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Hydro-Chemical Characterization and Aquaculture Suitability Assessment of Two Reservoir Ecosystems Ranganayakasagar and Mid Manair Reservoirs (2019–2022)

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A B S T R A C T

This study evaluates the hydro-chemical characteristics and aquaculture suitability of Ranganayakasagar and Mid Manair reservoirs over a three-year period (2019–2022). Seasonal variations in key physico-chemical parameters—including Temperature(^{0}C), electrical conductivity (EC), pH, dissolved oxygen (DO), nutrients (nitrates and phosphates), turbidity, hardness, and alkalinity—were systematically analyzed to assess their influence on aquatic productivity and fish culture potential. Water temperature remained relatively stable (~29°C) across both reservoirs, supporting favorable metabolic and reproductive conditions for fish. Dissolved oxygen levels consistently exceeded 5 mg/L, indicating a healthy environment for aquatic life. The pH values were slightly alkaline and within optimal limits for aquaculture. Seasonal patterns were evident, with higher turbidity and nutrient levels during the monsoon, and increased hardness and alkalinity during pre- and post-monsoon periods. The high concentrations of nutrients, particularly phosphates and nitrates, indicate eutrophic conditions and enhanced primary productivity in both reservoirs. Overall, the findings reveal that Ranganayakasagar and Mid Manair reservoirs are highly productive and suitable for aquaculture.

Introduction

Water quality management is a fundamental aspect of aquaculture because most production problems arise from the deterioration of water conditions. Aquatic ecosystems are dynamic in nature, and their physico-chemical characteristics vary seasonally due to complex interactions among environmental factors. Therefore, a clear understanding of water chemistry is essential for sustainable aquaculture practices. A study conducted during 2019–20, 2020–21, and 2021–22 in Ranganayakasagar Reservoir and Mid Manair Reservoir assessed important water quality parameters to evaluate their suitability for fish culture. During the study period, water temperature in both reservoirs remained relatively stable, averaging around 29°C, with minor seasonal fluctuations. The lowest temperatures were recorded in December and the highest in May, indicating that atmospheric conditions and seasonal heat variations primarily influenced water temperature. Electrical

conductivity showed a gradual increasing trend over the three years in both reservoirs, with higher values observed during the monsoon season and lower values during post-monsoon. Conductivity reflects the concentration of dissolved ions and indicates the nutrient status of the water body. Higher conductivity values may be attributed to decomposition of organic matter, evaporation, and accumulation of dissolved salts, whereas lower values may result from ion utilization by aquatic organisms. Conductivity showed positive correlation with free carbon dioxide, bicarbonates, potassium, and phosphates, and negative correlation with dissolved oxygen and nitrates (Jagadeeshwara Chari *et al.,* 2023).

Dissolved oxygen (DO), a crucial parameter for fish survival and growth, ranged between approximately 6.2 and 6.7 ppm, with maximum levels recorded during monsoon months. Adequate DO levels above 5 ppm support healthy fish growth, whereas levels below 5 ppm reduce growth and increase susceptibility to diseases, and levels below 1 ppm may cause mortality. DO levels fluctuated diurnally, increasing during the daytime due to photosynthesis and decreasing during nighttime due to respiration. Chloride concentrations were generally higher during pre-monsoon and lower during monsoon, likely due to dilution effects during heavy rainfall. Sulphate concentrations showed moderate seasonal variations and originated mainly from natural drainage, rainwater, and decomposition processes (Krishna PM, *et al.,* 2024). Nitrate levels were comparatively higher during monsoon and post-monsoon periods, reflecting runoff from surrounding areas, while phosphate concentrations were higher during pre-monsoon, possibly due to reduced water levels and concentration effects. Turbidity values were highest during monsoon because of inflow of suspended particles such as silt, clay, and organic matter, which reduced light penetration and photosynthesis. High turbidity can lower dissolved oxygen and adversely affect fish health. Calcium levels peaked during post-monsoon, whereas magnesium concentrations were highest during pre-monsoon, and both showed lower values during monsoon due to dilution. Carbonates and bicarbonates also exhibited seasonal fluctuations, with higher concentrations during pre-monsoon and lower during post-monsoon, influencing alkalinity levels. Overall, the study indicated that although seasonal variations significantly affected water quality parameters, the reservoirs-maintained conditions generally suitable for aquaculture with proper monitoring and management.

Result and Discussion

Physico-chemical Parameters

Temperature

The temperature of both reservoirs remained relatively stable throughout the study period (2019–20 to 2021–22), reflecting the buffering capacity of water. In Ranganayakasagar, the mean temperatures recorded were 29.13°C, 29.76°C, and 29.93°C, while in Mid Manair the corresponding values were 29.13°C, 29.76°C, and 29.61°C. A slight increasing trend was observed over the three years. The narrow range of variation indicates seasonal consistency, which is favorable for fish metabolism, feeding, reproduction, and overall productivity.

Electrical Conductivity

Electrical conductivity showed comparatively higher values in Mid Manair than in Ranganayakasagar. In Ranganayakasagar, the mean conductivity values were 1585 µS/cm, 1605.7 µS/cm, and 1619.6 µS/cm during 2019–20, 2020–21, and 2021–22, respectively. In Mid Manair, the values were 1740 µS/cm, 1810 µS/cm, and 1830 µS/cm. Conductivity was highest during the monsoon and lowest during the post-monsoon period. The increasing trend over the years suggests nutrient enrichment and higher ionic concentration, possibly due to anthropogenic inputs and runoff.

pH

The pH of both reservoirs indicated slightly alkaline conditions throughout the study period. In Ranganayakasagar, the mean pH values were 7.78, 7.80, and 7.98, with an overall average of 7.85. In Mid Manair, the values ranged from 7.29 to 7.47 and reached up to 7.98 in 2021–22, with an overall average of 7.40. Higher pH values were recorded during the pre-monsoon season, while lower values were observed during the onset of monsoon. The recorded pH range (6.5–9.0) (Jagadeeshwara Chari *et al.,* 2023). Supports healthy fishery conditions and indicates medium to high productivity.

Dissolved Oxygen

Dissolved oxygen levels in both reservoirs remained

above 5 mg/L throughout the study, indicating healthy aquatic conditions. In Ranganayakasagar, the maximum average values recorded were 6.47 mg/L, 6.58 mg/L, and 6.67 mg/L during the three respective years. In Mid Manair, the values were 6.29 mg/L, 6.60 mg/L, and 6.68 mg/L. Dissolved oxygen levels were generally higher during the monsoon months due to wind-induced mixing and aeration of surface waters. The consistently adequate oxygen levels support good fish growth and survival.

Chlorides

Chloride concentrations were relatively high in both reservoirs and showed higher values in Mid Manair. In Ranganayakasagar, chloride levels were 211.73 mg/L, 223.37 mg/L, and 202.35 mg/L across the three years. In Mid Manair, the corresponding values were 219.73 mg/L, 234.77 mg/L, and 238.82 mg/L. Higher chloride levels were generally observed prior to the monsoon, while lower values occurred during the monsoon due to dilution effects. Elevated chloride concentrations may indicate organic pollution and anthropogenic influence.

Sulphates

Sulphate concentrations showed a gradual increasing trend in both reservoirs over the study period. In Ranganayakasagar, sulphate levels were 69.1 mg/L, 71.86 mg/L, and 74.1 mg/L, while in Mid Manair they were 71.2 mg/L, 72.63 mg/L, and 76.63 mg/L. The values were slightly higher in Mid Manair, suggesting increased nutrient input and mineral contribution from runoff and catchment areas.

Nitrates

Nitrate concentrations were relatively high in both reservoirs and exceeded typical values for unpolluted reservoirs. In Ranganayakasagar, nitrate levels were 20.16 mg/L, 21.80 mg/L, and 19.12 mg/L. In Mid Manair, the values were 21.16 mg/L, 23.33 mg/L, and 22.94 mg/L. The highest nitrate concentrations were observed during monsoon months, likely due to agricultural runoff and sewage inflow. These elevated nitrate levels indicate nutrient enrichment and classify the reservoirs as highly productive.

Phosphates

Phosphate concentrations were notably high in both reservoirs throughout the study period. In Ranganayakasagar, values ranged from 19.0 mg/L to 19.3 mg/L and 19.26 mg/L over the three years. In Mid Manair, phosphate values ranged from 17.43 mg/L to 21.6 mg/L. Higher phosphate levels were observed during monsoon due to surface runoff and during pre-monsoon due to reduced water levels and decomposition of organic matter. The high phosphate concentration strongly indicates eutrophic conditions and enhanced primary productivity.

Turbidity

Turbidity levels were highest during the monsoon season in both reservoirs. In Ranganayakasagar, mean turbidity values were 28.33 NTU, 28.66 NTU, and 28.88 NTU, while in Mid Manair they were 27.66 NTU, 28.66 NTU, and 28.77 NTU. Turbidity decreased during winter and post-monsoon periods. Increased turbidity during monsoon is attributed to suspended particles, silt, and runoff from surrounding areas. High turbidity may reduce light penetration and affect photosynthesis.

Total Hardness (Calcium and Magnesium)

Total hardness values were generally higher during the post-monsoon period and lower during the monsoon months. Calcium concentrations in the north tank ranged from 120.5 ppm to 124.4 ppm (highest post-monsoon) and 104.5 ppm to 111.8 ppm (lowest during monsoon). In the south tank, calcium values reached up to 185.2 ppm in 2021–22.

Magnesium values also followed a similar seasonal trend, with higher concentrations during post-monsoon and lower during monsoon. The overall hardness values (>50 ppm) classify the water as hard and suitable for fish culture (Krishna PM, *et al.,* 2024).

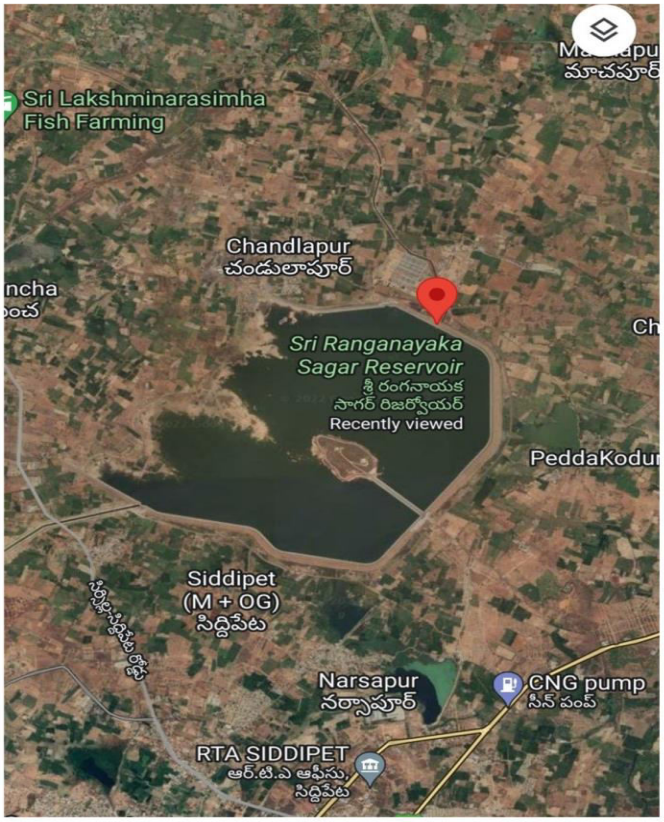
Carbonates and Bicarbonates

Carbonate concentrations were higher during the pre-monsoon season and lower during the post-monsoon period. In the north tank, average carbonate values increased from 15.23 ppm in 2019–20 to 22.3 ppm in 2021–22. Similar trends were observed in the south tank. Bicarbonate concentrations were significantly higher than carbonates and showed maximum values during pre-monsoon months.

Satellite view of Research sites

MAPS OF RESEARCH SITE

RANGANAYAKA SAGAR



MID MANAIR

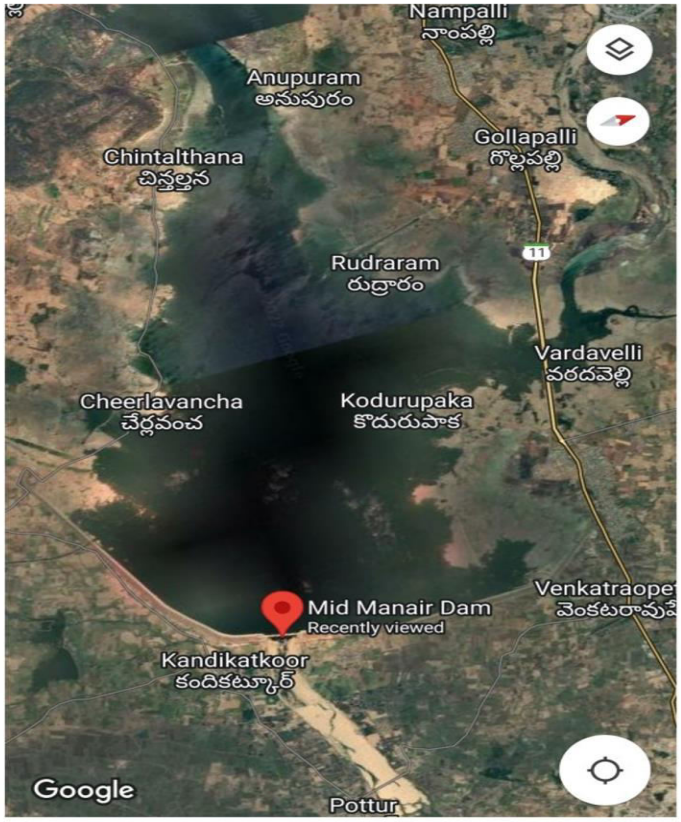
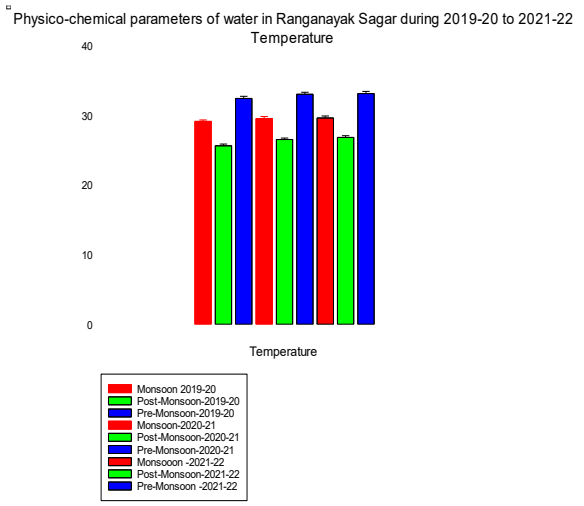


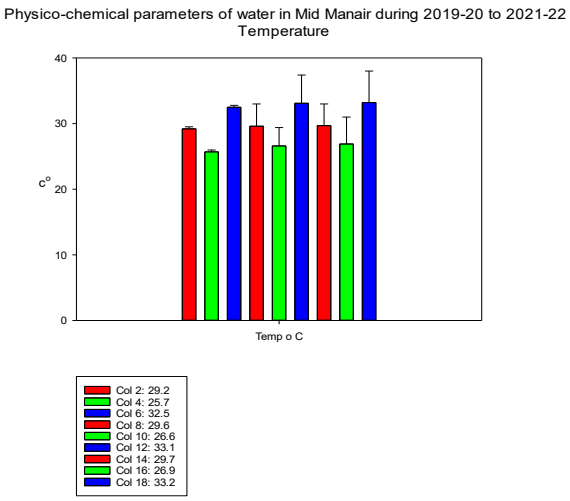
Table.1 Physico-chemical Parameters of Water During 2019–20 to 2021–22 — Ranganak Sagar

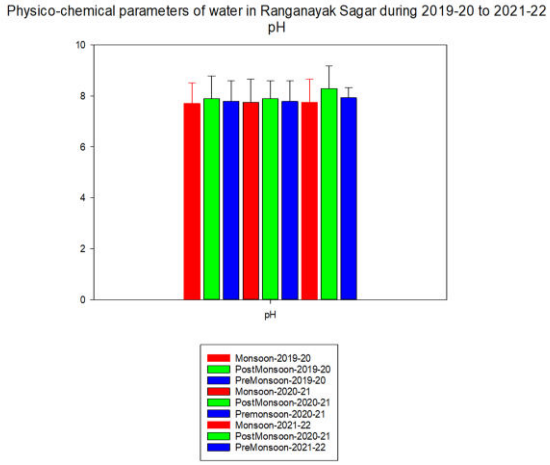
Parameter	2019–20 Monsoon	2019–20 Post-monsoon	2019–20 Pre-monsoon	2019–20 Average	2020–21 Monsoon	2020–21 Post-monsoon	2020–21 Pre-monsoon	2020–21 Average	2021–22 Monsoon	2021–22 Post-monsoon	2021–22 Pre-monsoon	2021–22 Average	Grand Average
Temp °C	22.2 ± 2.1	25.7 ± 2.5	32.5 ± 3.1	29.3	28.6 ± 3.1	26.6 ± 2.1	33.1 ± 2.9	29.6	29.7 ± 2.8	26.9 ± 2.5	33.2 ± 3.1	29.9	29.61
pH	7.7 ± 0.8	7.88 ± 0.9	7.78 ± 0.8	7.78	7.75 ± 0.9	7.89 ± 0.7	7.78 ± 0.8	7.80	7.75 ± 0.9	8.28 ± 0.9	7.90 ± 0.4	7.98	7.86
EC (µS/cm)	1612 ± 132	1546 ± 108	1598 ± 112	1585	1628 ± 122	1851 ± 112	1688 ± 124	1666.7	1645 ± 142	1594 ± 139	1620 ± 122	1619.66	1600.4
Dissolved O_2	6.55 ± 0.8	6.54 ± 0.9	6.34 ± 0.7	6.47	6.59 ± 0.8	6.56 ± 0.9	6.54 ± 0.7	6.56	7.04 ± 0.3	6.56 ± 0.5	6.42 ± 0.06	6.67	6.51
Carbonates	14.1 ± 2.5	103 ± 2.01	21.3 ± 2.0	15.23	19.3 ± 2.2	115 ± 2.0	268 ± 4.01	192	213 ± 2.3	182 ± 2.8	27.5 ± 3.1	223.9	189.2
Bicarbonates	366.1 ± 2.1	241.3 ± 2.2	409.4 ± 8.5	397.26	428.5 ± 8.7	372.4 ± 4.3	403.5 ± 12	417.07	402 ± 9.3	380.3 ± 3.3	615.4 ± 28	624	392.77
Total Hardness	304.8 ± 8.5	380.6 ± 4.3	389.3 ± 8.5	366	341.8 ± 3.3	380.4 ± 3.6	375.3 ± 3.6	371.17	341.5 ± 0.3	365.2 ± 3.4	368.4 ± 1.8	371.16	380.64
Magnesium	165.23	219.25	186.18	190	162.21	219.24	198.19	193	159.23	221.32	198.21	192.6	191.8
Calcium	104.5 ± 7.2	120.5 ± 8.5	106.6 ± 7.3	110.5	108.9 ± 7.1	123.5 ± 9.2	165.9 ± 9.4	128.3	111.8 ± 6.2	124.4 ± 6.9	118.3 ± 6.3	118.16	118.33
Chloride	166.5 ± 0.3	189.4 ± 1.2	280.3 ± 13.2	211.73	176.2 ± 9.3	204.9 ± 0.5	289 ± 11.8	223.37	165.6 ± 6.6	202.5 ± 10.2	289.9 ± 13.4	219.96	202.35
Sulphate	78.6 ± 6.1	60.2 ± 4.3	68.5 ± 6.6	69.1	81.3 ± 8.1	64.8 ± 6.3	69.5 ± 4.8	71.88	85.7 ± 7.9	66.3 ± 6.4	70.4 ± 6.8	74.1	71.68
Nitrate	18.6 ± 5.2	24.4 ± 5.6	17.5 ± 4.3	20.16	20.4 ± 4.6	28.5 ± 4.5	16.5 ± 5.3	21.8	15.6 ± 3.5	20.2 ± 4.6	10.4 ± 4.2	15.4	19.12
Phosphate	6.4 ± 1.2	3.7 ± 0.6	4.6 ± 0.5	4.90 ± 0.8	6.6	4.8 ± 0.4	5.1 ± 0.6	5.5	5.6 ± 0.4	3.3 ± 0.2	4.8 ± 0.3	4.46	4.95
Turbidity (NTU)	32 ± 1.3	24 ± 1.4	29 ± 1.2	28.33	32 ± 1.3	24 ± 1.6	30 ± 1.4	28.66	3 ± 1.8	25 ± 1.4	30 ± 1.3	29.66	28.88

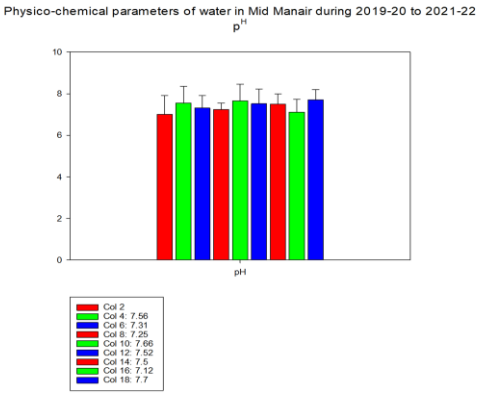
Table.2 Physico-chemical Parameters of Water at Mid Manair

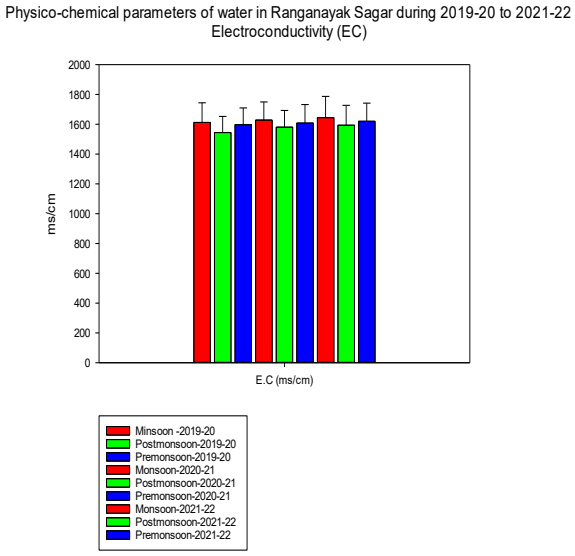
Parameters	2019–20 Monsoon	2019–20 Post-monsoon	2019–20 Pre-monsoon	2019–20 Average	2020–21 Monsoon	2020–21 Post-monsoon	2020–21 Pre-monsoon	2020–21 Average	2021–22 Monsoon	2021–22 Post-monsoon	2021–22 Pre-monsoon	2021–22 Average	Grand Average
Temp °C	29.2 ± 3.1	25.7 ± 2.8	32.5 ± 2.8	29.13	29.6 ± 3.4	26.6 ± 2.8	33.1 ± 4.3	29.76	29.7 ± 3.3	26.9 ± 4.1	33.2 ± 4.8	29.93	29.61
pH	7.01 ± 0.9	7.56 ± 0.8	7.31 ± 0.6	7.29	7.25 ± 0.3	7.66 ± 0.8	7.52 ± 0.7	7.40	7.56 ± 0.5	7.12 ± 0.6	7.7 ± 0.5	7.44	7.40
EC (µS/cm)	1810 ± 141	1620 ± 128	1790 ± 132	1740	1890 ± 125	1700 ± 115	1840 ± 125	1810	1910 ± 135	1720 ± 105	1860 ± 112	1830	1793.33
Dissolved O_2	6.42 ± 1.1	6.32 ± 0.9	6.14 ± 0.8	6.29	7.01 ± 0.8	6.59 ± 0.6	6.4 ± 0.5	6.66	7.18 ± 0.9	7.08 ± 0.8	7.01 ± 0.6	7.09	6.68
Carbonates	16.5 ± 2.1	10.1 ± 1.1	20.3 ± 1.9	15.63	18.4 ± 2.1	16.2 ± 1.8	23.1 ± 2.2	19.23	23.6 ± 2.2	20.4 ± 1.8	29.6 ± 1.9	24.53	19.8
Bicarbonates	381.3 ± 35.3	356.8 ± 32.1	412.8 ± 39.8	383.63	401.3 ± 40.4	376.3 ± 36.3	456.2 ± 42.1	412.27	460.2 ± 41.3	400.3 ± 40.6	481.8 ± 44.8	448.43	414.77
Total Hardness	300.8 ± 31.1	363.6 ± 34.6	324.9 ± 38.6	329.73	321.4 ± 33.6	389.3 ± 39.4	366.1 ± 32.6	358.6	364.3 ± 30.4	412.1 ± 42.1	398.4 ± 38.3	391.6	359.97
Magnesium	16.6 ± 2.1	18.5 ± 2.5	17.2 ± 2.2	17.43	17.1 ± 2.2	22.1 ± 2.8	20.5 ± 1.8	19.9	18.2 ± 1.8	25.6 ± 2.4	21.2 ± 2.3	21.66	19.66
Calcium	105.2 ± 18.9	126.8 ± 15.5	117.2 ± 16.3	116.43	108.2 ± 14.4	128.1 ± 15.6	114.8 ± 12.6	117.13	122.5 ± 13.8	185.2 ± 19.5	161.1 ± 12.6	156.6	129.97
Chloride	178.3 ± 12.6	189.4 ± 16.4	291.5 ± 24.6	219.73	178.3 ± 16.5	221.5 ± 21.3	304.5 ± 28.7	234.77	205.6 ± 21.6	268.9 ± 24.4	311.4 ± 36.3	261.97	238.82
Sulphate	78.4 ± 4.8	65.4 ± 4.3	69.8 ± 5.8	71.2	78.9 ± 5.3	68.2 ± 4.3	70.8 ± 6.1	72.63	83.8 ± 6.9	69.8 ± 5.3	76.3 ± 6.3	76.63	73.48
Nitrate	21.5 ± 3.2	25.4 ± 4.4	17.5 ± 3.6	21.67	24.3 ± 4.5	28.8 ± 3.8	16.8 ± 2.6	23.33	27.8 ± 2.6	28.8 ± 2.8	15.5 ± 1.9	24.03	22.94
Phosphate	6.2 ± 0.9	5.2 ± 0.7	5.3 ± 0.4	5.56	6.5 ± 0.8	5.0 ± 0.2	6.1 ± 0.6	5.86	5.9 ± 0.3	4.8 ± 0.4	5.1 ± 0.6	5.26	5.56
Turbidity (NTU)	30 ± 3.1	25 ± 2.8	28 ± 2.6	27.66	31 ± 3.2	26 ± 2.1	29 ± 2.3	28.66	32 ± 3.2	26 ± 2.8	32 ± 2.9	30	28.77

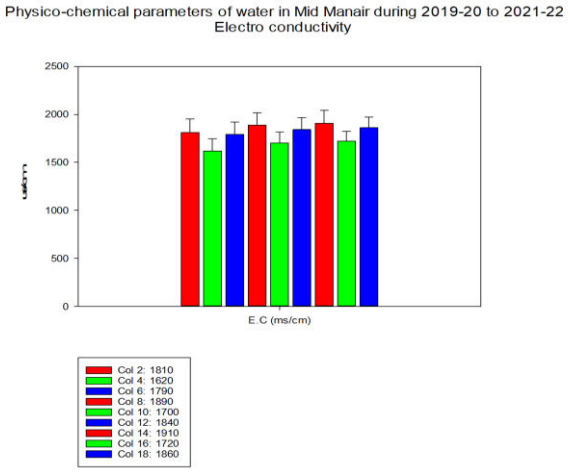

Physico-chemical parameters of water in Ranganayak Sagar during 2019-20 to 2021-22
Temperature
40
30
20
10
0
Temperature
Monsoon 2019-20
Post-Monsoon-2019-20
Pre-Monsoon-2019-20
Monsoon-2020-21
Post-Monsoon-2020-21
Pre-Monsoon-2020-21
Monsooon -2021-22
Post-Monsoon-2021-22
Pre-Monsoon -2021-22


Physico-chemical parameters of water in Mid Manair during 2019-20 to 2021-22
Temperature
40
30
20
10
0
Temp o C
Col 2: 29.2
Col 4: 25.7
Col 6: 32.5
Col 8: 29.6
Col 10: 26.6
Col 12: 33.1
Col 14: 29.7
Col 16: 26.9
Col 18: 33.2

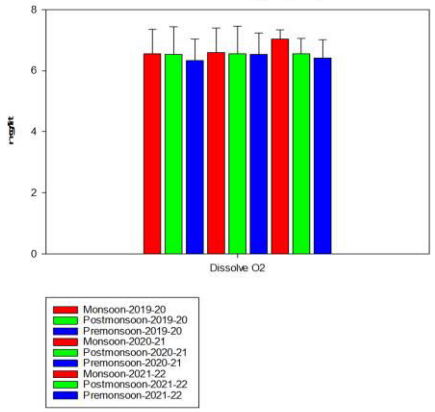

Physico-chemical parameters of water in Ranganayak Sagar during 2019-20 to 2021-22
pH
10
8
6
4
2
0
pH
Monsoon-2019-20
PostMonsoon-2019-20
PreMonsoon-2019-20
Monsoon-2020-21
PostMonsoon-2020-21
Premonsoon-2020-21
Monsoon-2021-22
PostMonsoon-2020-21
PreMonsoon-2021-22


Physico-chemical parameters of water in Mid Manair during 2019-20 to 2021-22
pH
10
8
6
4
2
0
pH
Col 2
Col 4: 7.56
Col 6: 7.31
Col 8: 7.25
Col 10: 7.66
Col 12: 7.52
Col 14: 7.5
Col 16: 7.12
Col 18: 7.7

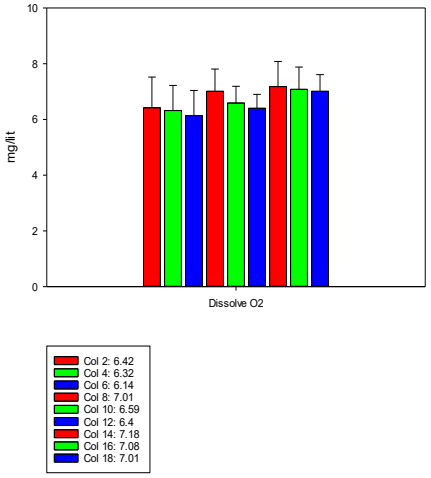

Physico-chemical parameters of water in Ranganayak Sagar during 2019-20 to 2021-22
Electroconductivity (EC)
2000
1800
1600
1400
1200
1000
800
600
400
200
0
ms/cm
E.C (ms/cm)
Minsoon -2019-20
Postmonsoon-2019-20
Premonsoon-2019-20
Monsoon-2020-21
Postmonsoon-2020-21
Premonsoon-2020-21
Monsoon-2021-22
Postmonsoon-2021-22
Premonsoon-2021-22


Physico-chemical parameters of water in Mid Manair during 2019-20 to 2021-22
Electro conductivity
2500
2000
1500
1000
500
0
E.C (ms/cm)
Col 2: 1810
Col 4: 1620
Col 6: 1790
Col 8: 1890
Col 10: 1700
Col 12: 1840
Col 14: 1910
Col 16: 1720
Col 18: 1860

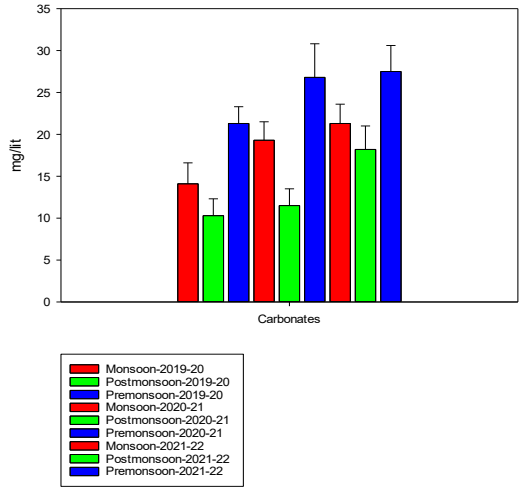
Physico-chemical parameters of water in Ranganayak Sagar during 2019-20 to 2021-22
Dissolved oxygen (DO)



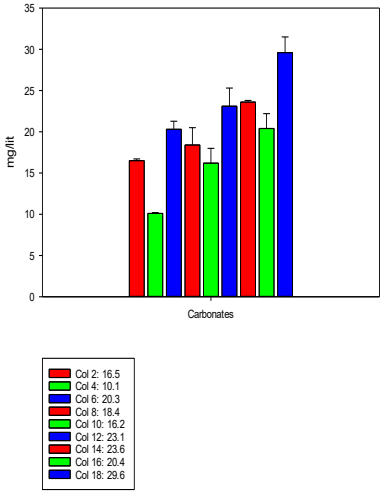
Physico-chemical parameters of water in Mid Manair during 2019-20 to 2021-22
Dissolved oxygen



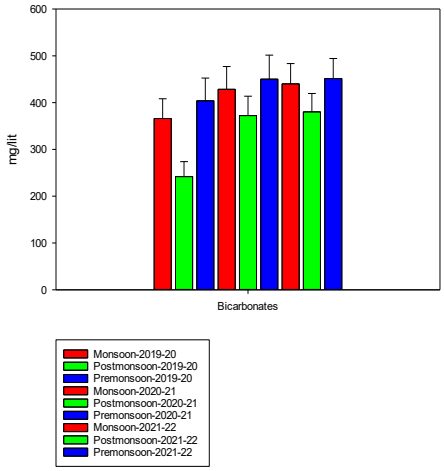
Physico-chemical parameters of water in Ranganayak Sagar during 2019-20 to 2021-22
Carbohydrates



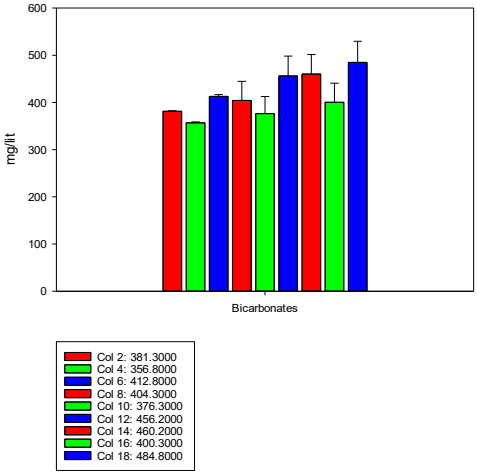
Physico-chemical parameters of water in Mid Manair during 2019-20 to 2021-22
Carbonates



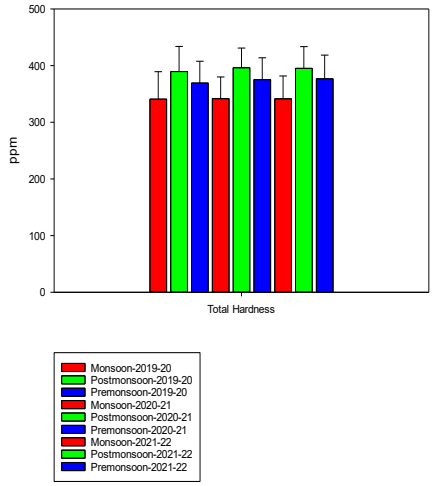
Physico-chemical parameters of water in Ranganayak Sagar during 2019-20 to 2021-22
Bicarbonates



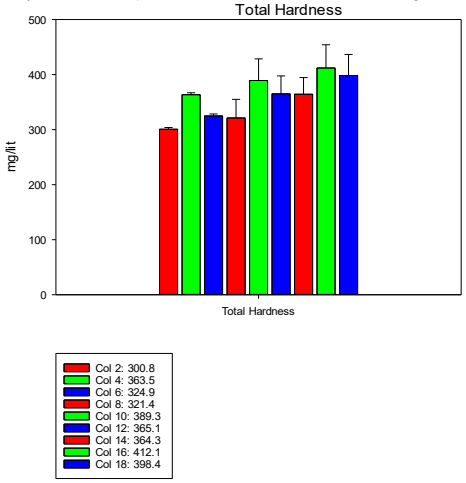
Physico-chemical parameters of water in Mid Manair during 2019-20 to 2021-22
Bicarbonates



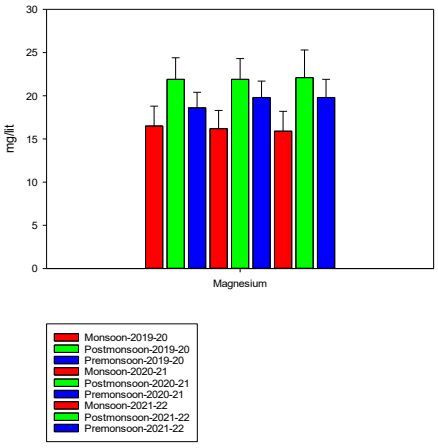
Physico-chemical parameters of water in Ranganayak Sagar during 2019-20 to 2021-22
Total Hardness



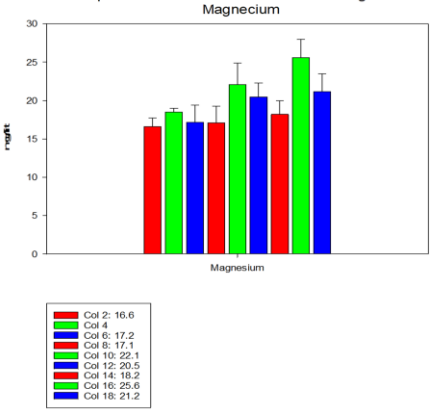
Physico-chemical parameters of water in Mid Manair during 2019-20 to 2021-22
Total Hardness



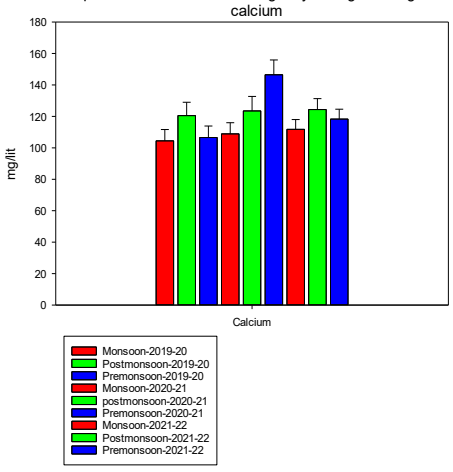
Physico-chemical parameters of water in Ranganayak Sagar during 2019-20 to 2021-22
Magenecium



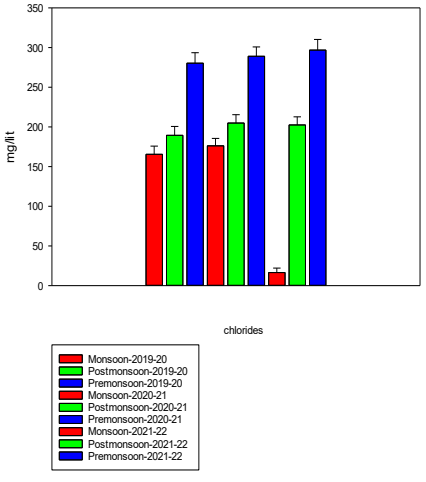
Physico-chemical parameters of water in Mid Manair during 2019-20 to 2021-22
Magnesium



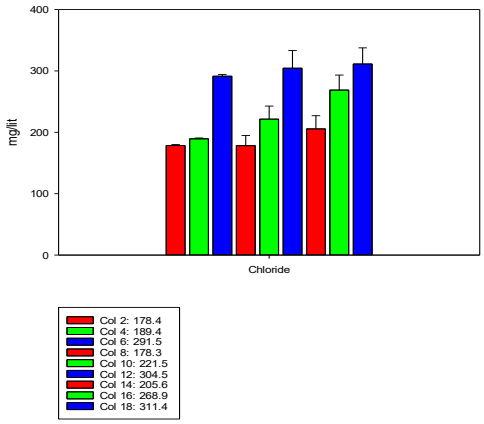
Physico-chemical parameters of water in Ranganayak Sagar during 2019-20 to 2021-22
calcium



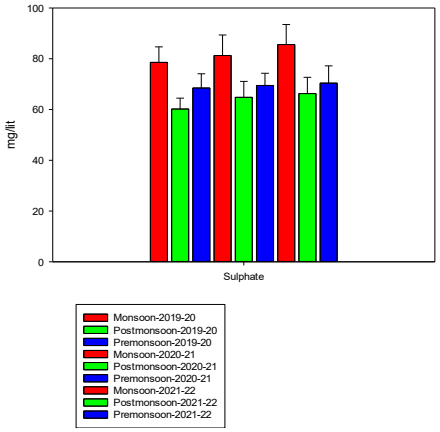
Physico-chemical parameters of water in Ranganayak Sagar during 2019-20 to 2021-22
chlorides



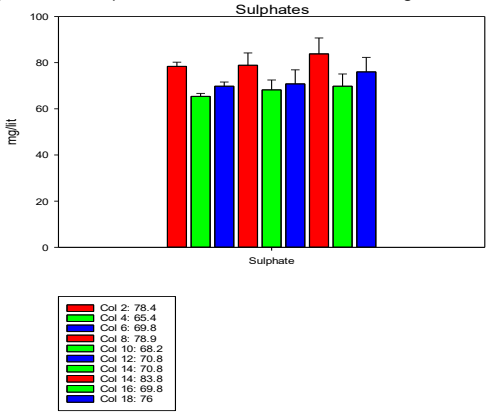
Physico-chemical parameters of water in Mid Manair during 2019-20 to 2021-22
Chlorides



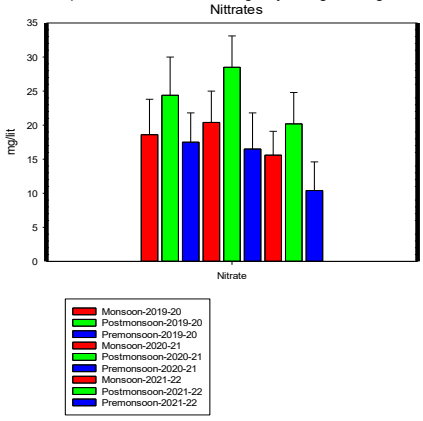
Physico-chemical parameters of water in Ranganayak Sagar during 2019-20 to 2021-22
sulphates



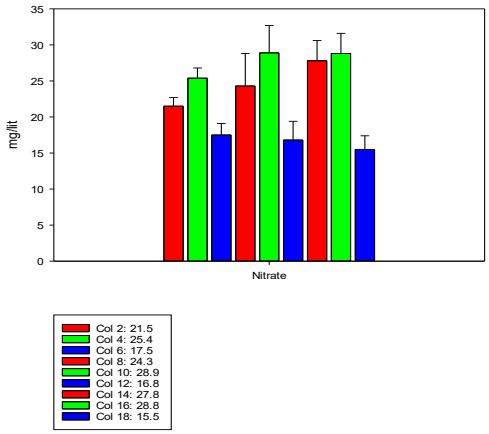
Physico-chemical parameters of water in Mid Manair during 2019-20 to 2021-22
Sulphates



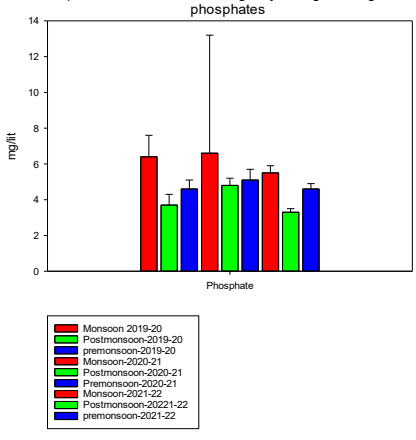
Physico-chemical parameters of water in Ranganayak Sagar during 2019-20 to 2021-22
Nittrates

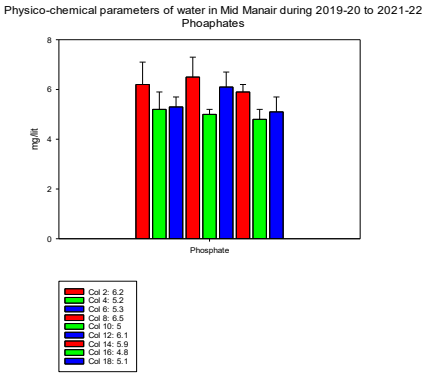


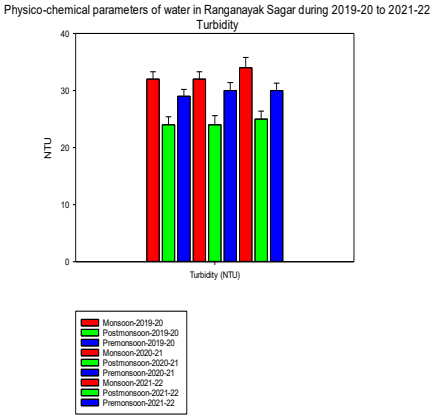
Physico-chemical parameters of water in Mid Manair during 2019-20 to 2021-22
Nitrate

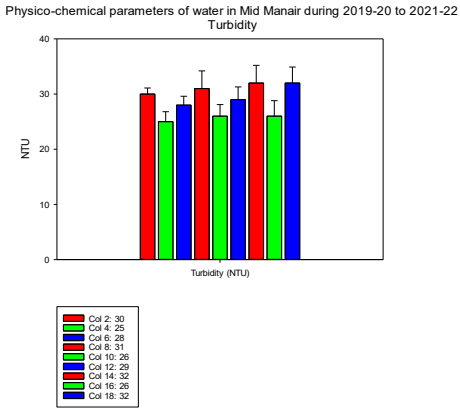


Physico-chemical parameters of water in Ranganayak Sagar during 2019-20 to 2021-22
phosphates









In the north tank, average bicarbonate concentrations increased from 353.9 ppm to 424 ppm, while in the south tank they ranged from 383.6 ppm to 448.4 ppm. High bicarbonate levels contribute to alkalinity and buffering capacity, indicating high productivity of the reservoirs.

The physico-chemical parameters of both Ranganayakasagar and Mid Manair reservoirs indicate nutrient-rich conditions with clear seasonal variations. Dissolved oxygen, pH, and hardness fall within favorable limits for aquaculture. However, elevated nitrate and phosphate concentrations suggest eutrophic conditions influenced by anthropogenic activities and runoff. Overall, both reservoirs can be classified as highly productive systems with good potential for fish culture, though continued nutrient enrichment may pose future ecological risks.

The study of Ranganayakasagar and Mid Manair reservoirs from 2019 to 2022 shows that both reservoirs have generally good water quality suitable for fish production. Key physico-chemical parameters such as temperature, pH, dissolved oxygen, and hardness remained within acceptable limits, supporting healthy fish growth and productivity. However, the consistently high levels of nitrates and phosphates indicate nutrient-rich (eutrophic) conditions mainly caused by runoff and human activities. While these nutrients enhance biological productivity, they may lead to future water quality issues if not properly managed. Seasonal variations, especially during the monsoon, significantly influenced turbidity and nutrient levels. Overall, both reservoirs are highly productive and suitable for fish culture, but regular monitoring and proper management practices are essential to maintain water quality and ensure sustainable aquaculture in the long term.

Author Contributions

G. Paramesh: Investigation, formal analysis, writing—original draft. T. Jagadeeshwara Chari: Validation, methodology, writing—reviewing.

Data Availability

The datasets generated during and/or analyzed during the current study are available from the corresponding author on reasonable request.

Declarations

Ethical Approval Not applicable.

Consent to Participate Not applicable.

Consent to Publish Not applicable.

Conflict of Interest The authors declare no competing interests.

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