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# **Study on Selected Physicochemical Parameters of Jaju Sagar Dam, Neemuch, Madhya Pradesh India**

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**ABSTRACT:** This research article deals with the study of physicochemicals of water samples collected in various seasons from February 2022 -23 2023-24 from Jaju Sagar Dam also known as Harkiyakhal water body of district Neemuch, Madhya Pradesh (India). Harkiyakhal water body provides drinking water to Neemuch. Study of parameters that affect water quality is an important criteria for evaluating the suitability of water for drinking and irrigation. Analysis of various physico-chemical characteristics like temperature, light, depth of visibility, water PH, dissolved oxygen, dissolved carbon dioxide, chloride nitrate, sulfate, Phosphate and alkalinity is very important as it directly affects the fishers and farmers. Fresh water of Ponds, lakes, water bodies as well as groundwater used for irrigation, drinking purposes depend on various chemical constituents and their concentration. Physico-chemical properties also affect the biodiversity of that water body.

Considering the importance of keeping a check on biodiversity and these parameters, samples were collected in various seasons and observations were made. Observed values were compared with standard values.

Understanding these seasonal dynamics is crucial for effective water resource management and conservation strategies. It enables the identification of critical periods of vulnerability or resilience within the dam ecosystem. Furthermore, the research provides insights into the complex interactions between physicochemical parameters and biological components, contributing valuable knowledge for sustainable environmental planning.

**KEYWORDS** – Physico-chemical Characteristics, parameters, pond water.

## **I. INTRODUCTION**

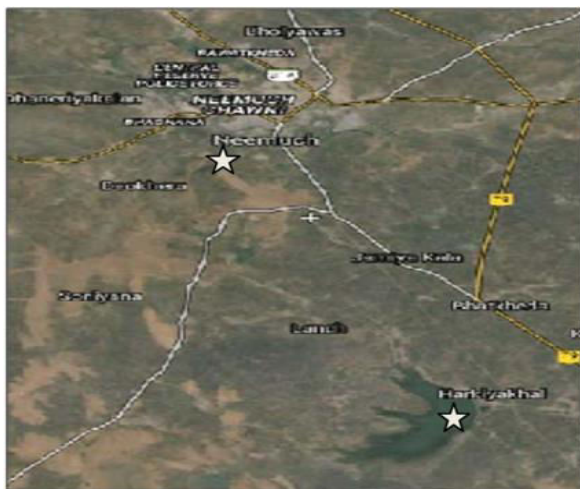
Freshwater ecology Is also called limnology it refers to the study of freshwater organisms about their environment and deals with the physical-chemical, and biological aspects of freshwater ecosystems cover about 2 percent of the earth's surface, an area of about 2-5 million km' although referred to as freshwater lakes and ponds contain a variety of chemicals referred to collectively as salts according to Burgis and Morris 1987 volume of inland saline water containing more than 3 grams of salts per liter. Is estimated to be 104x10' km' in contrast to a total volume of 125x10" km' for non-saline water fresh water of both kinds lentic and lotic has a low percentage of dissolved salts and is subjected to the influence of a wide array of physical and chemical factors. The rise and fall of these factors very frequently affect the fauna altering their number and diversity. Important factors of the freshwater environment are O<sub>2</sub>, Co<sub>2</sub>, Cl water, pH, water temp., depth of visibility, light etc.

A study was conducted on the surface and groundwater quality in the Nimach district; however, there were certain gaps in the research that needed further exploration(Amb et al., 2018). Various physico-chemical characters of pond water of selected villages of Kalanaur block of Rohtak district in Haryana were compared with WHO and Indian standards. Most of the samples were highly polluted due to higher values of conductivity, turbidity, TDS and dissolved ions and were out of the permissible limits. The results suggested that the water quality of these freshwater bodies is rapidly declining. Regularly updating the data on pond water and appointment of pond managers can help to conserve these freshwater ecosystems.

Material and method:

Study sites:

| Pond Name      | Location     | Distance              | District    |
|----------------|--------------|-----------------------|-------------|
| Jaju Sagar Dam | Harkiyakhhal | 150 km from (Udaipur) | Neemuch(mp) |



Neemuch is a part of Ujjain division. Rajasthan Morwan dam is 24 km from Neemuch and built on Gambhiri tributary of Chambal river that supply water for irrigation and water supply to nearby Jaju sagar Dam is commonly known as Harkiyakhhal reservoir, which is a soul source of drinking water to 26 villages of Neemuch district. The Dam water is treated by Hingoria water treatment plant then sent for chlorination and then supplied to the locality.

Length: 46.03 km

Depth: 35 m

Built in: 1960

One of the main sources of drinking water for the people of Neemuch city is the Sitaram Jaju Sagar Dam, which is situated close to the town of Jiran (17 km from Neemuch) in the Neemuch District (M.P.). It's a man made dam, which was brought into existence through blocking of the water flow from the surrounding nallas, and a dam was built on it in 1961 and now it is commonly known as Jaju Sagar Dam. The dam has a catchment area of 176.12 sq. kms. The dam is a very valuable and sole source of drinking water to the residents of Neemuch. Gross storage capacity of the dam is 276 MCFT (when water level rises up to 21 ft). Present water supply was designed in 1955 for the population of 50,000 up to 1975. The total water demand of the city for domestic use is 7.55 mld. (Million liters per day). The dam has a yield of 12,280 mld for the year of minimum rainfall i.e.14 inches.

### III. METHODOLOGY

I. Methodology of Water Quality Analysis For the collection and analysis of above stated water quality parameters standard methods such as APHA (1989) will be following:

- Water Temperature: Temperature will be measured with the help of an ordinary thermometer in °C.
- Hydrogen ion concentration (pH): Hydrogen ion concentration of test water will be used in field electronic digital pH meters. Dissolved oxygen (D.O.): The dissolved oxygen of pond water will be determined by Winkler's Method".
- Depth of visibility: The transparency of water will be determined using a standard Secchi disc of 20 cm diameter. Two readings, one for disappearance and other for reappearance will record and the average of the two will take as the depth of visibility:

Depth of visibility (cm) = tD

Where,

D Depth of disappearance in cm

D2 Depth of reappearance in cm

(e) Chloride: Chloride will be estimated by "Mohr's Method".

(f) Nitrate : This will be analyzed by using phenol disulphonic acid (PDA) method.

(g) Phosphate : Deniges method will be followed for phosphate determination. (S.H. Yuen, et al. 1955).

(h) sulphate : Determination of sulphate by gravimetric method.

(i) Alkalinity : For estimating carbonate and bicarbonate alkalinities hydrochloric acid 0.01 N strength will be employed together with phenolphthalein and methyl orange indicators.

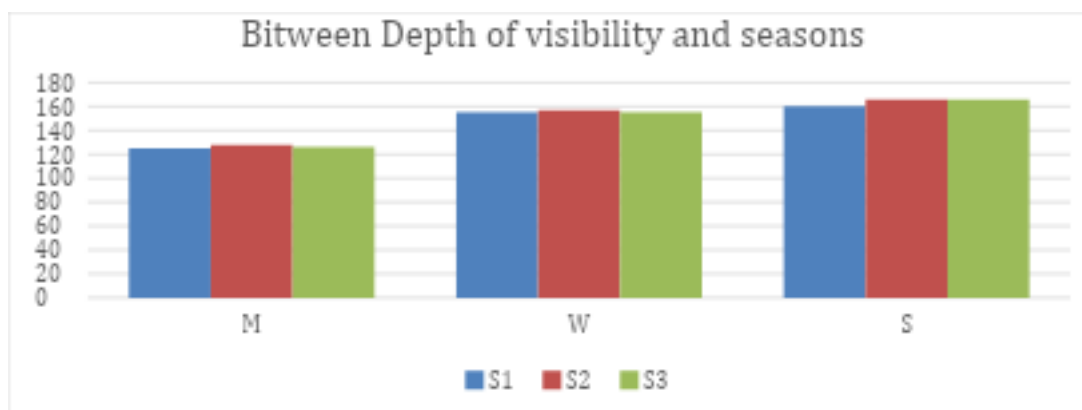
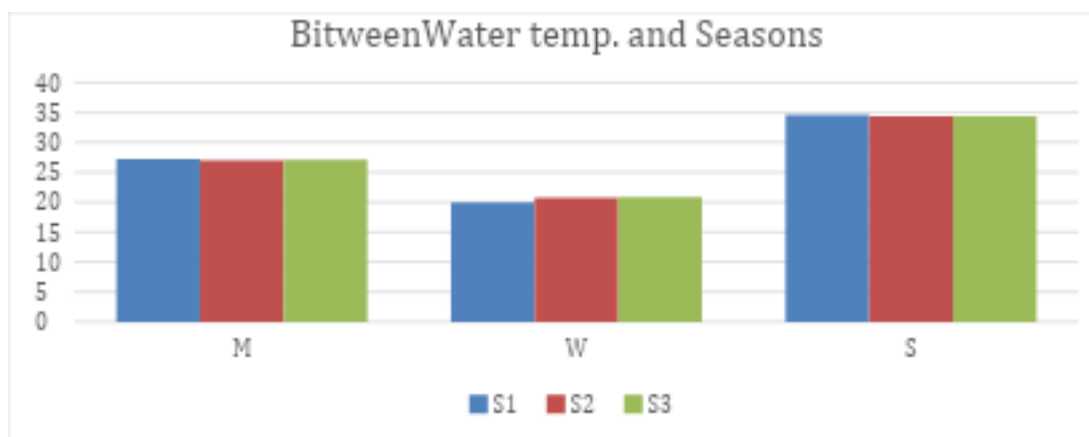
## RESULT -

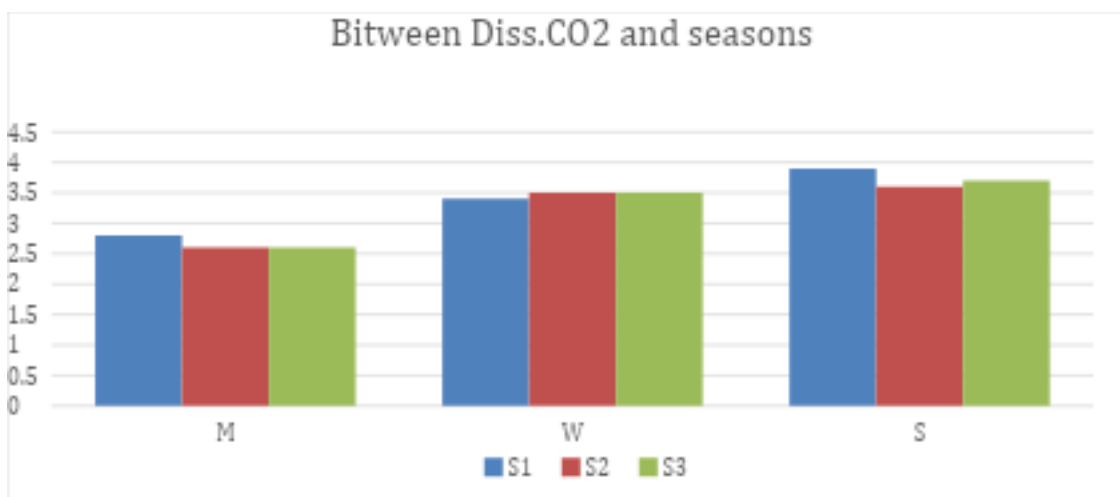
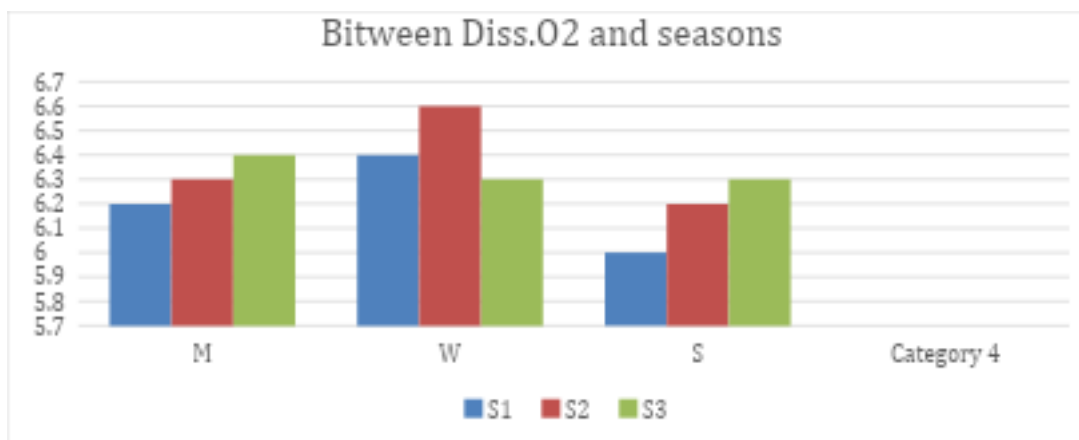
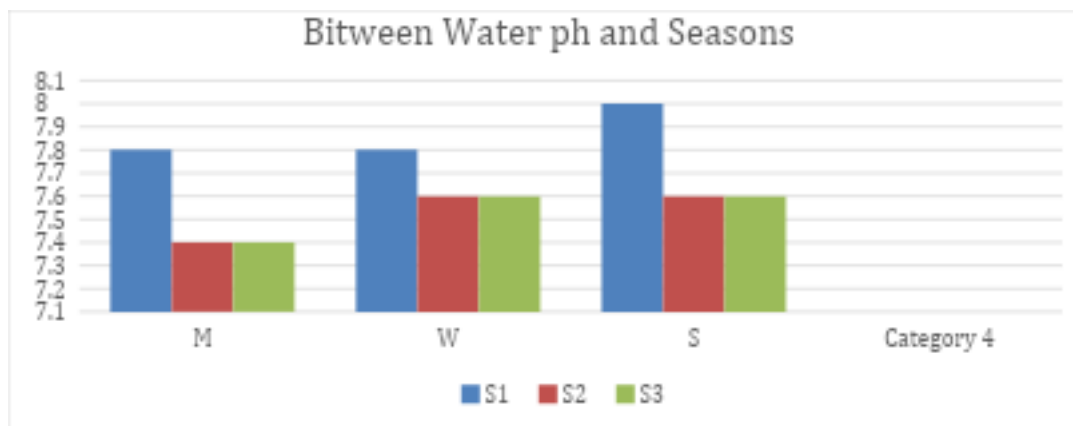
Physico-chemical parameters of Jaju Sagar Dam Neemuch during 2022-24.

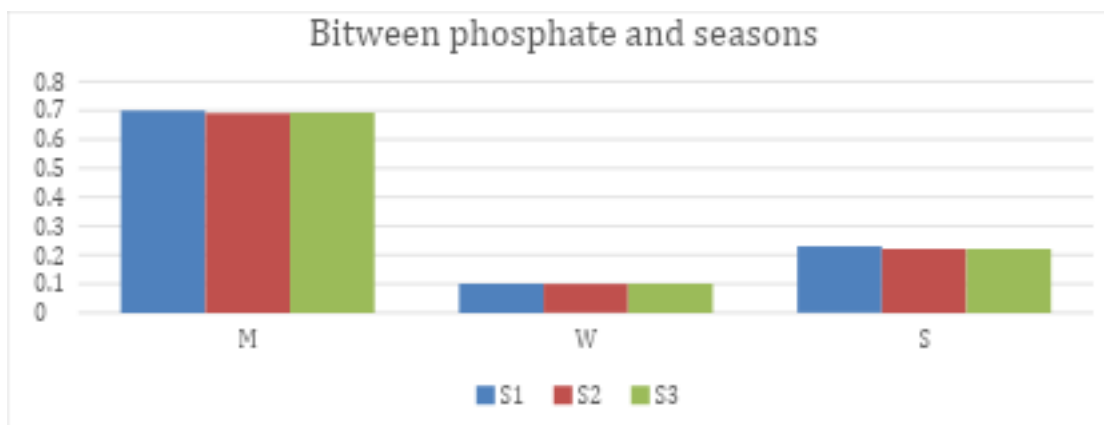
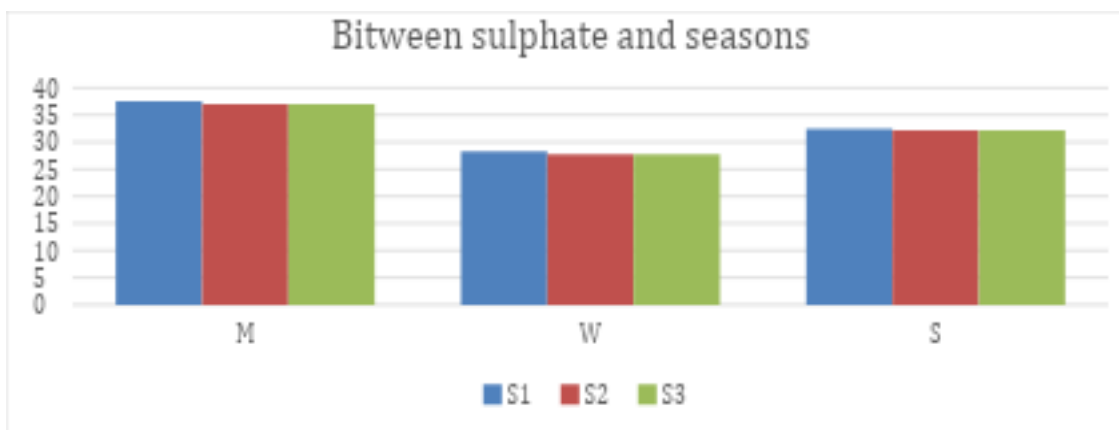
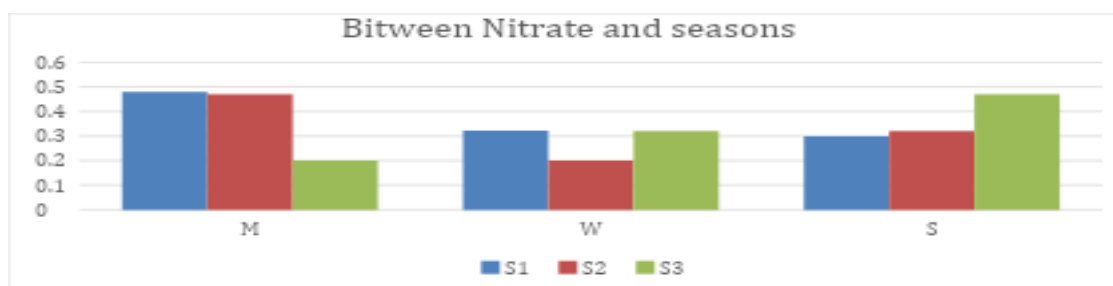
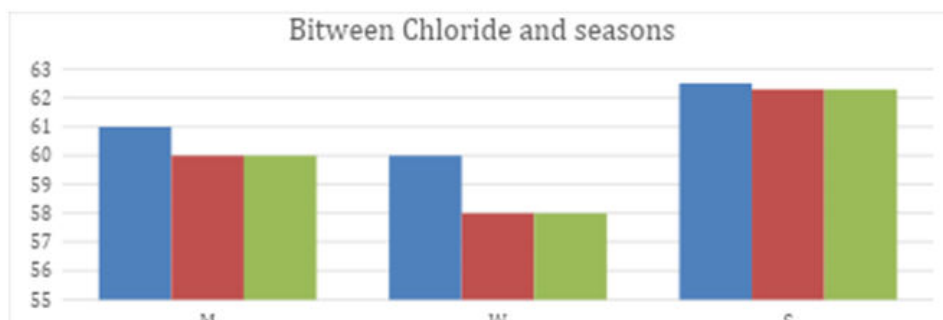
Table A-

| Parameters               | 2022-23 |       |      |       |      |       |      |       |       | Avg.  | Min. | Max.  |
|--------------------------|---------|-------|------|-------|------|-------|------|-------|-------|-------|------|-------|
|                          | M       |       |      | W     |      |       | S    |       |       |       |      |       |
|                          | S1      | S2    | S3   | S1    | S2   | S3    | S1   | S2    | S3    |       |      |       |
| Water temp.              | 27.2    | 27.0  | 27.1 | 20.8  | 20.7 | 20.8  | 34.6 | 34.4  | 34.4  | 27.4  | 20.7 | 34.6  |
| Depth of visibility (cm) | 125     | 128   | 126  | 155   | 157  | 155   | 160  | 166   | 166   | 148.6 | 125  | 166   |
| Water pH                 | 7.8     | 7.4   | 7.4  | 7.8   | 7.6  | 7.6   | 8.0  | 7.6   | 7.6   | 7.6   | 7.4  | 8.0   |
| Dis. O2 mg/lit           | 6.2     | 6.3   | 6.4  | 6.4   | 6.6  | 6.3   | 6.0  | 6.2   | 6.3   | 6.3   | 6.0  | 6.6   |
| Dis. Co2 mg/lit          | 2.8     | 2.6   | 2.6  | 3.4   | 3.5  | 3.5   | 3.9  | 3.6   | 3.7   | 3.2   | 2.6  | 3.9   |
| Chloride mg/lit          | 62      | 60    | 61   | 62.3  | 62.0 | 62.2  | 63.8 | 63.5  | 63.3  | 62.2  | 60   | 63.8  |
| Nitrate mg/lit           | 0.480   | 0.470 | 0.2  | 0.322 | 0.2  | 0.320 | 0.30 | 0.320 | 0.470 | 0.342 | 0.2  | 0.480 |
| Sulphate mg/lit          | 37.5    | 37.0  | 37.0 | 28.3  | 27.8 | 27.8  | 32.4 | 32.2  | 32.2  | 32.4  | 27.8 | 37.5  |

|                     |       |       |           |          |      |      |       |       |           |       |      |      |
|---------------------|-------|-------|-----------|----------|------|------|-------|-------|-----------|-------|------|------|
| Phosphate<br>mg/lit | 0.700 | 0.690 | 0.69<br>2 | 0.1<br>0 | 0.10 | 0.10 | 0.230 | 0.220 | 0.22<br>0 | 0.33  | 0.10 | 0.70 |
| Alkalinity<br>ppm   | 103   | 100   | 100       | 88       | 83   | 83   | 100   | 98    | 98        | 94.77 | 83   | 103  |







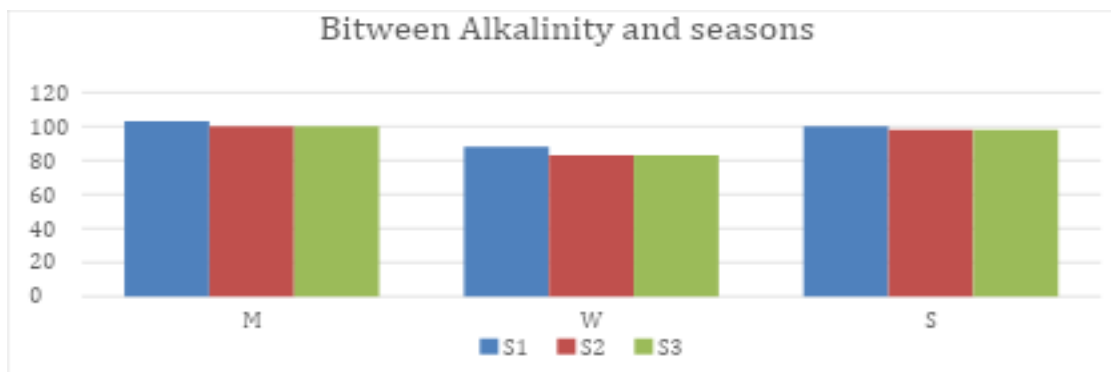
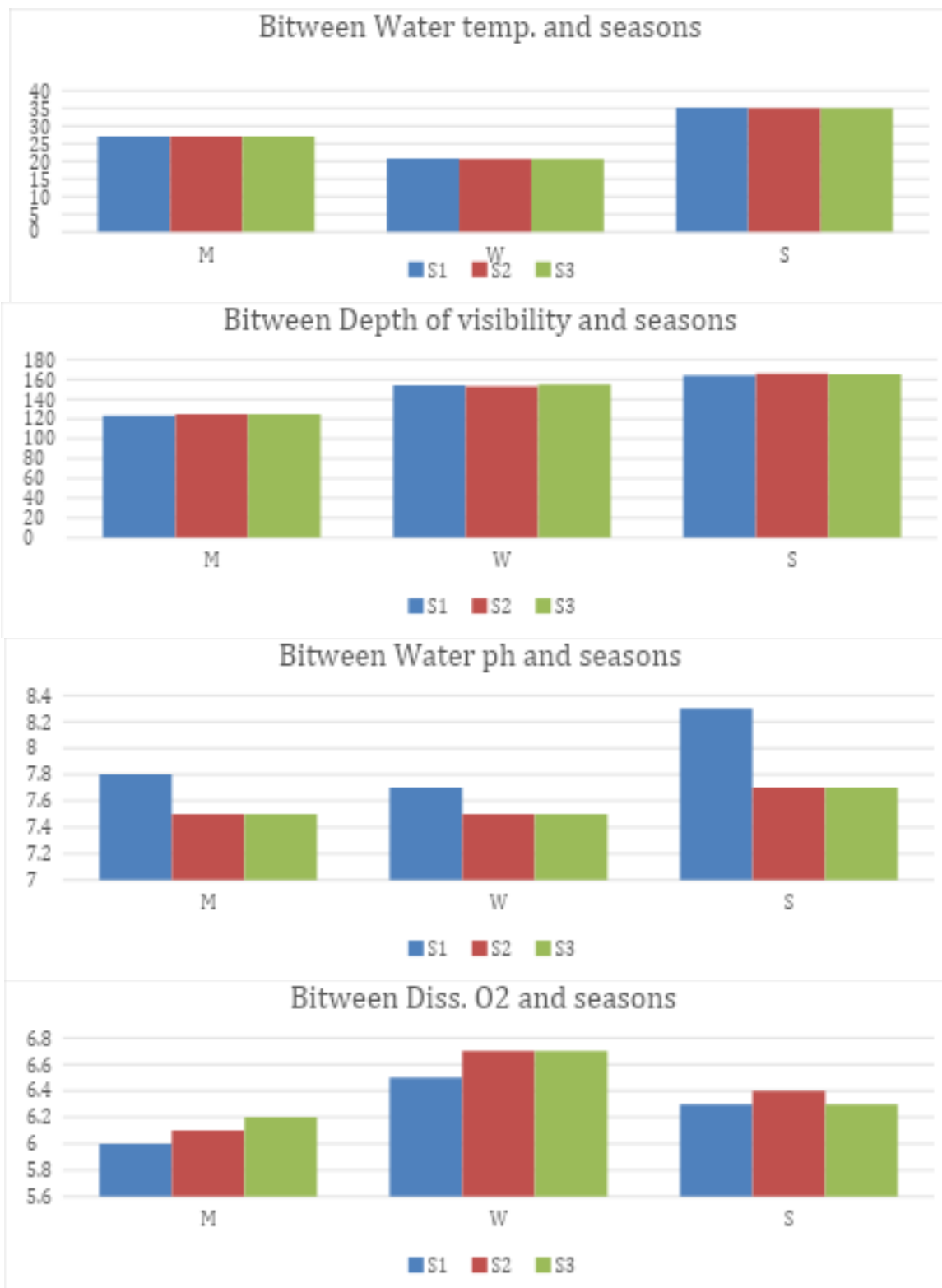
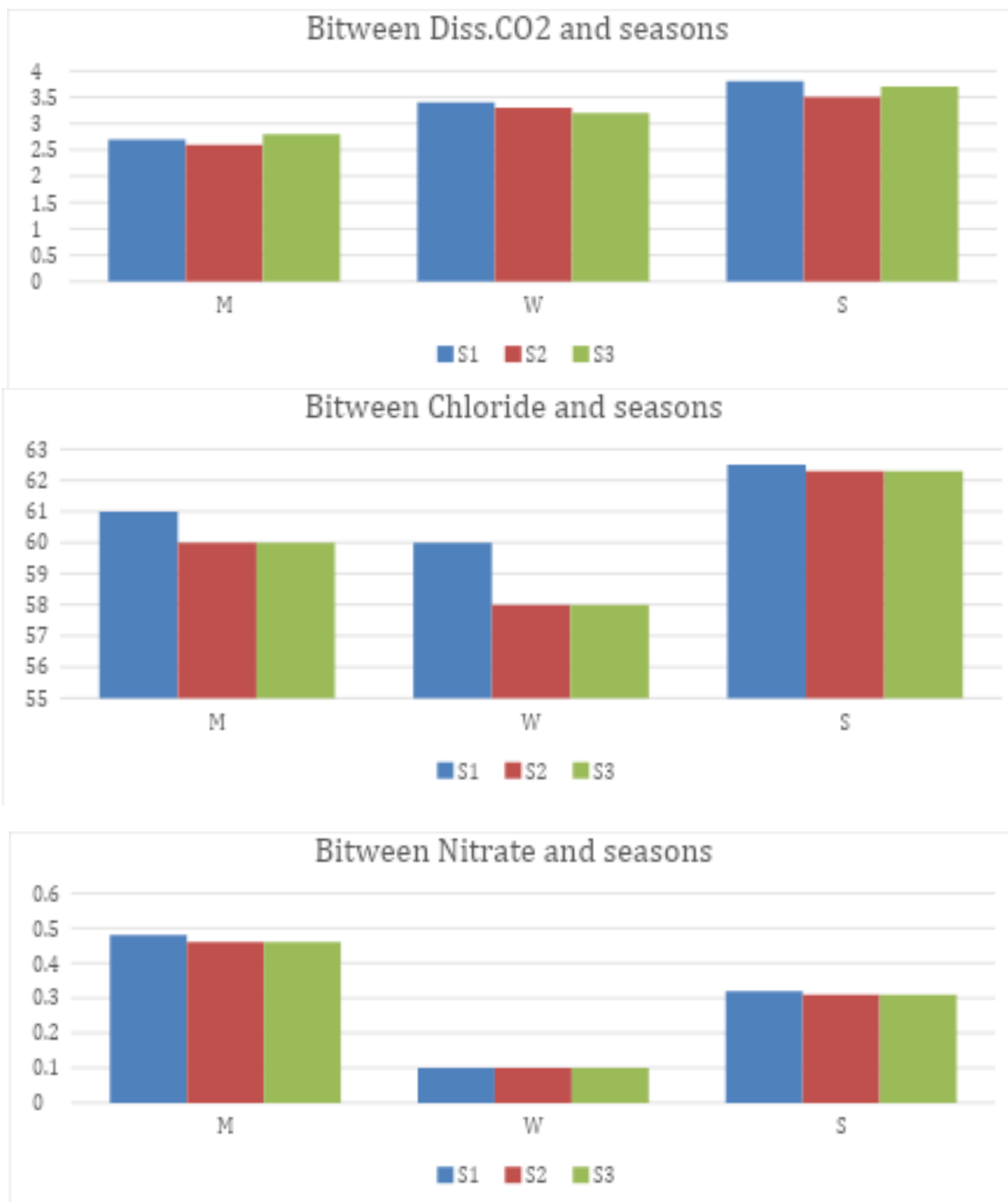


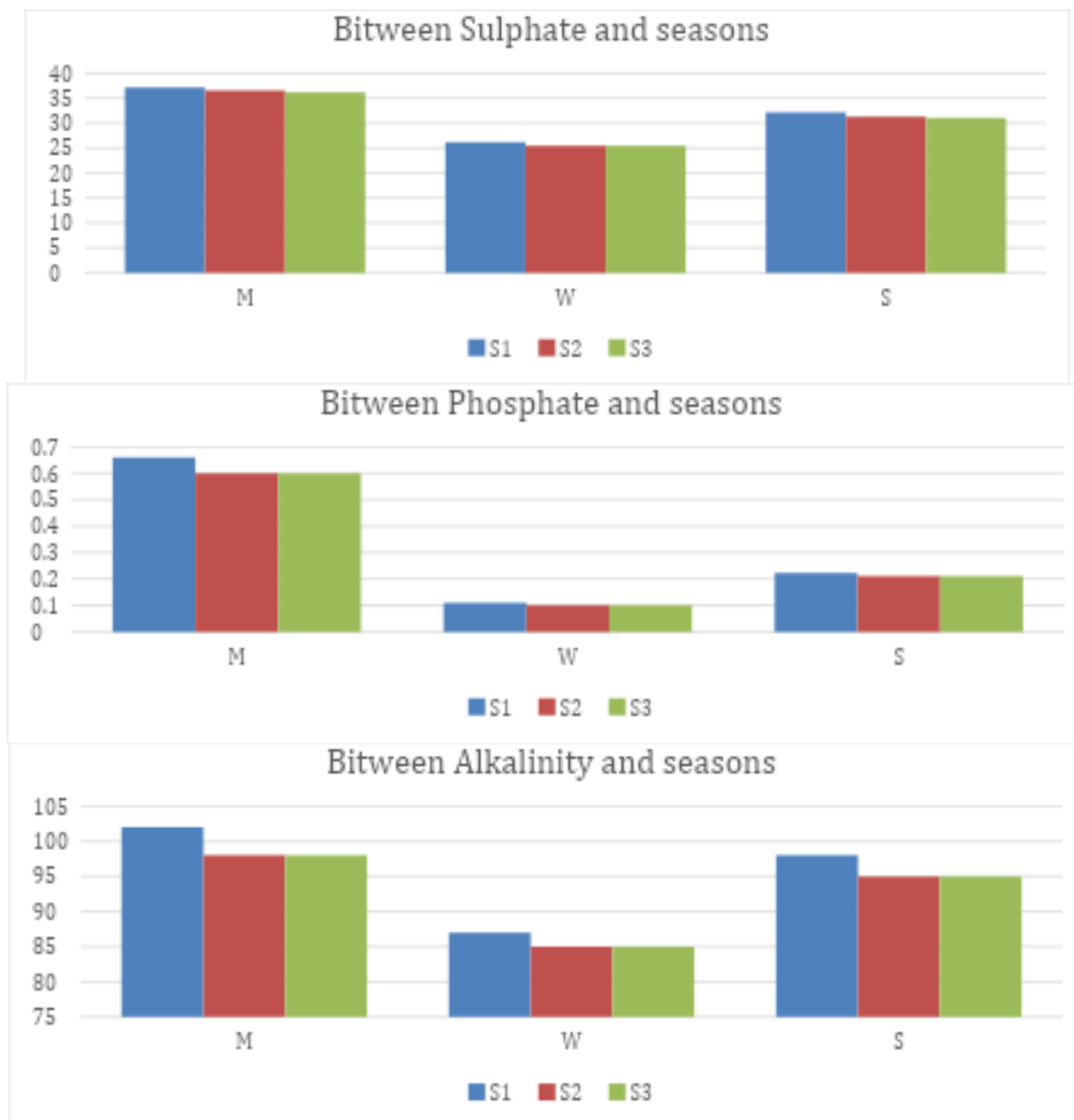
Table B-

| Parameters               | 2023-24 |       |       |      |      |      |       |       |       | Avg   | Min  | Max   |
|--------------------------|---------|-------|-------|------|------|------|-------|-------|-------|-------|------|-------|
|                          | M       |       |       | W    |      |      | S     |       |       |       |      |       |
|                          | S1      | S2    | S3    | S1   | S2   | S3   | S1    | S2    | S3    |       |      |       |
| Water temp.              | 27.1    | 27.0  | 27.0  | 20.8 | 20.7 | 20.7 | 35.2  | 35.1  | 35.0  | 27.62 | 20.7 | 35.2  |
| Depth of visibility (cm) | 123     | 125   | 125   | 154  | 153  | 155  | 164   | 166   | 165   | 147.7 | 123  | 166   |
| Water pH                 | 7.8     | 7.5   | 7.5   | 7.7  | 7.5  | 7.5  | 8.3   | 7.7   | 7.7   | 7.6   | 7.5  | 8.3   |
| Diss. O2 Mg/lit          | 6.0     | 6.1   | 6.2   | 6.5  | 6.7  | 6.7  | 6.3   | 6.4   | 6.3   | 6.3   | 6.0  | 6.7   |
| Diss. Co2 Mg/lit         | 2.7     | 2.6   | 2.8   | 3.4  | 3.3  | 3.2  | 3.8   | 3.5   | 3.7   | 3.2   | 2.6  | 3.8   |
| Chloride Mg/lit          | 61.0    | 60.0  | 60.0  | 60.0 | 58.0 | 58.0 | 62.5  | 62.3  | 62.3  | 60.4  | 58.0 | 62.5  |
| Nitrate Mg/lit           | 0.480   | 0.460 | 0.460 | 0.10 | 0.10 | 0.10 | 0.320 | 0.310 | 0.310 | 0.29  | 0.10 | 0.480 |
| Sulphate Mg/lit          | 37.2    | 36.5  | 36.2  | 26.2 | 25.5 | 25.5 | 32.1  | 31.3  | 31.0  | 31.27 | 25.5 | 36.5  |
| Phosphate Mg/lit         | 0.660   | 0.600 | 0.600 | 0.11 | 0.10 | 0.10 | 0.223 | 0.210 | 0.210 | 0.31  | 0.10 | 0.660 |
| Alkalinity Ppm           | 102     | 98    | 98    | 87   | 85   | 85   | 98    | 95    | 95    | 93.6  | 85   | 102   |

Table-B







2022-23, 2023-24 Result and discussion-

#### 1. Water Temperature:-

Temperature is a major factor, with governor chemical reaction and biological processes in any water body (Gour et. al 2014)

According to table 'A'(2022-23) temperature of Jaju sagar dam in duration 2022-23, average value of water temperature of 27.4 at all three stations in different seasons. Highest temperature 34.6 °C was recorded during summer 2022-23. Whereas the lowest Temperature was recorded 20.7 °C during the winter 2022-2023.

According to table B(2023-24)- Temperature of Jaju Sagar dam in duration 2023-24.

Average value of temperature of 27.6° C at all three station in different season.

The highest temperature of 35.2 was recorded during the summer season. 2023-24. Whereas the lowest temperature. Was recorded 20.7 ° C in winter season.

2.Depth of visibility - The depth of visibility gives information regarding water quality (Sharma et al., 2000). Suspended materials in water are produced by turbidity and reduce light penetration (Mathur et al., 2010).

According to table 'A' (2022-23)

In the present study, of jaju sagar dam water depth visibility varied between 125 cm to 166 cm During 2022-23. Average value of depth of visibility 148.6cm at all three stations of jaju sagar highest Depth of visibility 166cm was recorded during the Summer season 2022-23. Jaju sagar dam where the lowest depth of visibility 125cm was recorded during the monsoon season 2022-23.

According to the table 'B'(2023-24)

Average value of depth of visibility of jaju Sagar dam. recorded was 147.7 °C in All three stations. In different seasons. The highest depth of visibility 166cm was recorded. During the summer season.

Whereas the lowest depth of visibility 123cm. Was recorded in the monsoon season.

3.Potential of hydrogen (ph) -

According to the table 'A' (2022-23) Ph was measured by ph meter, ph value of jaju sagar dam pond water varies between 7.4 to 8.0 during 2022-23. Average value of ph 7.6 at all three stations of jaju sagar dam highest ph 8.0 recorded during the summer season 2022-23. Jaju sagar dam whereas the lowest ph 7.4 recorded during the monsoon season 2022-23.

According to the table 'B' (2023-24)

The average value of PH 7.6 of Jaju Sagar dam recorded was 7.6 in all three stations In different seasons.

The highest PH 8.3 was recorded during the summer season. Whereas the lowest PH of pond water of 7.5.

season respectively indicating well permissible limits this Ph range is considered to be congenial for aquatic production owing to greater availability of most the nutrient elements and also due to increased biological activities under this ph range, (Boyd, 1978)

4.Dissolve Oxygen:-

Dissolved oxygen is essential for the direct need of many organisms, affects the solubility of many nutrients and the periodicity of aquatic ecosystems (Wetzel 1983).

According table 'A'

The average value of dissolved oxygen was recorded 6.3 mg/l. All three stations in different seasons of jaju sagar dam.

Highest dissolved O<sub>2</sub> 6.6 mg/ l. During the winter 2022-23 at jaju sagar dam, the lowest dissolved O<sub>2</sub> 6.0 was recorded during Summer season 2022-23.

According to the table 'B'

The average value of Dissolve O<sub>2</sub> was recorded 6.3 mg/l. Highest value of Dissolve O<sub>2</sub> 6.7 mg / l. was recorded during winter season.

Lowest dissolved O<sub>2</sub> 6.0 was recorded during the summer season.

Through the study dissolved oxygen showed a positive correlation with Temperature, chlorides hardness nitrate, phosphate and pH (Sharma et al. 2012).

5. Dissolve CO<sub>2</sub>:-

Dissolve CO<sub>2</sub> is essential for the Aquatic plants and is released by aquatic animals. The concentration of CO<sub>2</sub> in freshwater ponds typically ranges from about 10 to 50 mg/L (milligrams per liter) under natural conditions. However, this can vary based on factors such as:

Photosynthesis and Respiration: During daylight, photosynthesis can lower CO<sub>2</sub> levels, while respiration at night increases them.

Temperature: Warmer temperatures can lead to higher CO<sub>2</sub> solubility.

Organic Matter: Decomposition of organic material can increase CO<sub>2</sub> concentrations.

Water Movement: Stagnant water may have higher CO<sub>2</sub> levels compared to flowing water due to reduced gas exchange.

In certain scenarios, especially in nutrient-rich or heavily populated ponds, CO<sub>2</sub> levels can exceed these typical ranges.

The result of the present study showed that the highest peak value of Dissolve CO<sub>2</sub> was recorded at 3.9mg/lit. during the Summer 2022-23 at jaju sagar dam.

Whereas the lowest dissolved Co<sub>2</sub> 2.6 recorded during the monsoon season 202-23 and average value of CO<sub>2</sub> 3.2

recorded at all three stations of the jaju sagar dam during 2022-23.

The jaju sagar dam during 2023-24.

The average value of the dissolved CO<sub>2</sub> was recorded 3.2 and the highest value was recorded 3.8 during the summer season and the lowest value of dissolved CO<sub>2</sub> was recorded 2.6 during monsoon season.

6. Chloride -The chloride ranged from 60 to 63.8 mg/l and average value of chloride 62.2 in different seasons during the 2022 to 2023 at jaju sagar dam . minimum Value of chloride was recorded 60 mg /lit during monsoon season and maximum value of Chloride 63.8 was recorded during summer season.

The chloride ranged from 58.0 to 62.5 mg/l and average value of chloride 60.4 in different seasons during the 2023 - 24 at jaju sagar dam . Minimum Value of chloride was recorded 58.0 mg /lit winter season and maximum value of Chloride 62.5 was recorded during summer season .

Chloride of all samples was below the permissible limit. The optimum concentration of chloride ions in freshwater aquaculture is lacking. 1-100 ppm concentrations are usually considered to be favorable (Chattopadhyay1998).

7. Nitrate:-The nitrate concentration of the jaju sagar dam water samples range from 0.1 to 0.4 mg/l the maximum nitrate content was found in the pond the present investigation maximum concentrations of nitrate 0.480mg/l. was recorded during the monsoon and minimum 0.2 mg/l during the winter season in jaju sagar dam during the 2022-23 and session 2023-24 maximum nitrate concentration 0.480 was recorded during monsoon season.and minimum 0.10 recorded was during winter season.

8. Sulphate- The sulphate concentration of the jaju sagar dam pond water during 2022 to 24, samples varied from 25.5 to 37.5 mg/l in the pond. Maximum sulphate 37.5 and 36.5 was recorded during monsoon season and minimum sulphate 27.8 and 25.5 was recorded during winter season in 2022 to 2024

The result should be that the pond water has a permissible range of sulphate ions. Physicochemical water quality constraints are substantial to the firmness of marine and other water ecologies. (Sargaonkar and Deshpande, 2003)

9. Phosphate:-The Phosphate concentration of the jaju sagar dam pond water during 2022 to 24. Samples varied from 0.10 - 0.70 mg/l in the pond. Highest value 0.70 mg/l 2022-23 and 0.66mg/l is phosphate recorded during monsoon season and lowest value 0.10 recorded during winter season.2022-24. The result should be that the pond water has a permissible range of phosphate ions.

10. Alkalinity:- Total alkalinity is the buffering capacity of water, it is constituted principally by carbonate and bicarbonates of calcium, magnesium, potassium and sodium and other bases. The alkalinity range of alkalinity at jaju sagar dam water from 85 ppm to 103 Ppm. Highest value of alkalinity 103 and 102 recorded during monsoon season 2022 to 24 and lowest alkalinity 83 ppm to 85 ppm recorded during winter season 2022 to 24 alkalinity was inversely related to the water level. The reported high alkalinity during the rainy season followed by step fall in the monsoon. In related 17 views. (Mishra et al. (2008) reported high and low alkalinity in season.

Conclusion :-After the careful study and analysis, interpretation and discussion the numerical data to the following conclusion have been drawn for the physico-chemical analysis of jaju sagar dam pond water in Neemuch district During different seasons, 2022-24 the collected Sample from pond water .

Most of the parameters within the acceptable limit, among all the studies of Pond water, is the highest value for temperature, Ph ,D.O<sub>2</sub>, D. CO<sub>2</sub>; chloride Nitrate Sulphate alkalinity are also between under the permissible limit according to WHO. Will through these more status of this pond water sample. Overall detailed analysis of pond water of different seasons . Jaju Sagar dam water may be used for drinking, irrigation, domestic as well as domestic pisciculture without any scientific treatment however regular assessment of water quality parameters are required for further management and conservation of Neemuch district related parameters show the good status. Further detailed analysis in different seasons and other related parameters as well, throw more status and light characteristic properties of these ponds.

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A comprehensive textbook covering the physical, chemical, and biological aspects of freshwater systems.

This list provides a foundation for understanding the physico-chemical parameters relevant to freshwater ponds.

Adjust or expand the list based on specific needs or areas of focus.



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