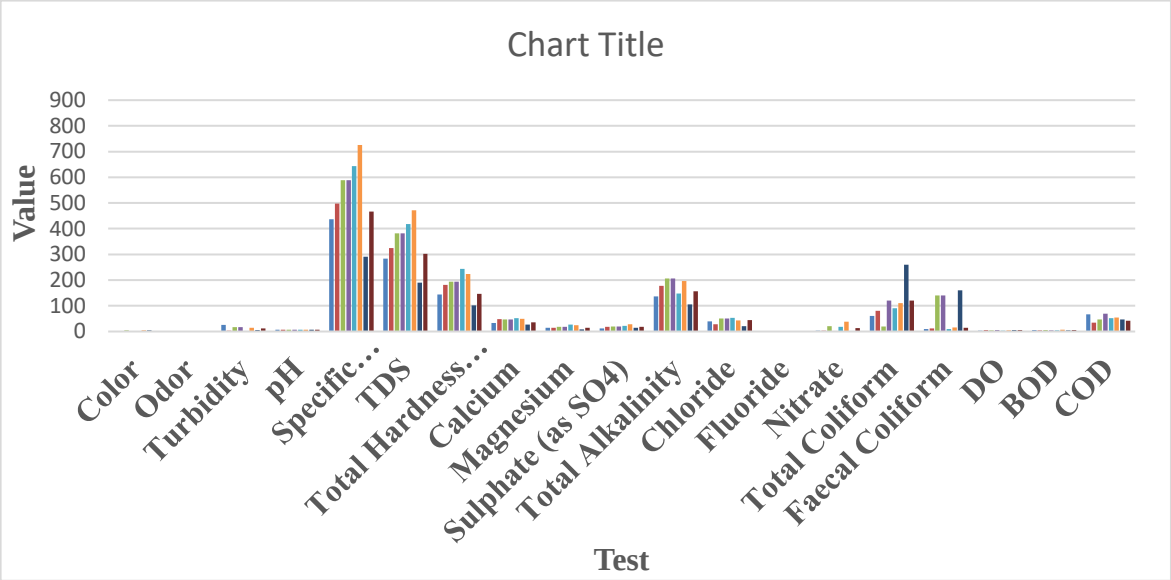


4.2 Winter season result

The chemistry of pond water can experience significant changes during winter months, influenced by physical and biological processes: The winter season is characterized by a drop in air temperature, which directly influences pond water temperatures. cold temperatures can influence the solubility of gases such as carbon dioxide, leading to changes in pH levels. Nutrient availability can also shift due to changes in biological activity and sediment interactions. Microbial processes become less active in colder temperatures, which can alter decomposition rates and nutrient cycling. pH level low in Munjsagar (6.74) and high in Himmatgard and Dilwara (7.42). turbidity is high in Hatod pond and low in Gangmahadev. High amount of calcium found in Himmatgard (49.6mg./l) and less amount of calcium in Munjsagar (27.2mg/l). Munjsagar pond has large number of biological compounds and Hatod has low biological activity.

Table No. 02 Results of Water analysis of 08 pond during winter season

PARAMETERS	Hatod	Kalbhairav	Devi sagar	Depalpur	Gang mahadev	Himmatgard	Munj sagar	Dilawara
Color			5	0	0	5	5	0
Odor			0	0	0	0	0	0
Turbidity	25.2	2.8	16.9	16.9	2.5	15.1	5.2	12.4
pH	6.93	7.26	7.15	7.15	7.27	7.42	6.74	7.42
Specific Conductivity	437	498	589	589	643	726	291	467
TDS	284	324	382	382	418	472	190	302
Total Hardness (as $CaCO_3$)	144	182	194	194	244	224	102	146
Calcium	33.6	48	47.2	47.2	52	49.6	27.2	35.2
Magnesium	14.4	14.9	18.2	18.2	27.4	24	8.2	13.9
Sulphate (as SO_4)	12	18	20	20	22	28	14	18
Total Alkalinity	136	178	206	206	148	196	106	156
Chloride	39	28	51	51	53	43	21	44
Fluoride	0.16	0.17	0.13	0.13	0.22	0.48	0.18	0.32
Nitrate	3.4	3.2	21	2.1	18	38.6	2.6	13
Total Coliform	60	80	20	120	90	110	260	120
Faecal Coliform	10	12	140	140	10	16	160	14
DO	2.8	5.8	3.9	5.3	3	4.9	5.6	5.6
BOD	6.2	4.3	5.5	4.9	5	6.5	4.9	5.4
COD	66.3	34	47	69.6	51.4	54	46.5	42.4



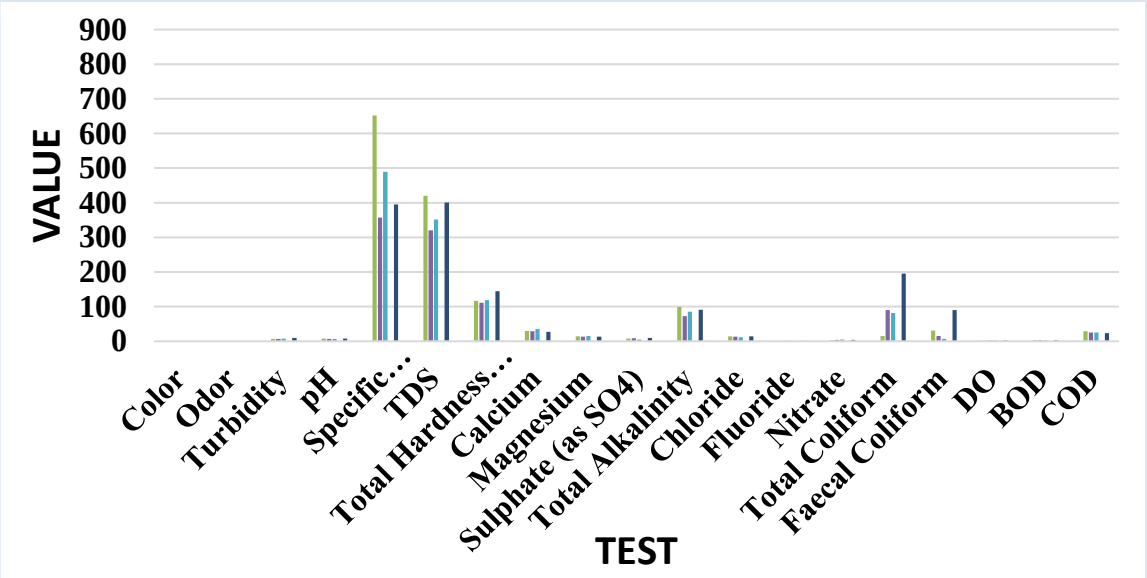
4.3 Summer season result

Summer typically brings an increase in air temperatures, Temperature is a crucial parameter because it influences chemical reactions, biological processes, and the solubility of gases in water. Warmer temperatures can lead to stratification, where warmer, less dense water sits atop cooler, denser water. This stratification can inhibit the mixing of different water layers, affecting nutrient distribution and oxygen levels. Summer is often associated with increased nutrient inputs to ponds. Increased nutrient concentrations can trigger eutrophication, where excessive nutrient loading leads to algal blooms. Here we could not observe the parameters in all ponds, because at summer season some ponds was in dry condition. Higher pH value 7.76 is found in summer season in Munjsagar and lowest pH 6.82 is in Gangmahadev. Turbidity is reported between 9.4 in Munjsagar to 6.5 in Devisagar. Calcium is found 27.01mg/l in Munjsagar to Gangmahadev 35.5 mg/l. Number of biological compounds are minimum in summer season. here we got water sample from 4 ponds, rest of 4 ponds was completely dry in condition.

Table no. 3 Results of Water analysis of 08 pond during summer season (# Sampling Not done due to pond is dry)

PARAMETERS	Hatod	Kalbhairav	Devi sagar	Depal pur	Gang mahadev	Himmat gard	Munj sagar	Dila wara
Color	#	#	0	0	0	#	0	#
Odor	#	#	0	0	0	#	0	#
Turbidity	#	#	6.5	6.6	8.2	#	9.4	#
pH	#	#	7.41	7.01	6.82	#	7.76	#
Specific Conductivity	#	#	652	357	489	#	395	#
TDS	#	#	420	320	352	#	401	#
Total Hardness (as $CaCO_3$)	#	#	117	111	119	#	145	#
Calcium	#	#	30.2	28.96	35.5	#	27.01	#
Magnesium	#	#	14.2	13.5	14.9	#	13.25	#
Sulphate (as SO_4)	#	#	8	9	5	#	10	#
Total Alkalinity	#	#	99	72	85	#	91	#
Chloride	#	#	14	13	11	#	14	#
Fluoride	#	#	0.09	0.1	0.08	#	0.25	#

Nitrate	#	#	2.9	3.9	4.6	#	4.1	#
Total Coliform	#	#	15	90	82	#	195	#
Faecal Coliform	#	#	31	15	7	#	90	#
DO	#	#	1.5	1.9	2.1	#	1.8	#
BOD	#	#	2.9	3.2	2.4	#	3.1	#
COD	#	#	29	25	25	#	23	#



5. Discussion

The results show notable seasonal fluctuations in water quality measures, with clear trends linked to both human and climatic factors.

- **Temperature and Dissolved Oxygen:** The inverse relationship between water temperature and DO highlights the challenges fish and other aquatic organisms face during hotter months.
- **Nutrient Dynamics:** The seasonal spike in nutrients during the rainy season necessitates careful management to prevent adverse ecological effects such as algal blooms.
- **Microbial Contamination:** Elevated fecal indicator levels during the wet season highlight the necessity of wastewater treatment monitoring and perhaps implementation.

6. Conclusion

In summary, the ecological framework of these habitats is significantly shaped by the seasonal variation in pond water. The health and resilience of pond habitats are influenced by a variety of interrelated factors, including variations in temperature, light, nutrient dynamics, and biodiversity. Understanding and resolving these seasonal changes will be key to maintaining the integrity of ponds and guaranteeing that they continue to perform vital ecological services for future generations as global environmental problems continue to change.

The study highlights the significance of regularly monitoring the water quality in the ponds in the Dhar district. Effective management strategies are required to reduce the detrimental impacts that seasonal fluctuations and human demands have on aquatic ecosystems. Future research should focus on developing sustainable water management plans that consider the interdependencies between local populations and their water supplies.

7. Recommendations

1. To evaluate pond water quality, regular monitoring methods must to be set up.
2. Programs to educate the public about how agricultural runoff affects water quality ought to be started.
3. To lessen nutrient inflow, best management techniques should be promoted in agriculture close to bodies of water.

8. References

1. APHA. (2021). *Standard Methods for the Examination of Water and Wastewater*. 23rd Edition.
2. Sinha, S. K., & Bhattacharya, P. (2020). Water quality assessment of rural ponds in India: Implications for water-based livelihoods. *Environmental Monitoring and Assessment*, 192(3), 1-12.
3. Dhir, B., & Singh, J. (2019). Water quality degradation and its effects on aquatic ecosystem in Madhya Pradesh, India. *Environmental Science and Pollution Research*, 26(19), 19580-19592.
4. M.W. Beck, A.H. Claassen, P.J. Hundt, Environmental and livelihood impacts of dams: common lessons across development gradients that challenge sustainability, Int. J. River Basin Manag., 10 (1) (2012), pp. 73-92.
5. Baker, J. (2009). "Dissolved Oxygen and Water Quality: An Overview." *Journal of Environmental Quality*, 38(3), 951-958.
6. O'Neill, R. V., et al. (2001). "The Role of Decomposition in the Dynamics of Wetland Ecosystems." *Wetlands Ecology and Management*, 9(1), 1-14.
7. Ryder, R. A., & Bass, S. (1983). "Thermal Stratification and Its Impact on Lake Water Quality." *Lake and Reservoir Management*, 10(2), 223-236.
8. Schindler, D. W. (1978). "Factors Affecting the Authigenic Nutrient Cycling in Lakes." *Limnology and Oceanography*, 23(4), 1005-1015.
9. Smith, V. H. (2003). "Eutrophication of Freshwater and Coastal Marine Ecosystems: A Global Problem." *Environmental Science & Technology*, 37(16), 2802-2808.
10. X. Li, S. Dong, Q. Zhao, S. Liu, Impacts of manwan dam construction on aquatic habitat and community in middle reach of Lancang River, Procedia Environmental Sciences, 2 (5) (2010), pp. 706-712