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Research Paper

Comparative Assessment of Physico-Chemical Characteristics of Ransagar, Bodigama Dam, and Sable Lake in Dungarpur, Rajasthan

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Abstract:
The present study investigates the seasonal variation in physico-chemical parameters of three prominent freshwater bodies in Dungarpur district—Ransagar Pond, Bodigama Dam, and Sabela Lake—during the period from March 2019 to February 2020. Key water quality parameters such as temperature, pH, dissolved oxygen (DO), free carbon dioxide (CO_2), total alkalinity, phosphate, nitrate, biological oxygen demand (BOD), total dissolved solids (TDS), chloride, and water transparency were analysed across summer, monsoon, and winter seasons.

*At **Ransagar Pond**, summer recorded the highest temperature (36.5°C), accompanied by decreased DO (4.89 mg/L) and transparency (69.2 cm). pH shifted from alkaline to neutral, while phosphate levels declined and BOD slightly increased, indicating rising organic load. Monsoon brought moderate cooling and increased turbidity, while winter saw improved DO and transparency and a return to alkaline pH. Nutrient levels were lowest in winter. **Bodigama Dam** exhibited similar seasonal trends, with peak temperature (36.3°C) and lower transparency in summer. pH dropped from 8.84 to 7.7 and DO reduced due to thermal stress. During monsoon, rainfall-induced dilution improved DO and reduced nutrient levels. In winter, lower temperatures and higher transparency reflected reduced biological activity. DO and pH values increased again during this period. **Sabela Lake** also showed clear seasonal variation, with highest temperatures in summer and lowest in winter (17.95°C). Summer months recorded increased nutrient levels and reduced DO, while monsoon caused decreased visibility and fluctuating DO. Winter conditions favoured better water quality, with higher transparency, increased DO, and reduced BOD and TDS. **Comparative analysis** of the three sites revealed a consistent pattern of seasonal fluctuation: summer months were characterized by high temperatures, low DO, increased BOD, and reduced transparency; monsoon months exhibited increased turbidity and nutrient dilution due to runoff; and winter months showed improved water quality across all parameters. However, Sabela Lake showed relatively higher nutrient concentrations, while Ransagar exhibited the greatest fluctuation in pH and Bodigama maintained relatively stable alkalinity throughout the year.*

Keywords: *Physico-chemical parameters, seasonal variation, Ransagar Pond, Bodigama Dam, Sabela Lake, Dungarpur, water quality, nutrient dynamics, dissolved oxygen, BOD, TDS.*

I. Introduction

Freshwater ecosystems such as ponds, lakes, and reservoirs play a vital role in maintaining ecological balance and supporting biodiversity, particularly in semi-arid regions like Rajasthan. These aquatic systems are sensitive to seasonal changes and anthropogenic influences, which directly affect their physico-chemical properties and, subsequently, the biological communities they support (Wetzel, 2001). Physico-chemical parameters—such as temperature, pH, dissolved oxygen (DO), total dissolved solids (TDS), biological oxygen demand (BOD), nutrients (phosphate, nitrate), and others—are widely used to assess the health and productivity of aquatic ecosystems (Trivedy & Goel, 1986; APHA, 2012). Several studies have emphasised the importance of evaluating seasonal variations in these parameters to understand the limnological status of water bodies. For instance, Patil et al. (2013) assessed water quality in Maharashtra reservoirs and found strong seasonal patterns in DO and BOD linked to organic pollution. Similarly, Chaurasia and Adoni (1985) explored nutrient cycling in Indian ponds and highlighted the impact of phosphate and nitrate fluctuations on eutrophication.

In Rajasthan, where water scarcity and seasonal dependency are prominent, small and medium reservoirs serve as critical sources for irrigation, fisheries, and drinking water (Jakher & Rawat, 2003). Studies by Meena et al. (2019) on the Som Kamla Amba Dam revealed distinct physico-chemical trends in monsoon versus dry seasons, correlating with fish and plankton diversity. Likewise, Dahare (2020) documented seasonal dynamics in zooplankton communities in relation to water chemistry in Sindewahi ponds. The relationship between physico-chemical parameters and aquatic productivity has also been studied extensively. Dhanapathi (2000) highlighted that changes in alkalinity, CO_2, and nutrient load directly influence phytoplankton composition. Recent investigations by Sharma and Bora (2019) in Bhopal lakes emphasized the role of TDS and BOD in indicating pollution levels, while Yadav et al. (2021) found that high summer temperatures and declining DO reduce fish diversity in Southern Rajasthan wetlands.

Shinde et al. (2011) conducted water quality assessment in Waluj Dam, demonstrating how anthropogenic runoff during monsoon alters chloride, phosphate, and nitrate levels. Studies by Kumar and Dua (2009) in Jammu wetlands confirmed that water temperature and TDS are primary indicators of aquatic ecosystem stress. Mandal et al. (2013) also suggested that winter conditions improve DO and visibility, promoting better ecological health. In a similar vein, Upadhyay et al. (2016) analysed seasonal changes in Mahi River water, revealing how rainfall and runoff contribute to nutrient loading and fluctuations in pH. Their findings aligned with those of Verma and Saksena (2010), who reported that winter brings a resurgence in water quality due to reduced microbial decomposition.

Despite these studies, limited comprehensive work has been done on smaller water bodies of Dungarpur district. The present study aims to fill this gap by conducting a comparative assessment of the seasonal physico-chemical characteristics of Ransagar Pond, Bodigama Dam, and Sabela Lake. This analysis will provide insights into water quality patterns across different seasons and their ecological implications, contributing to future conservation and management efforts in the region.

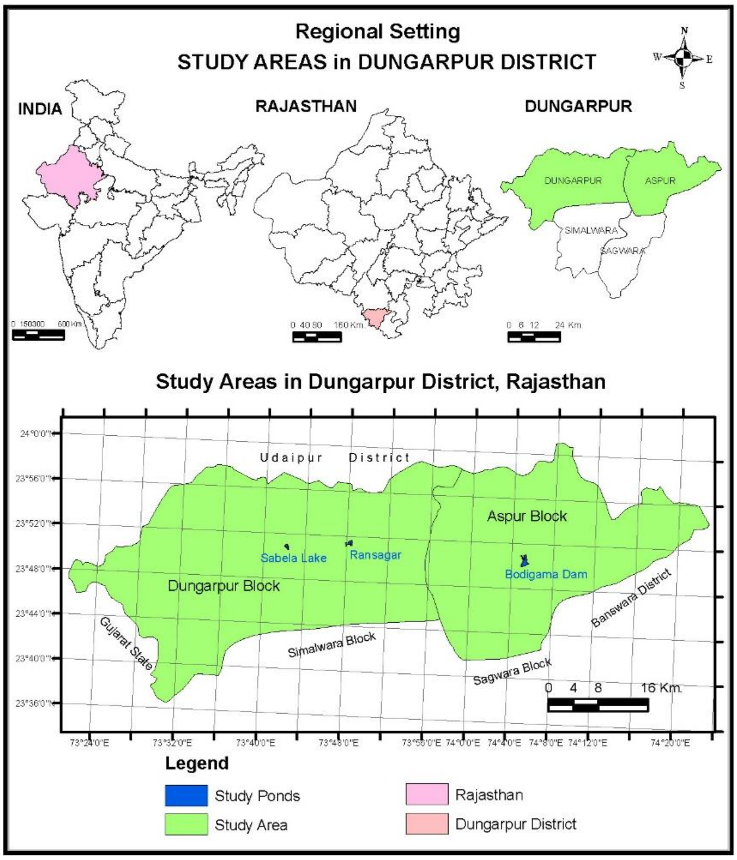
II. Material and Methods

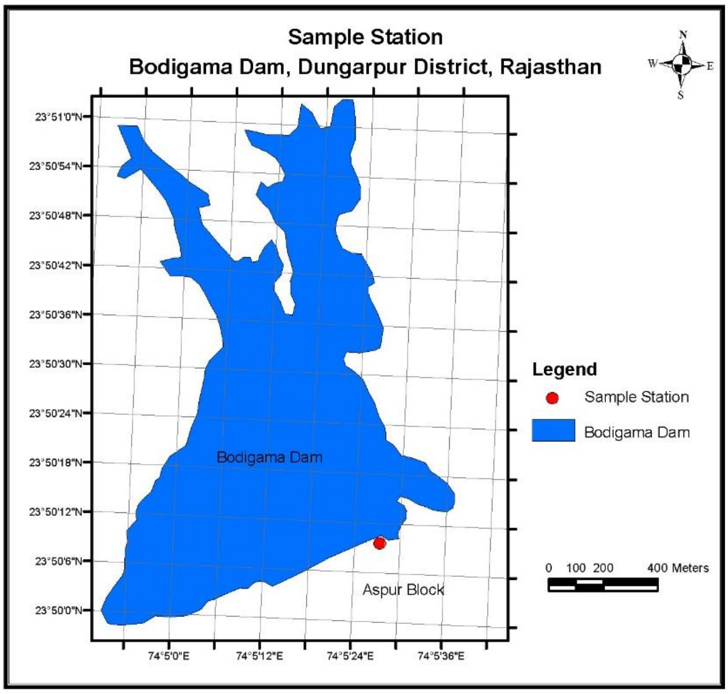
Study Area

The present study was conducted in three prominent freshwater bodies located in Dungarpur district, Southern Rajasthan: **Ransagar Pond**, **Bodigama Dam**, and **Sable (Sabela) Lake**. These water bodies serve as crucial resources for irrigation, fisheries, and local biodiversity.

- **Ransagar Pond** is situated near the urban center of Dungarpur and is a semi-natural lentic water body influenced by domestic runoff and anthropogenic activities. It exhibits seasonal variation in hydrological and limnological characteristics, with moderate eutrophication during summer and monsoon months.
- **Bodigama Dam**, located approximately 15 km from Dungarpur town, is a medium-sized reservoir constructed primarily for irrigation purposes. The dam's catchment area includes agricultural land, which influences its water quality through seasonal runoff carrying fertilizers and organic matter.
- **Sable Lake (Sabela Pond)** is a relatively isolated, small water body surrounded by vegetation and agricultural fields. It is seasonally influenced by monsoon inflows and dry season evaporation. It plays an essential role in local water storage and supports moderate aquatic biodiversity.

All three sites fall within the semi-arid climatic zone of Southern Rajasthan, characterized by hot summers (March–June), monsoon rains (July–October), and mild winters (November–February). These seasonal variations significantly influence the water quality and ecological dynamics of the selected water bodies.


Regional Setting
STUDY AREAS in DUNGARPUR DISTRICT
INDIA
RAJASTHAN
DUNGARPUR
Study Areas in Dungarpur District, Rajasthan
Udaipur District
Aspur Block
Sabela Lake
Ransagar
Bodigama Dam
Dungarpur Block
Banswara District
Gujarat State
Simalwara Block
Sagwara Block
0 4 8 16 Km.
Legend
Study Ponds
Study Area
Rajasthan
Dungarpur District


Sample Station
Bodigama Dam, Dungarpur District, Rajasthan
Bodigama Dam
Aspur Block
Legend
Sample Station
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0 100 200 400 Meters
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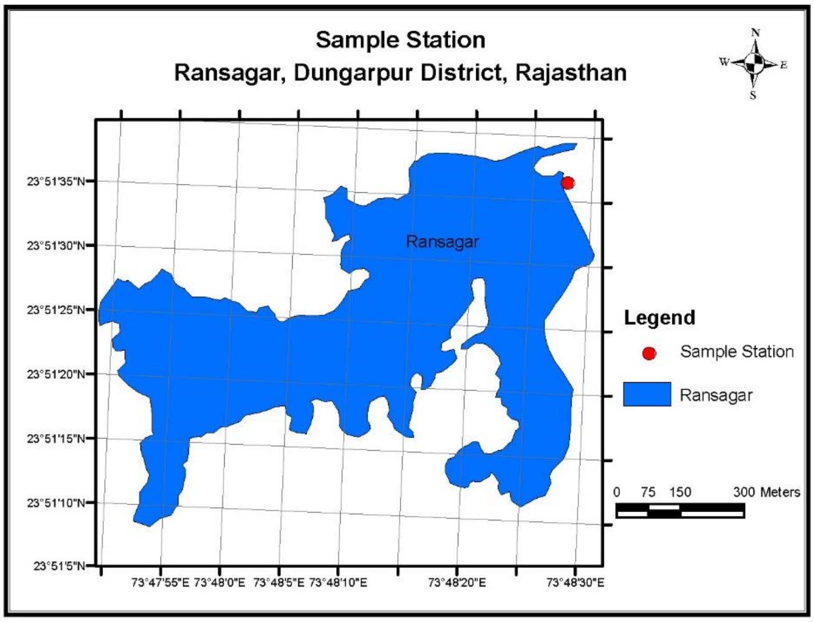
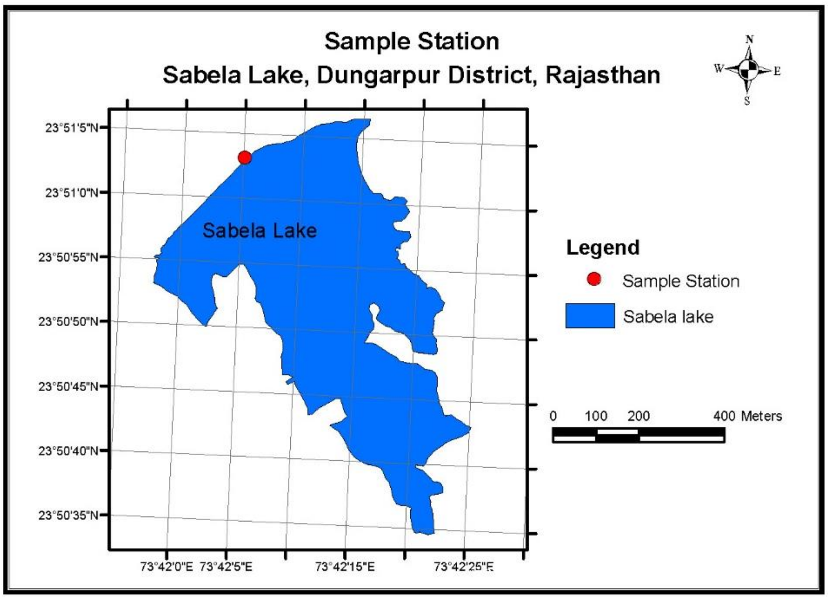
74°5'24"E
74°5'36"E





III. Methodology

Sampling Period and Frequency

Water samples were collected monthly from **March 2019 to February 2020**, covering three distinct seasons: **summer (March–June), monsoon (July–October), and winter (November–February)**. Each site was sampled from a representative location near the centre of the water body to avoid edge effects and ensure consistency.

Sample Collection and Analysis

Water samples were collected using clean, labelled polyethylene bottles (1-liter capacity) during morning hours (8:00–10:00 a.m.) to minimise diurnal variation. **In situ measurements** of temperature, pH, dissolved oxygen (DO), and transparency (Secchi disc visibility) were recorded at the sampling sites using standard portable instruments and equipment.

Physico-chemical Parameters

The following parameters were analysed following **standard methods recommended by APHA (2017)** and Trivedy & Goel (1986):

- **Temperature (°C)**: Measured using a digital thermometer on-site.
- **Transparency (cm)**: Determined using a standard Secchi disc.
- **pH**: Measured with a portable digital pH meter.
- **Dissolved Oxygen (DO, mg/L)**: Determined by the Winkler titration method.

- **Free Carbon Dioxide (CO_2, mg/L)**: Estimated by titration with standard NaOH.
- **Chloride (mg/L)**: Analyzed using the argentometric method.
- **Total Alkalinity (mg/L)**: Determined by titration with H_2SO_4 using phenolphthalein and methyl orange indicators.
- **Phosphate (mg/L)**: Measured spectrophotometrically using the stannous chloride method.
- **Nitrate (mg/L)**: Determined using the phenoldisulphonic acid method.
- **Biochemical Oxygen Demand (BOD, mg/L)**: Measured after 5 days incubation at 20°C.
- **Total Dissolved Solids (TDS, mg/L)**: Determined gravimetrically by evaporating filtered water samples.

IV. Data Analysis

Seasonal averages of all physico-chemical parameters were computed for each water body. Comparative evaluation across sites and seasons was performed to identify trends, potential sources of pollution, and ecological implications. Descriptive statistics (mean, range, standard deviation) were calculated using MS Excel. Graphs and charts were plotted for visual interpretation of seasonal variations.

V. Result

Ransagar pond

During the summer months, Ransagar Pond experienced a noticeable rise in water temperature, beginning at 28.67°C in March and peaking at 36.5°C in June, which is the highest temperature recorded during the year. As temperatures increased, visibility decreased from 78.39 cm in March to 69.2 cm in June, likely due to algal blooms and suspended solids. The pH of the water gradually decreased from 8.52 in March to 7.3 in June, indicating a shift from more alkaline to neutral conditions.

The dissolved oxygen (DO) levels also dropped from 6.25 mg/L to 4.89 mg/L during this season, consistent with the reduced oxygen-holding capacity of warmer water. Free carbon dioxide (CO_2) showed slight fluctuations, with values rising from 2.43 mg/L in March to 2.58 mg/L in June. Chloride levels hovered between 35.34 and 39.1 mg/L, showing a mild increase. Total alkalinity remained fairly stable, ranging from 144 to 150 mg/L, indicating the pond's buffering capacity.

Phosphate content steadily decreased from 1.25 mg/L in March to 0.7 mg/L in June, likely due to uptake by aquatic organisms. On the other hand, nitrate levels increased slightly from 0.64 to 0.89 mg/L, possibly due to decomposition and runoff. Biochemical oxygen demand (BOD) showed a gradual increase from 6.1 to 6.5 mg/L, suggesting growing organic pollution. Total dissolved solids (TDS) decreased from 210 mg/L in March to 197 mg/L in June, possibly due to biological uptake and dilution effects.

With the arrival of the monsoon season, water temperature dropped from 29.31°C in July to 27°C in October, as rainfall cooled the pond. Visibility continued to decline, going from 64.85 cm in July to 57.41 cm in October, likely due to increased turbidity from runoff and suspended particles. The pH stayed within the neutral to slightly alkaline range, varying from 7.4 to 7.21.

Dissolved oxygen showed a slight upward trend, improving from 4.69 mg/L in July to 6.13 mg/L in October, aided by rainfall-induced aeration. Free CO_2 remained elevated, fluctuating between 2.71 and 2.08 mg/L. Chloride levels slightly declined, ranging from 38.9 to 33.9 mg/L, indicating dilution from precipitation. Total alkalinity stayed steady, from 145 to 153 mg/L, while phosphate levels continued to decline, reaching a low of 0.56 mg/L in October.

Nitrate concentrations also declined slightly during this season, from 0.71 to 0.64 mg/L. BOD hovered around 6.6 to 6.1 mg/L, indicating stable organic load. TDS levels remained relatively constant, ranging from 195 to 211 mg/L, with slight variations likely due to inflow of rainwater and biological activity.

In the winter months, the pond's water temperature dropped significantly, from 24.11°C in November to a yearly low of 17.2°C in January, before slightly rising to 23.52°C in February. Visibility improved, reaching 80.15 cm in February, the highest for the year, likely due to decreased biological activity and suspended solids.

The pH rose again, moving into more alkaline territory, from 7.84 in November to 8.44 in February. Dissolved oxygen levels peaked in winter, from 6.42 mg/L in November to 6.78 mg/L in January, due to the increased solubility of oxygen in colder water. Free CO_2 remained relatively low and stable, between 2.14 and 2.48 mg/L.

Chloride levels remained within a narrow range of 32.4 to 38.4 mg/L, and total alkalinity showed a slight downward trend, from 148 to 141 mg/L. Phosphate content reached its lowest level in January (0.3 mg/L), indicating minimal biological productivity, before rising again in February (1.22 mg/L). Nitrate values remained fairly stable around 0.55 to 0.61 mg/L.

BOD gradually declined from 5.9 mg/L in November to 5.7 mg/L in January, reflecting reduced microbial activity in cold temperatures. TDS values also decreased over this period, falling from 199 mg/L in November to 190 mg/L in February.

Bodigama pond

During the summer months (March to June), water temperature peaked, reaching up to 36.3°C in June, reflecting intense solar radiation. This period also showed declining water transparency, dropping from 79.04 cm in March to 69.8 cm in June, likely due to increased algal growth and suspended particles. The pH remained alkaline, decreasing slightly from 8.84 in March to 7.7 in June. Dissolved oxygen (DO) levels declined from 6.2 to 4.8 mg/L, indicating higher metabolic activity and possibly organic decomposition. Meanwhile, free CO_2 and chloride levels fluctuated slightly but remained elevated, with free CO_2 ranging from 2.4 to 2.62 mg/L and chloride from 36.3 to 39.5 mg/L. Nutrients like phosphate and nitrate showed a decreasing trend, while BOD and TDS remained relatively high, suggesting increased biological activity and organic load.

In the monsoon season (July to October), rainfall and runoff likely influenced the water chemistry. Temperature dropped gradually to 27.3°C in October, while visibility decreased further to 57.89 cm, indicating increased turbidity from surface runoff. pH dropped to 7.2 in October, reflecting a slightly more neutral condition. DO increased from July to October (4.6 to 6.1 mg/L), possibly due to wind-induced mixing and reduced microbial respiration. Free CO_2 levels peaked in August and September (up to 2.9 mg/L), and chloride values varied moderately. Total alkalinity remained stable, while phosphate and nitrate concentrations decreased, potentially due to dilution and uptake by aquatic vegetation. BOD and TDS values showed minor fluctuations, with TDS peaking at 214 mg/L in October.

Winter months (November to February) brought a notable drop in temperature, reaching a low of 18.01°C in January. Visibility increased (up to 78.51 cm in February), possibly due to lower biological activity and sedimentation. pH rose again to more alkaline values, reaching 8.54 in February. DO levels were high, ranging from 6.4 to 6.7 mg/L, and free CO_2 decreased slightly, reflecting reduced respiration and decomposition. Chloride and total alkalinity remained consistent, while nutrient concentrations like phosphate and nitrate showed a slight rise in February, indicating possible buildup during the dry season. BOD and TDS decreased slightly, suggesting improved water quality during the cooler months.

Sabela pond

During the summer months, the pond experienced the highest water temperatures, rising from 29°C in March to a peak of 35.9°C in June. Depth of visibility gradually decreased, indicating possible algal growth or turbidity with rising temperatures. The pH remained slightly alkaline (7.9–8.9), while dissolved oxygen (DO) showed a decreasing trend from 6.3 to 5.2 mg/L, possibly due to increased microbial activity. Free CO_2 slightly increased, and total alkalinity showed a mild upward trend. Phosphate levels were relatively high (0.7–1.27 mg/L), as were nitrate levels, suggesting nutrient enrichment. Biological Oxygen Demand (BOD) and Total Dissolved Solids (TDS) remained moderately high, with BOD increasing slightly over the months.

In the monsoon season, water temperature dropped (31.8°C in July to 27.3°C in October), and visibility continued to decrease, reaching a low of 57.49 cm in October, likely due to rainwater inflow and suspended solids. pH values dropped slightly (7.3–7.7), indicating a more neutral trend. DO levels fluctuated, reaching a low of 4.8 mg/L in July before recovering to 6.0 mg/L by October. Free CO_2 peaked during this period (up to 2.92 mg/L), possibly due to increased decomposition. Chloride and alkalinity remained fairly stable, while phosphate and nitrate concentrations decreased steadily, possibly due to dilution. BOD remained around 6.3–6.7 mg/L, and TDS fluctuated mildly.

In winter, the pond's water temperature dropped further, reaching a minimum of 17.95°C in January before rising slightly in February. Visibility improved, peaking in February at 78.1 cm, indicating clearer water. The pH rose again (7.8–8.6), and DO levels were consistently high (6.3–6.6 mg/L), suggesting better oxygenation. Free CO_2 was relatively stable. Chloride and total alkalinity decreased slightly, while phosphate dropped to as low as 0.44 mg/L in January before spiking to 1.36 mg/L in February. Nitrate levels declined to 0.53–0.57 mg/L. BOD showed a declining trend from 5.8 to 5.5 mg/L, indicating reduced organic pollution, and TDS also reduced slightly.

During summer, **all three ponds** exhibited elevated temperatures due to intense solar radiation:

Temperature peaked at **36.5°C in Ransagar**, **36.3°C in Bodigama**, and **35.9°C in Sabela**, reflecting high evaporation and heat accumulation. **Visibility** declined across all sites: from **78.39 cm to 69.2 cm in Ransagar**, **79.04 cm to 69.8 cm in Bodigama**, and a similar downward trend in Sabela, likely due to algal blooms and increased turbidity. **pH** values remained alkaline but showed a decreasing trend: from **8.52 to 7.3 in Ransagar**, **8.84 to 7.7 in Bodigama**, and **7.9 to 8.9 in Sabela**, indicating slight acidification with rising biological activity. **Dissolved Oxygen (DO)** decreased significantly in all ponds: from **6.25 to 4.89 mg/L (Ransagar)**, **6.2 to 4.8 mg/L (Bodigama)**, and **6.3 to 5.2 mg/L (Sabela)**, reflecting reduced oxygen solubility and increased microbial respiration. **Free CO_2** showed mild fluctuations, ranging from **2.4 to 2.62 mg/L** in all sites, consistent with respiratory activity. **Chloride** concentrations increased slightly, with values in the **35–39.5 mg/L** range, possibly due to concentration effects from evaporation. **Total Alkalinity** remained fairly stable across all sites, indicating strong buffering capacity. **Phosphate and Nitrate** levels declined steadily at all locations, likely due to uptake by plankton and macrophytes. **BOD** increased in all ponds, reaching up to **6.5–6.7 mg/L**, indicating rising organic load. **TDS** fluctuated mildly but stayed within the **moderate-high range** (around **190–214 mg/L**), suggesting concentration effects and biological uptake.

Rainfall and runoff during monsoon led to significant hydro chemical changes: **Temperature** decreased slightly in all ponds: to **27°C in Ransagar**, **27.3°C in Bodigama**, and **27.3°C in Sabela**, as precipitation cooled the water bodies. **Visibility** declined further due to suspended solids from runoff: dropping to **57.41 cm in Ransagar**, **57.89 cm in Bodigama**, and **57.49 cm in Sabela**. **pH** became more neutral, falling to **7.21–7.2**, likely due to dilution of alkaline substances. **DO** increased across sites, with **Ransagar and Bodigama reaching over 6.1 mg/L**, and **Sabela recovering to 6.0 mg/L**, aided by rainfall-induced mixing. **Free CO_2** peaked during this season, especially in **Sabela (up to 2.92 mg/L)** and was relatively high in the other two, due to decomposition and reduced photosynthesis. **Chloride** levels decreased slightly due to dilution from rainfall, ranging between **33–39 mg/L**. **Total Alkalinity** remained stable or showed minor fluctuations. **Phosphate and Nitrate** continued to decrease across all ponds, possibly due to uptake and dilution. **BOD** remained moderately high, around **6.1–6.7 mg/L**, indicating sustained organic matter input. **TDS** fluctuated mildly, peaking in **Bodigama (214 mg/L)** due to runoff carrying dissolved solids.

Winter brought about cooler temperatures and improved water quality: **Temperature** dropped significantly: to **17.2°C (Ransagar)**, **18.01°C (Bodigama)**, and **17.95°C (Sabela)**, the lowest recorded during the year. **Visibility** improved markedly: **80.15 cm in Ransagar**, **78.51 cm in Bodigama**, and **78.1 cm in Sabela**, due to reduced algal growth and sedimentation. **pH** increased again towards alkaline levels: reaching **8.44–8.54**, as photosynthetic activity resumed and CO_2 was consumed. **DO** levels peaked in all ponds: up to **6.78 mg/L (Ransagar)**, **6.7 mg/L (Bodigama)**, and **6.6 mg/L (Sabela)**, due to cold water's higher oxygen-holding capacity. **Free CO_2** remained low and stable across sites. **Chloride and Alkalinity** showed minimal variation, generally within stable ranges. **Phosphate** content hit seasonal lows in **January** at all sites (e.g., **0.3 mg/L in Ransagar**, **0.44 mg/L in Sabela**), but rebounded in February, likely due to decomposition or runoff. **Nitrate** remained stable or slightly decreased. **BOD** declined at all sites, reflecting reduced biological activity. **TDS** decreased slightly in all three ponds, indicating improved water quality.

VI. Discussion

The seasonal variation in the physico-chemical parameters of Ransagar, Bodigama, and Sabela ponds revealed distinct temporal patterns that correspond with climatic shifts and biological processes. The observed changes align with trends reported in various freshwater ecosystems across India.

Water temperature exhibited a clear seasonal pattern, peaking in summer and reaching minima in winter. Similar findings were reported by Verma and Munshi (1987), who documented elevated summer temperatures in tropical lentic systems due to increased solar insolation. Temperature not only influenced the solubility of gases but also impacted other parameters like dissolved oxygen and biochemical oxygen demand (BOD).

Dissolved oxygen (DO) was lowest during the summer months across all three sites, corresponding with the findings of Hujare (2008), who noted reduced oxygen levels during warmer periods due to heightened microbial respiration and decreased solubility. In contrast, winter saw increased DO levels due to lower temperatures and enhanced oxygen solubility, a pattern also supported by Chaurasia and Adoni (1985) in their study on Indian reservoirs.

The visibility or water transparency declined during summer and monsoon, likely due to algal blooms and runoff-induced turbidity. A similar seasonal reduction in transparency was observed by Sharma and Sarang (2004) in the water bodies of Rajasthan, emphasizing the role of suspended solids and organic matter.

pH values in all three ponds remained in the alkaline range but showed a slight decline during monsoon, aligning with findings by Trivedi and Goel (1984), who attributed such fluctuations to organic runoff and microbial activity. The post-monsoon increase in pH during winter may be due to higher photosynthetic activity and reduced CO_2 levels, as also reported by Rawat and Jakher (2002). Free carbon dioxide (CO_2) remained moderately high in monsoon and summer, which can be attributed to decomposition and organic input from runoff. Singh and Mathur (2005) similarly reported elevated CO_2 levels in monsoon due to high microbial decomposition in the Udaipur lakes. Chloride concentrations were relatively stable, with minor increases in summer likely due to evaporation. According to Saxena (1990), chloride values often rise in summer due to concentration effects, while monsoon precipitation causes dilution. This pattern was observed in the present study as well.

Total alkalinity remained within acceptable limits throughout the year, indicating the ponds' buffering capacity. Similar stability was reported by Bhowmick and Singh (1985), who studied alkaline properties in central Indian water bodies. Nutrient dynamics, particularly phosphate and nitrate concentrations, declined during summer and monsoon, indicating biological uptake by plankton and macrophytes. This observation is supported by Das and Srivastava (1956), who noted that nutrient concentrations often decrease during active biological periods due to assimilation by aquatic flora. Biochemical oxygen demand (BOD) increased during the summer, suggesting a rise in organic load and microbial activity. Kumar and Tripathi (2015) observed a similar summer spike in BOD levels in urban ponds due to enhanced decomposition and inflow of domestic sewage. Total dissolved solids (TDS) showed minor seasonal variations but remained within moderate levels. According to Kaur et al. (1996), TDS values are influenced by catchment runoff, biological activity, and evaporation—factors consistent with the fluctuations seen in the present study.

Overall, the results suggest that the limnological conditions of all three ponds are influenced primarily by seasonal changes, with summer posing the greatest stress in terms of oxygen depletion and organic load. The winter season appeared to be most favorable in terms of water quality, marked by higher DO, lower BOD, and clearer water.

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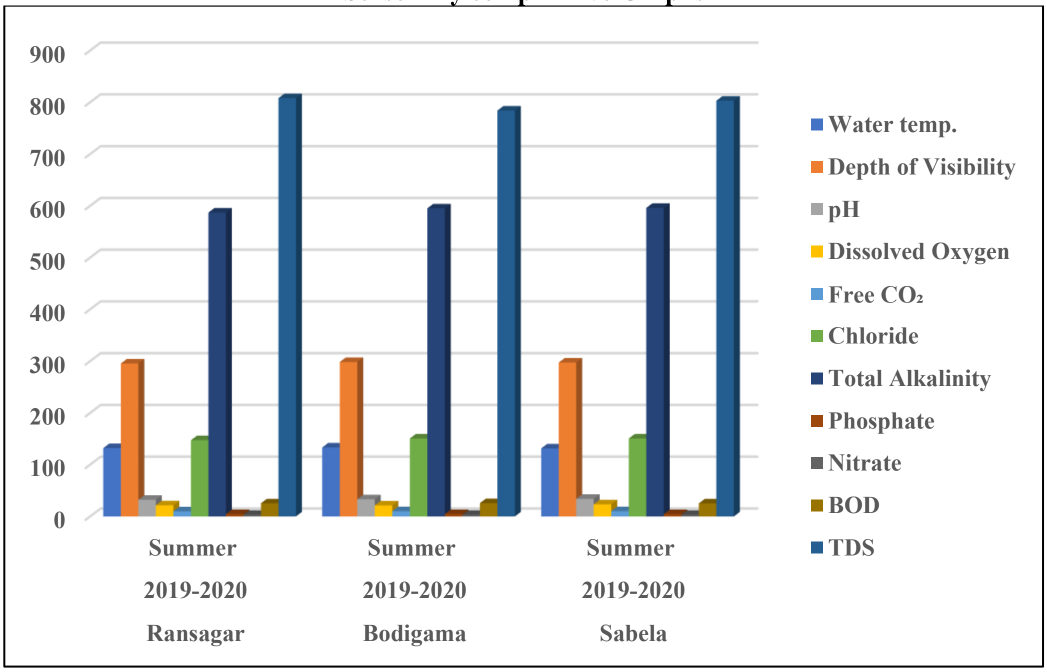
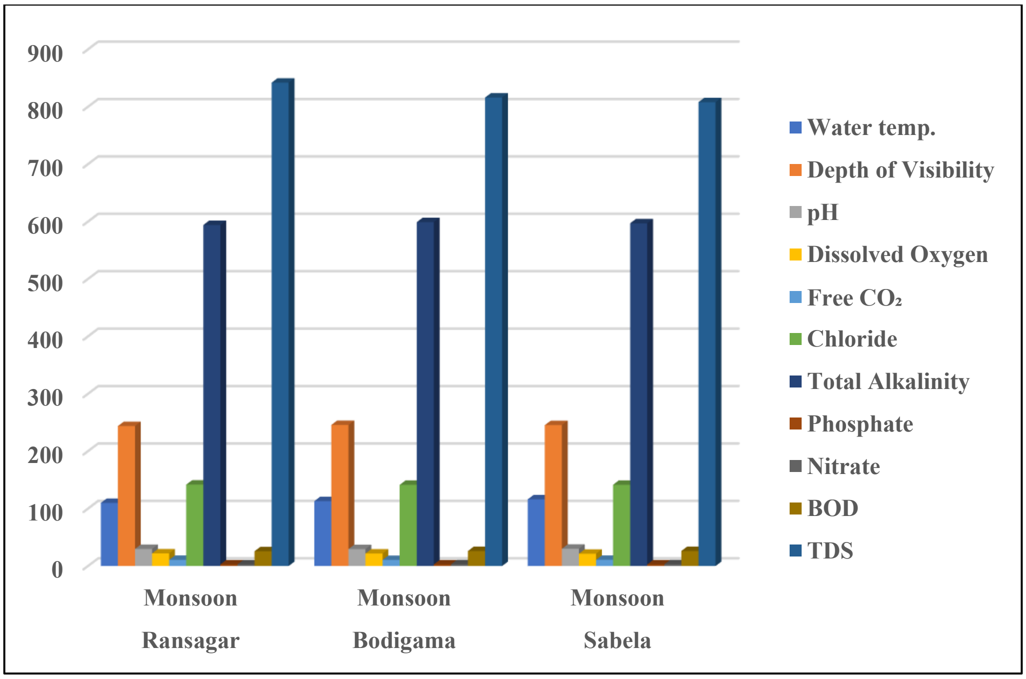
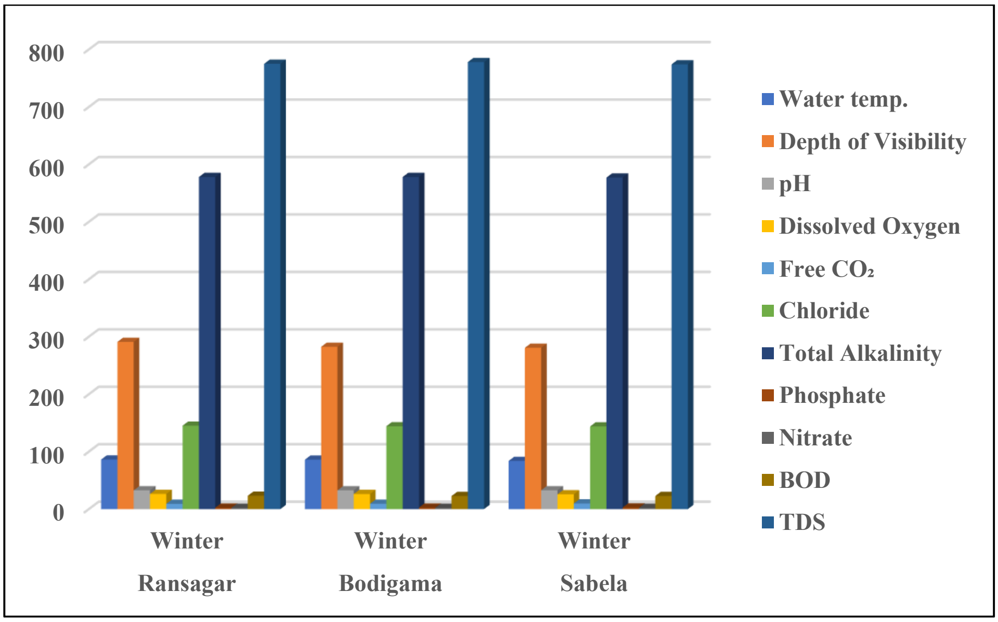
Seasonally comparative Graphs






800
700
600
500
400
300
200
100
0
Winter
Ransagar
Winter
Bodigama
Winter
Sabela
Water temp.
Depth of Visibility
pH
Dissolved Oxygen
Free CO_2
Chloride
Total Alkalinity
Phosphate
Nitrate
BOD
TDS