



PHYSICOCHEMICAL PARAMETER ANALYSIS OF WATER SAMPLES IN DIFFERENT SESSION FROM SHIVNATH RIVER DURG, CHHATTISGARH

Sonu Tiwari¹, Naresh Kumar Dewangan^{1*} and Naseem Ahmad²

¹*Shri Shankaracharya Professional University, Durg, Chhattisgarh, India*

²*Government Maharshi Valmiki College, District Kaker Bhanupratappur, Baster University*

INTRODUCTION

Freshwater aquatic insects live in rivers, streams, lakes, and reservoirs, inhabiting substrates such as sediments, detritus, macrophytes, and algae. Factors like water quality, substrate type, sediment size, water flow, organic matter, oxygen levels, and surrounding environmental conditions influence their community structure. Aquatic ecosystems, such as fish ponds, harbor a diverse range of insect species. The immature stages of these invertebrates can present substantial challenges within both freshwater and saline-influenced aquatic environments. Coleoptera, Odonata, Hemiptera, and Diptera are the most commonly known orders of water insects. Some larvae, notably dragonfly nymphs, feed on fish eggs and fry, vying with one another for limited food and space. Nonetheless, some insects act as biological control for weeds and mosquito larvae provide food for fish, augmenting sustainable fisheries establishment (Abowei and Ukoroije, 2012). Aquatic insects are critical biomarkers of ecosystem health and water quality in freshwater habitats. (Magurran, 2013). Aquatic insects are critical biomarkers of ecosystem health and water quality in freshwater habitats. This extensive diversity stems from the distinct genetic, structural, and operational characteristics that various insect types have developed to successfully acclimate to the complex and ever-changing habitats they inhabit (Sollai & Solari, 2022).

Water sample collection:

The 10 L water samples were collected from 3 different spots (3 replicates) of river in each session. The water sample were collected from Anjora and Mahamara in three different session winter, summer and rainy. The shallow and deep water were both collected for examine water quality parameter. Water sample were immediately transfer to laboratory for further examination.

Physicochemical Parameters:

The water quality parameters were analyzed according APHA (1999), Shrivastava et al., (2022) and Shanker R., et al (2020) Standard Operating Procedure on Ground Water Quality Data Analysis by central

ground water board, Ministry of Jal Shakti, India.

RESULTS

Comparative water-quality results:

pH:

The pH values were near neutral to slightly alkaline at both sampling sites over the course of the study. At Anjora, pH increased slightly (from 7.35 in winter) to 7.39 in summer before dropping to 7.30 in the rainy season. Similar observations were made at Mahamara, where pH ranged between 7.34 (winter), 7.46 (summer) and 7.26 (rainy season) (Figure 1.1).

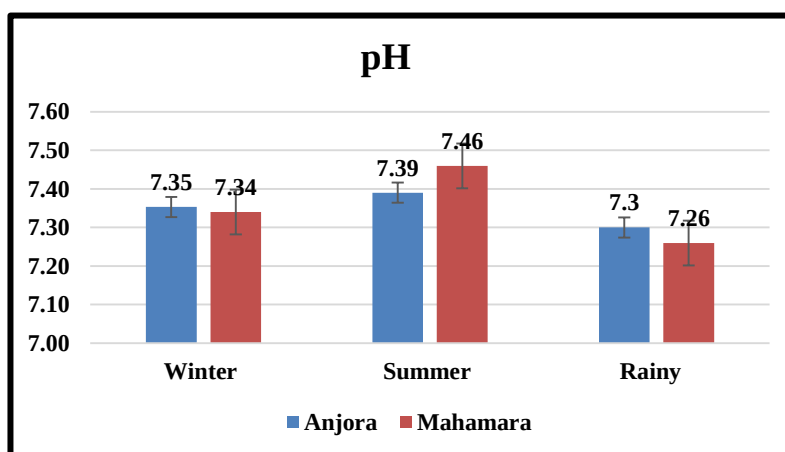


Figure 1.1: Sessional variation in pH at Anjora and Mahamara Sampling Site.

Temperature:

The values recorded for temperature revealed a distinct seasonal pattern at both sites with high temperatures recorded during summer. At Anjora, temperature values ranged between 21.00°C, 33.66°C, and 28.33°C in winter, summer and rainy season, respectively. Similar values were recorded at Mahamara (22.00°C, 33.66°C, 28.33°C) (Figure 1.2).

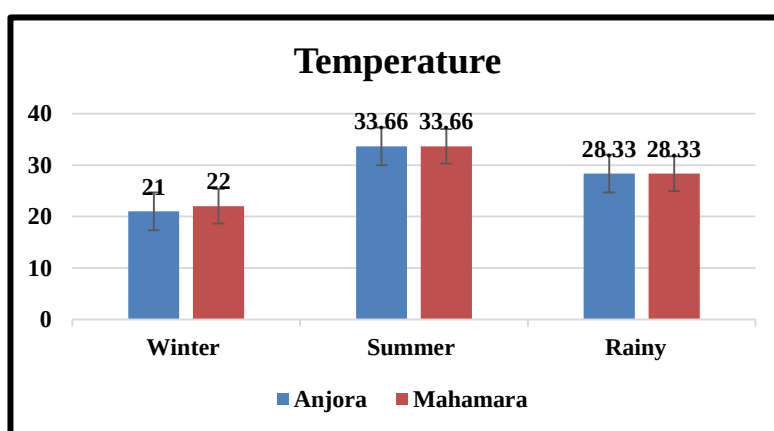


Figure 1.2: Sessional variation in temperature at Anjora and Mahamara Sampling Site

Conductivity:

The values of conductivity were highest in winter at Anjora and Mahamara (449.67 and 444.33 respectively). At Anjora, conductivity decreased gradually from winter (449.67) to summer (438.66) before dropping to 427.00 in rainy season. At Mahamara, conductivity increased slightly during summer (from 444.33 in winter to 449.00 in summer) before dropping sharply to 416.00 in rainy season (Figure 1.3).

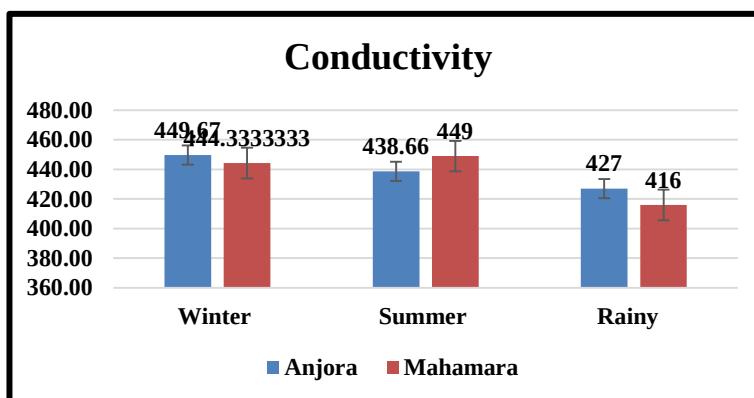


Figure 1.3: Sessional variation in conductivity at Anjora and Mahamara Sampling Site

Total dissolved solids:

The values of TDS recorded were generally lower in the rainy season and higher in summer at both sampling sites. At Anjora, for instance, the values ranged between 349.33 (winter), 330.66 (summer), and 315.66 (rainy season). In Mahamara, the corresponding values were 349.00, 347.00, 327.66 (Figure 1.4).

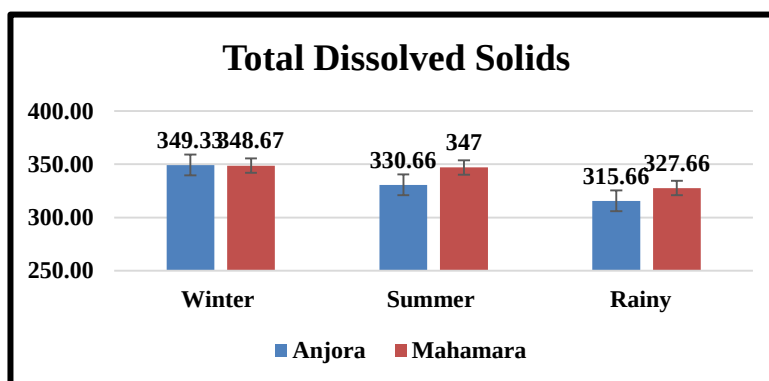


Figure 1.4: Sessional variation in total dissolved solids at Anjora and Mahamara Sampling Site

Total solids:

The values of total solids recorded at both sampling sites increased considerably during summer from their values in winter. At Anjora, for instance, the value was 300.67 in winter, 366.00 in summer and 361.00 in rainy season. Similar values were recorded in Mahamara with the value ranging between approximately 299.67 (winter), 382.00 (summer) and 377.33 (rainy season) (Figure 1.5).

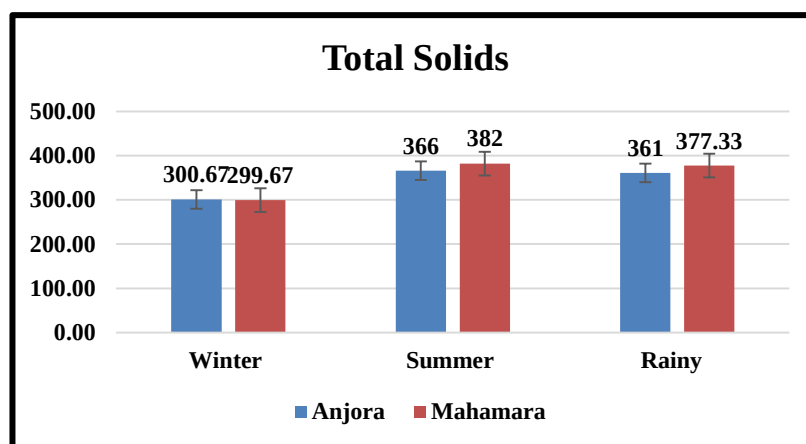


Figure 1.5: Sessional variation in total solids at Anjora and Mahamara Sampling Site

Suspended solids:

The values of suspended solids recorded were generally similar between the two sampling sites both in summer and winter. Anjora, for instance, registered 48.67 in winter and 35.33 in summer whereas in Mahamara the corresponding values were 50.33 and 35.00 (Figure 1.6).

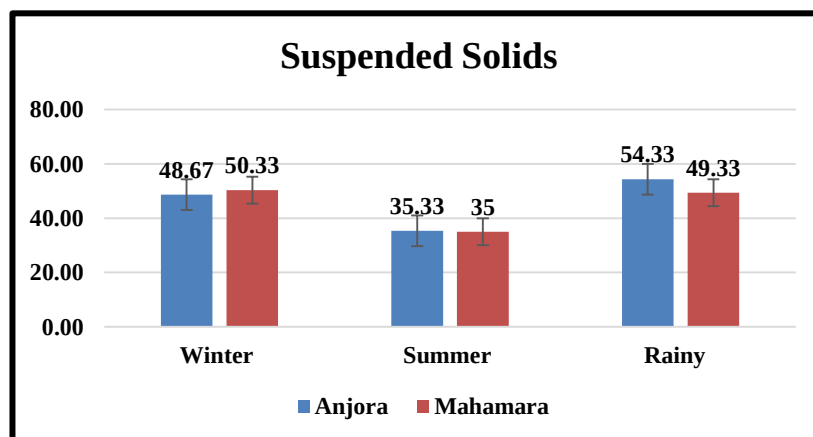


Figure 1.6: Sessional variation in suspended solid at Anjora and Mahamara Sampling Site

Dissolved oxygen:

The two sampling sites registered different patterns in the DO values with Anjora showing a slight increase in DO values from winter to summer before stabilizing in the rainy season. In Anjora, DO values, for instance, ranged between 6.17 (winter), 6.23 (summer) and 6.23 (rainy season) (Figure 1.7).

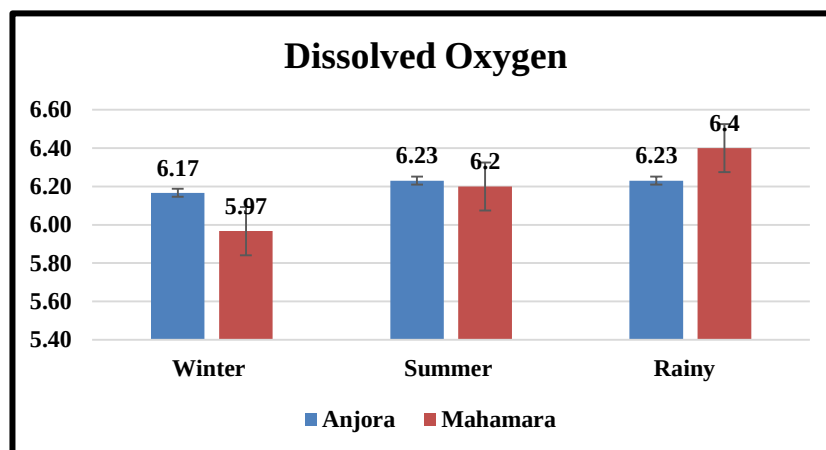


Figure 1.7: Sessional variation in suspended dissolve oxygen at Anjora and Mahamara Sampling Site

Chlorides:

The values of chlorides increased from winter to summer in both sampling sites before stabilizing in the rainy season. At Anjora, for instance, the values ranged between 39.67 (winter), 50.33 (summer) and 46.33 (rainy season). Similar values were recorded in Mahamara (approximately 40.00, 51.66, 51.00) (Figure 1.8).

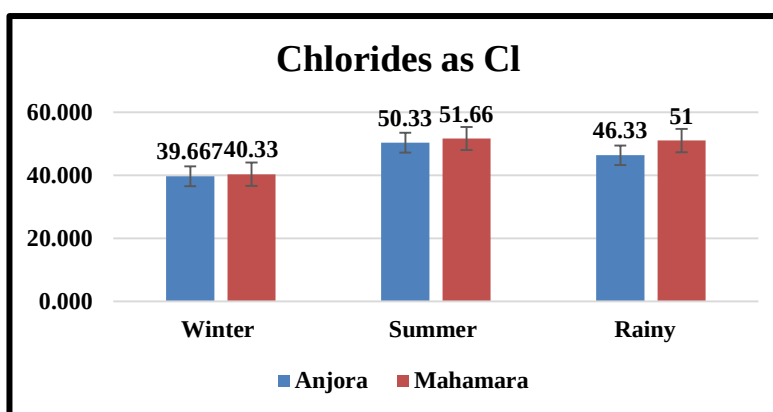


Figure 1.8: Sessional variation in chlorids at Anjora and Mahamara Sampling Site

Biochemical oxygen demand:

The values of BOD increased from winter to summer in both sampling sites but decreased slightly in the rainy season. In Anjora, for instance, the value ranged between approximately 2.45 (winter), 2.70 (summer) and 2.50 (rainy season). In Mahamara the corresponding values were 2.27, 2.70, 2.66 (Figure 1.9).

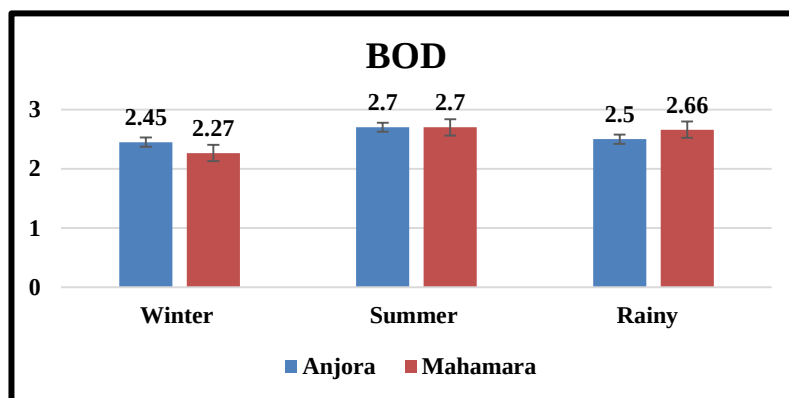


Figure 1.9: Sessional variation in BOD at Anjora and Mahamara Sampling Site

Chemical oxygen demand:

The values of COD increased considerably in summer at both sampling sites. Anjora, for instance, registered 31.42 (winter), 47.45 (summer) and 36.64 (rainy season). In Mahamara the corresponding values were approximately 32.00, 46.93, 40.38 (Figure 1.10).

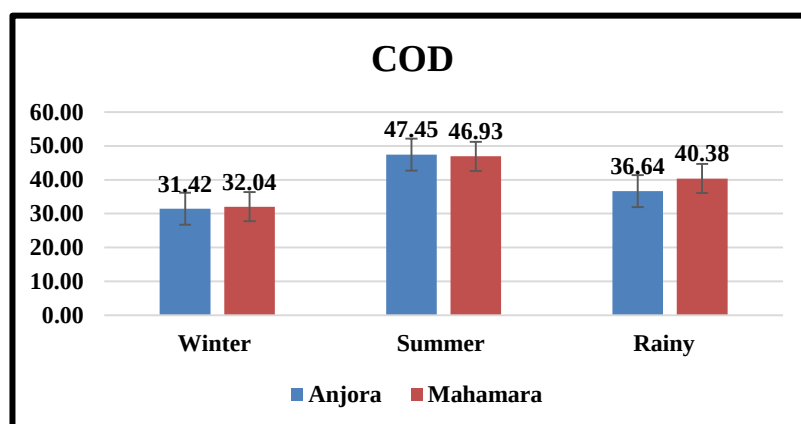


Figure 1.10: Sessional variation in COD at Anjora and Mahamara Sampling Site

Total alkalinity:

The values of total alkalinity increased gradually during the study period at both sampling sites. At Anjora, for instance, the values ranged between 56.67 (winter), 60.00 (summer) and 63.33 (rainy season). In Mahamara, the values ranged between 58.67 (winter), approximately 62.00 (summer) and 62.00 (rainy season) (Figure 1.11).

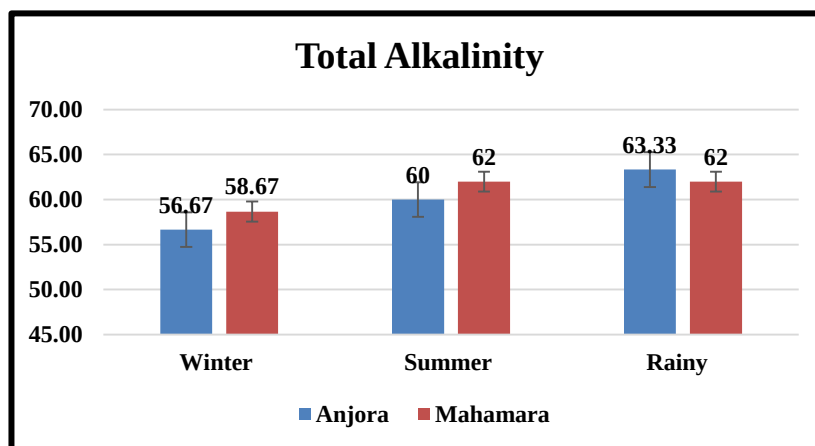


Figure 1.11: Sessional variation in total alkalinity at Anjora and Mahamara Sampling Site

Total hardness:

The values of total hardness varied throughout the study period at both sampling sites. At Anjora, for instance, the values ranged between 77.33 (winter), 71.33 (summer) and 72.66 (rainy season). In Mahamara the corresponding values were 80.00, 72.00, 76.66 (Figure 1.12).

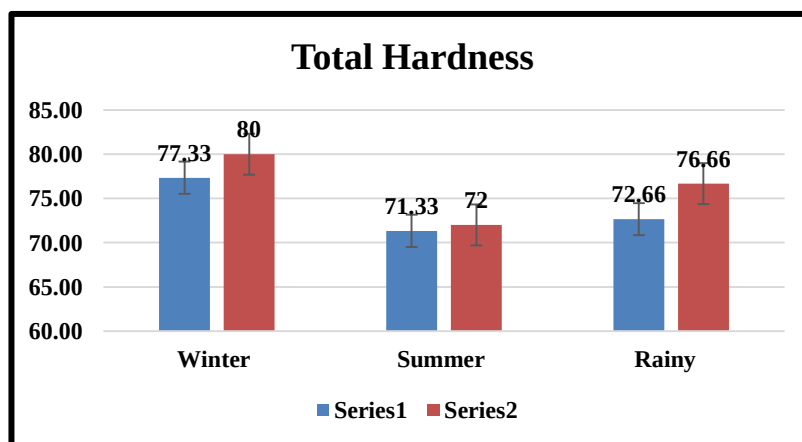


Figure 1.12: Sessional variation in total hardness at Anjora and Mahamara Sampling Site

Calcium hardness:

Calcium hardness at Anjora was almost constant throughout the study period with only marginal increase during summer. The values, for instance, ranged between 41.33 (winter), 40.66 (summer) and 40.66 (rainy season) (Figure 1.13).

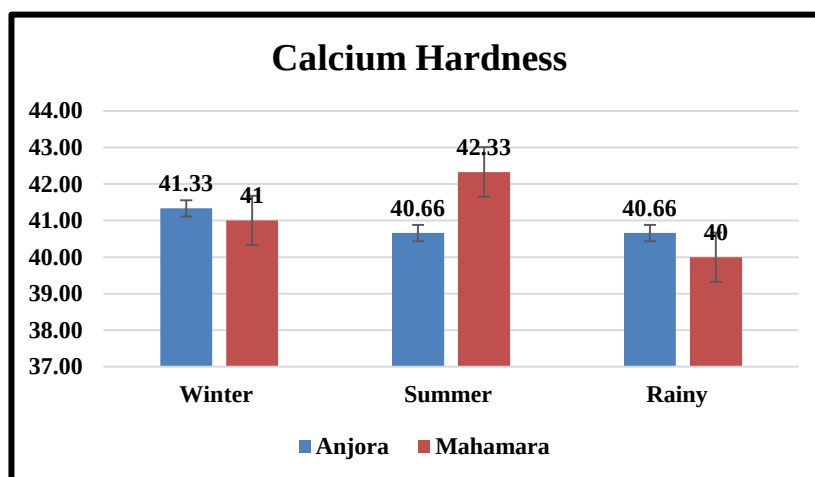


Figure 1.13: Sessional variation in calcium hardness at Anjora and Mahamara Sampling Site

Magnesium hardness:

The values of magnesium hardness varied considerably during the study period at both sampling sites with higher values recorded in winter. At Anjora, for instance, magnesium hardness ranged between 36.00 (winter), 30.66 (summer) and 35.33 (rainy season). In Mahamara the corresponding values were 40.00, 30.66, 36.66 (Figure 1.14).

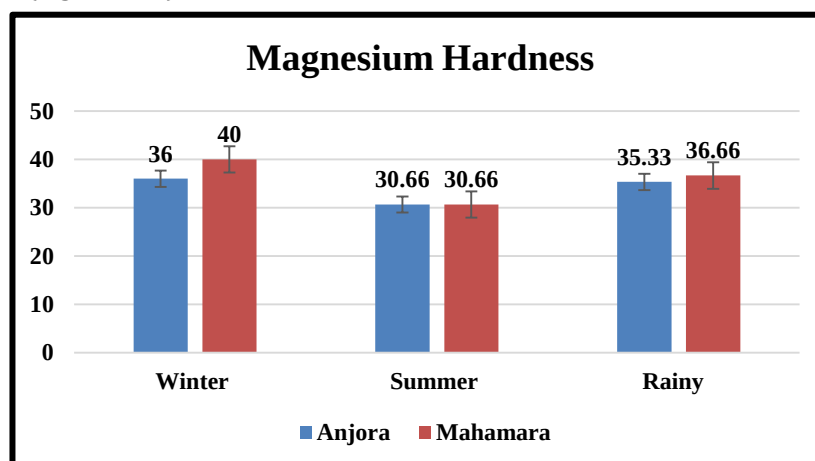


Figure 1.14: Sessional variation in magnesium hardness at Anjora and Mahamara Sampling Site

Calcium concentration:

Calcium concentration decreased slightly in summer and remained almost constant in rainy season at Anjora. The values, for instance, ranged between 16.53 (winter), 16.26 (summer) and 16.26 (rainy season). In Mahamara the values ranged between 17.00 (winter), 16.53 (summer) and 16.00 (rainy season) (Figure 1.15).

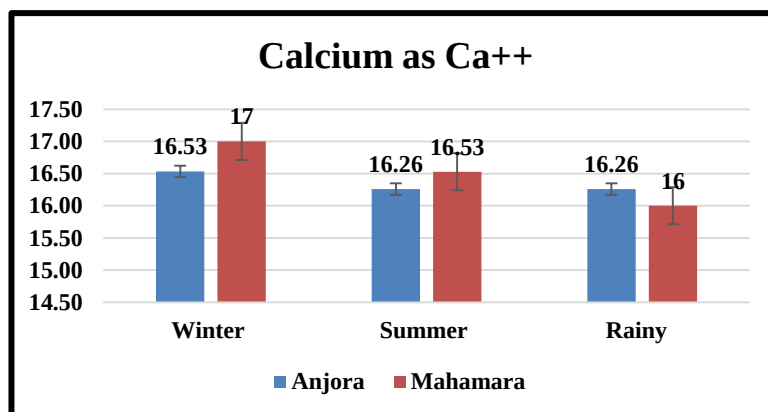


Figure 1.15: Sessional variation in calcium concentration at Anjora and Mahamara Sampling Site

Magnesium concentration:

The values of magnesium concentration varied marginally at both sampling sites with highest value recorded in winter. At Anjora, for instance, the values ranged between 8.70 (winter), 7.48 (summer) and 8.70 (rainy season). In Mahamara the values ranged between approximately 9.03, 7.80 and 8.89 (Figure 1.16).

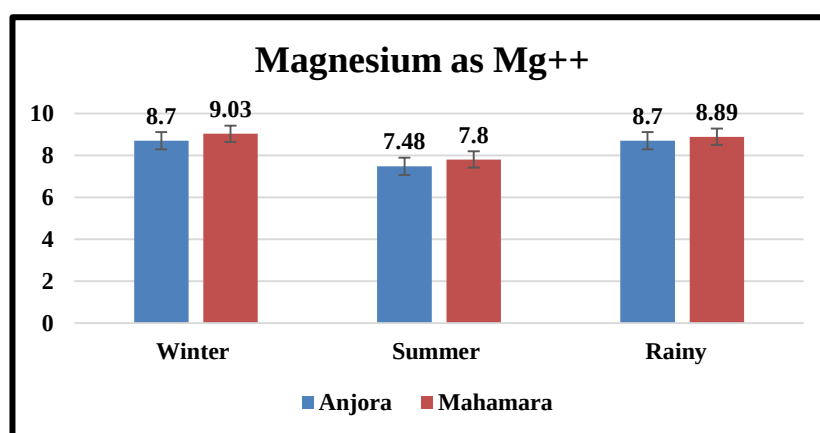


Figure 1.16: Sessional variation in magnesium concentration at Anjora and Mahamara Sampling Site

DISCUSSION

An overall comparison of the results revealed considerable seasonal variation in physicochemical characteristics of water at both Anjora and Mahamara. Temperature, total solids, chloride, BOD and COD all showed highest values in summer whereas conductivity, TDS and suspended solids declined towards the rainy season. This observation suggests that summer was a period of high temperatures in the two water bodies with consequent increase in total solids, BOD and COD. Conductivity and TDS generally declined towards the rainy season probably because of the effects of rainfall on dilution of the contents in the water. Suspended solids increased in rainy season at both sites probably because of increased contributions of such materials through runoffs, soil erosion and resuspension of bottom material.

In terms of concentrations, Mahamara registered higher concentrations of TDS, total solids, chloride, total hardness, magnesium hardness, calcium hardness, calcium and magnesium than Anjora in most cases. Mahamara also registered higher concentration of DO in rainy season whereas Anjora had higher values of suspended solids in rainy season and total alkalinity in rainy season as well.

Although most parameters showed similar patterns of variation at the two sampling sites, there were variations in the magnitude and direction of changes for several parameters. These differences in patterns of variation between Anjora and Mahamara could be explained by spatial variations in such factors as water retention, surrounding land use, drainage conditions, inflow and sediment transport processes at the two sites. As discussed earlier, however, such explanations should be proposed with caution because they are based on observations made in this study.

It can be concluded that both seasonal and spatial factors played a role in determining variations in water quality at the two sites. Summer was a period of high temperature, BOD, COD and total solids whereas rainy season was associated with increased DO and suspended solids with lower conductivity and TDS. The observed seasonal variations in physicochemical qualities of water at the two sampling sites may have influenced seasonal variations in the composition and distribution of aquatic insects at the sites.

REFERENCES

1. Abowei, J. F. N., & Ukoroije, B. R. (2012). The identification, types, taxonomic orders, biodiversity and importance of aquatic insects. *British Journal of Pharmacology and Toxicology*, 3(5), 218-229.
2. American Public Health Association (1999), American Water Works Association, Water Environment Federation. Printing - Standard Methods for the Examination of Water and Wastewater
3. Magurran, A. E. (2013). *Ecological diversity and its measurement*. Springer Science & Business Media.
4. Shanker R., et al (2020). FIELD WATER ANALYSIS MANUAL, Ministry of Jal Shakti Department of Water Resources, River Development and Ganga Rejuvenation CENTRAL WATER COMMISSION. *DO field-water-analysis-manual.pdf
5. Shrivastava et al., (2022). Standard Operating Procedure on Ground Water Quality Data Analysis, Step by step guidelines for Ground water quality data analysis, Central Ground Water Board, Department of Water Resource River Development and Ganga Rejuvenation, Ministry of Jal Shakti. Pg No (1-316). 17333891661542642909file.pdf
6. Sollai, G., & Solari, P. (2022). An overview of "insect biodiversity". *Diversity*, 14(2), 134.