4. RESULTS AND DISCUSSION

There are 6 sections in the results and discussion chapter:

1. Trend analysis result: Analysed data for 24 parameters from September 18 to December 21 for nine lakes.
2. Index Interpretation: The use of 15 different indices for the interpretation of water data for all nine lakes.
3. Modification of index: Suggested modifications in some indices which can help in better interpretation of the data.
4. Eco-Heart index: The concept of the Eco-heart index which can be used on ground level for easy interpretation of the actual status of a water body in the form of a heart shape.
5. Statistical analysis: The use of descriptive tools and Principal Component Analysis for 24 parameters for all nine lakes.
6. New suggested index: Details and the concept of a new suggested index for knowing the overall status of water bodies.

4.1 Trend Analysis

A total of 24 parameters were chosen for assessing water quality for all nine lakes. Data for all nine lakes are given from Table 31 to 39.

Sama Lake

The pH of the lake water ranges from 7.35 in September-19 to 9.1 in September-20, which is slightly alkaline. TDS varies from 143 mg/L in June-19 to 880 mg/L in September-21 ppm. High levels of TDS can make the water taste bad and can be harmful to some aquatic life. The TSS of the lake water values from 28 mg/L in September-20 to 84 mg/L on March-21. TSS is a measure of the amount of particulate matter that is suspended in the water. High levels of TSS can make the water cloudy and can reduce the amount of light that penetrates the water column, which can harm aquatic plants. The conductivity of the lake water varies from 180 in June-19 to 1990 µS/cm in March-19. Conductivity is a measure of the ability of the water to conduct electricity. High levels of conductivity can indicate presence of pollution. The maximum value of 1990 µS/cm is high and is an indicative of pollution. The temperature of the lake water ranges from 20.4 in March-19 to 27.8 °C in June-19. Temperature is an important factor for aquatic life, as it affects the metabolism and reproduction of many species. In September-20, the lake's water was 3 NTU; in December-2020, it was 76 NTU. The amount of light that penetrates the water column, can harm aquatic plants. The maximum value of 76 NTU is high and indicates the presence of pollution from sources such as soil erosion or algae blooms. From 8 in September-20 to 28.4 Hazen units in March-19, the lake's watercolor is varying. The colour of the water is influenced by a variety of factors, including the presence of algae, dissolved organic matter, and iron. Fluoride concentrations in lake water fluctuate from 0.191 in June-19 to 1.2 ppm in June-20. Fluoride is a naturally occurring element that can be beneficial for dental health at low levels. However, high levels of fluoride can be harmful to human health. The acidity of the lake water changes from 0 in June-20 to 135 mg/L in March-19. Acidity is a measure of the capacity of the water to neutralize bases. High levels of acidity can be harmful to aquatic life. The maximum value of 135 mg/L is high and may indicate pollution from other sources. The alkalinity of the lake water ranges from 62 in June-19 to 750 mg/L in March-19. Alkalinity is a measure of the capacity of the water to neutralize acids. High levels of alkalinity can make the water hard and can reduce the effectiveness of some water treatment methods. In September- 20, the lake's total hardness is 84 mg/L, while in

March-19, it is 390 mg/L. Between September-20 and December-20, the lake's calcium hardness changes from 19.2 to 204 mg/L. The lake's magnesium hardness varies from 8 mg/L in December-20 to 193.65 mg/L in March- 19. The COD of lake water differs between 10 in March-19 to 41 mg/L in June-20. COD is a measure of the amount of organic matter in water that can be oxidized by a strong chemical agent. High COD levels can indicate the presence of pollution. The DO of the lake water ranges from 0 in March-19 to 6.8 mg/L in June-21. Aquatic life needs oxygen to survive. Low DO levels can harm aquatic life. From 0 mg/L in March-20 to 13.5 mg/L in June-20, the lake's BOD levels differ. BOD is a measure of the amount of organic matter in water that can be decomposed by bacteria. High BOD levels can indicate the presence of pollution. In Sept-19, lake water was 29.704 mg/L and in March-19, it was 280.90 mg/L for chloride. Chloride is a naturally occurring ion that is found in all waters. High chloride levels can indicate the presence of pollution. Ammonical nitrogen content ranges from 0 in June-20 to 2.98 mg/L in Sept-21. From 0 in June-20 to 1.90 mg/L in Dec-18 for total kjeldahl nitrogen (TKN). The nitrate ranges from 0 in June-20 to 2.41 mg/L in March-20. High amount of nitrate can cause blue baby syndrome. The phosphate value varies from 0.1 in June -19 to 1.56 mg/L in Sep-21. Sulphate fluctuates from 47 mg/L in Sep-19 to 198 in Sept-20. The total number of coliform bacteria in the lake water shifts from 5 in March–21 to 27 MPN/100 mL in September–20. The range of fecal coliform is 0 in September–18 and 18 MPN/100ML in September–21. Data is given in table 31.

Motnath Lake: The pH is somewhat alkaline, ranging from 7.41 on March-21 to 9.1 on March-20. Between September-19 and September-18, the total dissolved solids ranged from 176 to 699 mg/L. In September-2018, TSS was 1.2 mg/L; in September-21, it was 73 mg/L. In September-2019, the conductivity was 219, and in March-2019, it was 1330 µS/cm. In March-19, the temperature is 20.9°C, and in June-19, it is 28.4°C. The range of turbidity is 3 NTU in September-20 to 46 NTU in June-19. March-19 and March-20 had varying color levels, with 1.5 and 29.8 hazen units, respectively. The September-19 fluoride reading is 0.14, whereas the September-18 value is 1.2 ppm. In June-20 to September-18, the acidity is 0 mg/L and 21 mg/L. From September-20 to September-19, the alkalinity varies from 100 to 602 mg/L. March- 20 to September-19, the total hardness varies from 84 to 410 mg/L. From 20.8 mg/L in June-20 to 325 mg/L on June-19, there is a variation in the calcium hardness. March-20 to September-18 has a range of 12.6 mg/L to 148.1 mg/L for magnesium hardness. In March-20 to March-21, the chemical oxygen demand is 12 mg/L to 66 mg/L. From 3.1 mg/L in June-21 to 8.14 mg/L on

September-19, there is a variation in the DO content. March-20 has a biochemical oxygen demand of 0.794 and December-20 has a BOD of 13.5 mg/L. Chloride concentrations vary from 38 mg/L in December-20 to 198 mg/L in September-18. The Ammonical nitrogen level changes from 1.6 mg/L in September-18 to 0 in June-20. Between June-20 and March-19, the total Kjeldahl nitrogen differs from 0 to 1.098 mg/L. From 0.252 in December-19 to 3.7 mg/L in September-18, the nitrate varies. The range of the phosphate value is 0.076 in December-19 to 1.4 mg in September-18. Sulfur fluctuates from 24 mg/L in September-19 to 205 mg/L in March-20. Between March-21 and December-21, the total coliform bacteria count in the lake water shifts from 6 to 27 MPN/100 mL. The range of fecal coliform is 3 in March-19 to 17 MPN/100 ml in December-21. Data given in table 32.

Dhobi Lake: pH minimum value is 6.94 in March-20 and the maximum is 8.41 in September-20. TDS value is 327 mg/L in September-21and 2250 mg/L in March-19. TSS ranges from 17 mg/L in September-21 to 68 mg/L in December-18. The conductivity varies from 414 in September-21 to 3150 µS/cm in March-19. Temperature value is 21.1°C in Decemeber-18, and 29.5°C in December-19. Turbidity is 3 NTU in September-20 and 30 NTU in March-20. The colour minimum value is 6 hazen units in September-20, and the maximum is 291 hazen units in September-18. The fluoride varies from 0.13 mg/L in December-20 and to 1.2 mg/L in June-19. Acidity is 0 mg/L in June-20 and 51 mg/L in December-19. The alkalinity is 44 mg/L in September-20 and 601 mg/L in September-19. Total hardness is 144 mg/L in September-20 and 745 mg/L in March-19. Chemical oxygen demand is 9 mg/L in March-20 and 56 mg/L in June-20. The dissolved oxyge minimum value is 0 mg/L in March-20 and the maximum is 6.4 mg/L in March-21. Biochemical oxygen demand is 0.39 mg/L in September-18 and 21 mg/L in June-20. The chloride value is 89.33 mg/L in September-19 and 588.61 mg/L in September-18. The ammonia nitrogen varies from 0.217 mg/L in June-20 and 2.7 mg/L in June-19. The Kjeldahl nitrogen ranges from 0 mg/L in June-20 and the maximum is 1.34 mg/L in September-18. The nitrate is 0.34 mg/L in December-19 and 3.97 mg/L in March-20. The phosphate differs from 0.16 mg/L in December-19 and 1.45 mg/L in December-20. The sulphate is 115 mg/L in September-20 and 745 mg/L in March-21. Total coliforms is 10 MPN/100 mL in June-21 and 43 MPN/100 ml in March-21. The fecal coliforms range from 4 MPN/100 mL in September-21 and 25 MPN/100 mL in March-21. Data given in table 33.

Bapod Lake: pH minimum value is 7.01 in March-20 and the maximum is 8.3 in June-19. TDS is 425 mg/L in June-19 and 1104 mg/L in September-20. TSS ranges from 12 mg/L in March-21 to 58 mg/L in March-20. The conductivity varies from 947 in September-21 to 2240 µS/cm in December-18. Temperature minimum value is 20.9°C in December-18, and the maximum is 29.3°C in June-19. Turbidity is 1.43 NTU in March-21 and 20 NTU in March-20. 2.33 hazen units in June-19, and 20.7 hazen unit in December-18 for color. Fluoride is 0.325 mg/L in June-19 and 1.01 mg/L in September-20. Acidity is 0 mg/L in September-20 and 23 mg/L in March-19. Alkalinity is 68 mg/L in September-20 and 705 mg/L in September-19. Total hardness is 110 mg/L in March-20 and 620 mg/L in March-19. Chemical oxygen demand is 9.55 mg/L in September-20 and 128 mg/L in March-21. The dissolved oxygen is 3.9 mg/L in June-20 and 8.34 mg/L in March-19. Biochemical oxygen demand is 0 mg/L in September-19 and 15 mg/L in March-19. Chloride is 67.49 mg/L in September-19 and 262.04 mg/L in June-19. The ammonical nitrogen is 0.49 mg/L in December-20 and 2.99 mg/L is June-19. The Kjeldahl nitrogen is 0.12 mg/L in December-19 and 1.23 mg/L in June-20. The nitrate minimum value is 0 mg/L in Decemeber-20 and the maximum is 4 mg/L in Septemper-19. Phosphate is 0.12 mg/L in March-19 and 1.7 mg/L in September-21.Sulphate value ranges from 53.2 mg/L in September-21 and 174.25 mg/L in Decemeber-20. Total coliforms is 9 MPN/100 mL in September-20 and 30 MPN/100 mL in September-19. The fecal coliforms varies from 8 MPN/100 mL September-20 and 21 MPN/100 mL September-19. Data given in table 34.

Danteshwar Lake: The pH is somewhat alkaline, ranging from 7.47 in December-19 to 8.4 in March-19. Between September-19 and June-21, the total dissolved solids vary from 210 to 550 mg/L. September-19 TSS is 14 mg/L; September-21 TSS is 61 mg/L. In September-19, the conductivity is 511, and in September-21, it is 1853 µS/cm. The variation of temperatures is 20.7°C in December-20 to 29.5°C in September-18. Decemeber-20 to December-18, the turbidity is between 1 to 30 NTU. The color changes in December-20 from 5 to September-19 from 23.13 hazen units. In September-20, the fluoride value is 0; in September-19, it is 1.03 ppm. From 0 in September-20 to 17 mg/L in December-19, the acidity varies. In September-19, alkalinity was 84 mg/L; in December-20, it was 488 mg/L. From September-20 to September-19, the fluoride value fluctuates from 0 to 1.03 ppm. In September-20 to December- 19, the acidity is 0 mg/L. Alkalinity varies from 84 mg/L in September-19 to 488 mg/L in December-20. Between June-19 and December-19, the total hardness ranges from 78 to 310 mg/L. The range of values of the calcium

hardness is 24 in September-20 to 204.75 mg/L in December-19. From 22 mg/L in June-19 to 124 mg/L in March-21, that is the range of magnesium hardness. In December-20 to December-19, the chemical oxygen demand is 28 mg/L to 110 mg/L. The variability of the dissolved oxygen level is 1.8 in March-21 to 6.35 mg/L in December-19. The range of the biochemical oxygen demand is 0 in December-21 to 13.5 mg/L in December-20. The ammonical nitrogen level varies from 2.57 mg/L in December- 20 to 0.47 mg/L in December-21. Total Kjeldahl nitrogen ranges from 0.07 mg/L in September-19 to 1.42 mg/L in December-20. The nitrate changes from 0.33 mg/L on December-21 to 4 mg/L in December-19. Phosphate values fluctuate between 0.09 mg/L in September-19 to 0.69 mg/L in December-20. Sulphate shifts from 47.82 mg/L on September-20 to 319 mg/L in March- 21. Total Coliform changes from 6 MPN/100 ml in March-21 to 45 MPN/100 ml on September-19. The range of fecal coliform is 2 in September-21 to 33 MPN/100 mL in December-19. Data given in table 35.

Gorwa Lake: The pH is quite alkaline, ranging from 7.48 in December-18 to 9.1 in June-19. TDS ranges from 212 mg/L on September-21 to 890 mg/L in December-19. TSS varies from 16 mg/L in September-20 to 44 mg/L in December-19. In September-20, the conductivity is 2681 µS/cm, whereas in September-21, it is 579. The temperature fluctuates from 21.2°C in December-18 to 26.4°C in September-20. The turbidity varies from 2 NTU in December-20 to 29.33 NTU on September-18. The color changes from 6.1 in December-21 to 22 hazen units in March-19. From 0.15 in September-20 to 1.2 ppm on June-19, there is a variance in the fluoride levels. Between September-18 and December-18, the acidity fluctuates from 0 to 32 mg/L.In September-20 to June-19, the range of alkalinity is 108 to 587 mg/L. From 88 mg/L on September-20 to 265.5 mg/L in December-18, that is the total hardness range. September- 20 to September-21 saw a variation in calcium hardness of 22.4 to 184 mg/L. From 3 in December-21 to 154.3 mg/L on December-18, there is a variance in the magnesium hardness. In December-20 and March-21, COD varies from 16 to 168 mg/L. September-18 to June-21 has a DO content ranging from 3.01 to 6.1 mg/L. December-20 to June-19 has a BOD range of 0 to 15 mg/L. In September-20 to December-18, the chloride content is 24 mg/L. In December- 21 and September-19, the ammonical nitrogen content is 0.25 and 1.89 mg/L, respectively. From December-21 to September-20, the total Kjeldahl nitrogen varies between 0.78 and 2.74 mg/L. In September-21 and December-19, the nitrate is 0.23 and 3.78 mg/L, respectively. From 0.04 in December-18 to 1.14 mg/L in September-19, the phosphate value fluctuates. From September-21 to December-20, the range of sulphate is 53.2

mg/L to 174.25 mg/L. Between September-20 and September-19, total coliform levels vary from 9 to 30 MPN/100 ml. From 8 September-20 to 21 MPN/100 ml in September-19, there is a range for fecal coliform. Data given in table 36.

Gotri Lake: pH minimum value is 7.28 in September-20 and the maximum is 8.8 in March-19. TDS is 345 mg/L in September-19 and 730 mg/L in March-19. TSS is 8 mg/L in June 20 and 50 mg/L in June-21. Conductivity is 478 µS/cm in December-19 and the maximum is 1641 µS/cm in September-20. Temperature minimum value is 21.1°C in December-18, and the maximum is 28.1°C in June-19. Turbidity is 5 NTU in September-20 and 28 NTU in June-21. Colour is 5 hazen units in June-20, and 36.06 hazen units in March-19. Fluoride is 0.2 mg/L in September-19 and 0.99 mg/L in March-19. Acidity is 0 mg/L in June-20 and 33 mg/L in March-20. The alkalinity is 91 mg/L in March-19 and 348.4 mg/L in December-18. Total hardness is 132 mg/L in September-20 and 312 mg/L in Decemeber-20. Ca-Hardness is 40 mg/L in September-20 and 268 mg/L in Decemeber-20. Mg-Hardness is 19 in December-21 and 189.5. mg/L in June-19. Chemical oxygen demand is 0 mg/L in September-20 and 84 mg/L in September-19. The dissolved oxygen is 1.80 mg/L in September-18 and 7.15 mg/L in March-19. Biochemical oxygen demand is 0 mg/L in September-20 and 10 mg/L in June-20. Chloride is 48 mg/L in September-20 and 229.62 mg/L in Decemeber-18. The ammonical nitrogen is 0 mg/L in June-20 and 5.6 mg/L in Septemeber-20. The Kjeldahl nitrogen ranges from 0 mg/L in June-20 and 2.184 mg/L in March-19. The nitrate is 0.487 mg/L in March-20 and 6.04 mg/L in Septemeber-21. Phosphate is 0.15 mg/L in Decemeber-19 and 2.56 mg/L in June-20. Sulphate is 70.74 mg/L in Septemeber-20 and 264 mg/L in March-21. Total coliforms minimum is 10 MPN/100 mL in March-21 and the maximum is 40 MPN/100 mL in March-20. The fecal coliforms is 6 MPN/100 mL in March-21 and 28 MPN/100 mL in March-20. Data given in table 37.

Harni Lake: pH minimum value is 7.31 in September-20 and the maximum is 8.47 in March-20.TDS is 300 mg/L in Decemeber-18 and 754 mg/L in September-19. TSS is 12 mg/L in June-20 and 218 mg/L in September-21. Conductivity is 451 µS/cm in December-18 and 1341 µS/cm in March-19. Temperature minimum value is 20.4°C in March-19 and the maximum is 28.8°C in June-19. Turbidity is 0.6 NTU in March-21 and 35 NTU in March-20. Colour is 2 hazen units, in March-21 and 13.3 hazen unit in September-21. The fluoride ranges from 0 mg/L in December-20 and 0.89 mg/L in December-21. The acidity varies from 0 mg/L in June-20 and 33.66 mg/L in

March-20. Alkalinity is 104 mg/L in June-20 and 416 mg/L in Decemeber-20. Total hardness is 80 mg/L in September-20 and 258 mg/L in June-19. Ca-Hardness is 22.4 mg/L in June-20 and 164 mg/L in September-21. Mg-Hardness is 16.95 mg/L in March-20 and 112.5 mg/L in June-19. Chemical oxygen demand minimum varies from 7.56 mg/L in September-20 and 120 mg/L in March-21. The dissolved oxygen is 1.8 mg/L in March-21 and 7.21 mg/L in December-19. Biochemical oxygen demand is 0 mg/L in December-20 and 18 mg/L in September-20. Chloride is 80.06 mg/L in December-19 and 256.45 mg/L in June-19. The ammonical nitrogen minimum value is 0 mg/L in June-20 and the maximum is 2.41 mg/L in September-18. The Kjeldahl nitrogen is 0 mg/L in June-20 and the 0.89 mg/L in March-19. Nitrate is 0 mg/L in September-20 and the maximum is 1.77 mg/L in September-21. Phosphate minimum value is 0.12 mg/L in December-19 and 0.99 mg/L in September-21. The Sulphate is 81.2 mg/L in September-21 and 465 mg/L in March-21. Total coliforms is 4 MPN/100 mL in March-21 and 40 MPN/100 mL in December-19. The fecal coliforms is 3 MPN/100 mL in September-21 and 22 MPN/100 mL in September-20. Data given in table 38.

Kamala Lake: pH minimum value is 7.1 in June-19 and the maximum is 8.29 in September-21. TDS is 241 mg/L is December-21 and 1171 mg/L in March-19. TSS is 14 mg/L in June-19 and 35 mg/L in June-21. Conductivity is 574 µS/cm in December-21 and 227 µS/cm in March-19. Temperature minimum value is 21.1°C in September-21, and the maximum is 29.2°C. in June-19. Turbidity is 1 NTU in September-20 and 10 NTU in September-18. Colour varies from 2.4 hazen units in March-19, and 20.6 hazen unit in September-19. Fluoride is 0.14 mg/L in December-18 and 1.01 mg/L is June-20. Acidity is 0 mg/L in September-20 and 22 mg/L in June-19. Alkalinity varies from 72 mg/L in March-21 and 605 mg/L in September-19. Total hardness is 44 mg/L in September-20 and 495 mg/L in March-19. Ca-Hardness is 14.4 mg/L in September-20 and 388.5 mg/L in March-19. Mg-Hardness is 16.85 mg/L in September-19 and 189.6. mg/L in September-18. Chemical oxygen demand is 4 mg/L in December-20 and 64 mg/L in December-19. The dissolved oxygen is 4.8 mg/L in June-20 and 7.54 mg/L in March-19. Biochemical oxygen demand is 0 mg/L in December-20 and 15 mg/L in June-20. Chloride is 57.57 mg/L in September-19 and the maximum is 310 mg/L in March-20. The ammonical nitrogen is 0.11 mg/L in December-21 and 1.79 mg/L in December-20. The Kjeldahl nitrogen is 0 mg/L in June-21 and 1.01 mg/L in December-20. The nitrate is 0.08 mg/L in September-19 and 2.78 mg/L in December-19. Phosphate is 0.01 mg/L in June-19 and 0.33 mg/L in December-20. Sulphate is 56 mg/L in June-

20 and 160 mg/L in December-20. Total coliforms is 2 MPN/100 mL in March-21 and 29 MPN/100 mL in September-20. The fecal coliforms is 3 MPN/100 mL in December-21 and 18 MPN/100 mL in September-20. Data given in table 39.

Table 31 Result Table for Sama Lake

Sr No	Parameters	Sep-18	Dec-18	Mar-19	Jun-19	Sep-19	Dec-19	Mar-20	Jun-20	Sep-20	Dec-20	Mar-21	Jun-21	Sep-21	Dec-21
1	**pH**	7.80	7.92	7.98	8.18	7.35	7.61	7.80	8.30	9.10	8.46	7.71	8.23	8.56	7.88
2	**TDS**	336.00	365.00	835.00	143.00	242.00	389.00	509.00	584.00	328.00	468.00	564.00	788.00	880.00	610.00
3	**TSS**	55.00	68.00	58.00	70.00	41.00	30.00	35.00	40.00	28.00	44.00	84.00	66.00	43.00	50.00
4	**Conductivity**	670.00	672.00	1990.00	180.00	298.00	589.00	637.00	1298.00	1826.00	1140.00	1529.00	1017.00	985.00	847.00
5	**Temperature**	26.70	21.70	20.40	27.80	25.20	22.90	24.10	26.40	26.30	22.60	25.40	24.50	23.10	21.30
6	**Turbidity**	30.00	35.00	10.00	12.00	11.00	8.00	7.00	5.00	3.00	76.00	56.50	40.00	12.00	29.00
7	**Colour**	12.10	18.40	28.40	13.87	9.60	13.49	17.50	18.00	8.00	15.00	9.00	13.00	26.00	20.00
8	**Fluoride**	0.78	0.56	0.97	0.19	0.33	0.54	0.63	1.20	1.01	0.28	0.31	0.87	0.41	0.21
9	**Acidity**	28.00	36.00	135.00	16.00	19.00	37.00	10.00	0.00	8.00	14.00	7.00	19.00	11.00	16.00
10	**Alkalinity**	377.00	346.00	750.00	62.00	561.00	278.00	215.00	144.00	92.00	724.00	284.00	247.00	205.00	178.00
11	**Total Hardness**	167.00	174.00	390.00	89.00	145.00	153.20	119.00	160.00	84.00	212.00	164.00	211.00	250.00	147.00
12	**Ca- Hardness**	151.20	148.05	196.35	68.25	118.65	129.15	85.40	41.60	19.20	204.00	32.00	131.00	178.00	101.00
13	**Mg-Hardness**	15.80	25.95	193.65	20.75	26.35	24.05	33.60	118.40	64.80	8.00	132.00	80.00	72.00	46.00
14	**COD**	12.00	16.00	10.00	24.00	28.00	18.00	11.00	41.00	35.00	32.00	28.00	30.00	24.00	12.00
15	**DO**	2.18	2.78	0.00	4.77	6.75	4.87	5.56	5.60	4.50	5.00	4.70	6.80	6.10	4.87
16	**BOD**	1.19	2.17	0.00	1.10	2.38	2.30	0.00	13.50	13.00	13.50	6.00	6.70	5.60	2.98
17	**Chloride**	79.41	91.32	280.91	123.08	29.70	110.67	116.13	128.00	40.00	108.00	132.00	127.00	99.98	71.00
18	**Ammonical Nitrogen**	0.89	1.12	1.78	2.57	1.56	0.56	0.90	0.00	0.23	1.56	2.13	2.57	2.98	2.41
19	**Total Kjeldahl Nitrogen**	0.90	1.90	0.90	1.06	0.90	1.04	1.18	0.00	0.42	0.66	0.98	1.23	1.58	0.96
20	**Nitrate**	0.97	1.00	1.17	0.14	0.17	0.97	2.42	0.00	0.88	0.97	1.25	1.99	2.18	1.84
21	**Phosphate**	0.30	0.70	0.90	0.10	0.22	0.47	0.73	0.58	0.38	1.20	1.19	1.47	1.56	0.94
22	**Sulphate**	0.00	0.00	0.00	0.00	47.00	76.00	98.00	121.08	198.00	110.00	154.00	84.00	59.00	48.00
23	**Total Coliform**	0.00	0.00	0.00	0.00	10.00	19.00	21.00	24.00	27.00	9.00	5.00	15.00	21.00	18.00
24	**Fecal Coliforms**	0.00	0.00	0.00	0.00	7.00	13.00	11.00	13.00	13.00	2.00	4.00	11.00	18.00	14.00

Table 32 Result Table for Motnath Lake

Sr No	Parameters	Sep-18	Dec-18	Mar-19	Jun-19	Sep-19	Dec-19	Mar-20	Jun-20	Sep-20	Dec-20	Mar-21	Jun-21	Sep-21	Dec-21
1	pH	7.70	Lake Under Red evel opment	7.80	7.81	7.71	8.18	9.10	8.60	8.96	8.85	7.41	7.87	8.32	8.01
2	TDS	699.00		560.00	606.00	176.00	196.00	211.00	284.00	315.00	264.00	240.00	387.00	432.00	401.00
3	TSS	1.20		49.00	58.00	21.00	24.00	28.00	35.00	32.00	20.00	16.00	33.00	73.00	55.00
4	Conductivity	1014.00		1330.00	854.00	219.00	240.00	279.00	700.00	675.00	606.00	816.00	603.00	669.00	617.00
5	Temperature	25.80		20.90	28.40	25.80	23.10	23.80	26.20	26.50	22.30	25.20	26.10	24.50	21.90
6	Turbidity	46.00		15.00	20.00	5.00	8.00	8.00	4.00	3.00	23.00	10.00	28.00	30.00	27.00
7	Colour	23.20		1.50	2.40	2.60	13.87	29.80	20.10	15.00	15.00	12.00	16.00	23.50	20.80
8	Fluoride	1.20		0.20	0.66	0.14	0.19	0.31	0.44	0.68	0.51	0.38	0.56	0.62	0.59
9	Acidity	21.00		10.00	17.00	8.00	13.00	16.00	0.00	14.00	8.00	2.60	11.00	19.00	13.00
10	Alkalinity	568.00		288.00	325.00	602.00	325.00	135.00	140.00	100.00	368.00	140.00	146.00	152.00	131.00
11	Total Hardness	347.00		394.00	410.00	97.00	178.00	84.00	108.00	92.00	192.00	116.00	123.00	195.00	175.00
12	Ca- Hardness	198.90		295.05	325.00	75.60	89.00	71.40	20.80	27.20	76.00	36.00	54.00	105.00	87.00
13	Mg-Hardness	148.10		98.95	85.00	21.40	89.00	12.60	87.20	64.80	116.00	80.00	69.00	90.00	88.00
14	COD	26.00		54.00	31.00	47.00	27.00	12.00	52.00	47.76	16.00	66.00	21.00	44.00	18.00
15	DO	3.77		7.75	7.15	8.15	6.89	4.17	5.40	7.70	5.60	4.40	3.10	6.10	4.20
16	BOD	1.39		3.58	2.38	3.38	2.13	0.79	10.50	10.56	13.50	6.00	5.20	2.50	3.40
17	Chloride	198.00		118.12	127.05	39.70	49.63	53.60	66.00	186.00	38.00	66.00	87.00	67.99	79.00
18	Ammonical Nitrogen	1.60		0.99	0.75	0.34	0.90	1.12	0.00	0.87	1.40	0.40	0.60	0.87	0.63
19	Total Kjeldahl Nitrogen	1.05		1.10	1.00	0.73	1.01	0.95	0.00	0.43	0.98	0.10	0.23	0.47	0.33
20	Nitrate	3.70		1.79	1.54	0.49	0.25	2.85	1.87	1.47	1.21	1.98	1.33	1.66	1.47
21	Phosphate	1.40		0.91	0.56	0.16	0.08	0.26	0.56	0.91	0.35	0.68	0.98	1.01	0.71
22	Sulphate	0.00		0.00	0.00	24.00	29.00	34.00	125.50	32.57	40.89	205.00	64.00	79.80	51.00
23	Total Coliform	0.00		0.00	0.00	25.00	23.00	20.00	18.00	22.00	10.00	6.00	19.00	20.00	27.00
24	Fecal Coliforms	0.00		0.00	0.00	15.00	11.00	9.00	10.00	8.00	6.00	3.00	13.00	7.00	17.00

Table 33 Result Table for Dhobi Lake

Sr No	Parameters	Sep-18	Dec-18	Mar-19	Jun-19	Sep-19	Dec-19	Mar-20	Jun-20	Sep-20	Dec-20	Mar-21	Jun-21	Sep-21	Dec-21
1	pH	7.20	7.50	8.10	7.96	7.60	7.75	6.94	7.30	8.41	7.72	6.98	7.87	7.58	7.58
2	TDS	1260.00	1050.00	2250.00	1965.00	327.00	555.00	752.00	1348.00	692.00	668.00	736.00	987.00	1121.00	1048.00
3	TSS	58.00	68.00	50.00	47.00	25.00	35.00	19.00	22.00	28.00	28.00	24.00	28.00	17.00	23.00
4	Conductivity	1880.00	1350.00	3150.00	2745.00	414.00	817.00	1675.00	3020.00	773.00	1680.00	1868.00	1317.00	1672.00	1487.00
5	Temperature	27.20	21.10	26.10	26.50	29.40	29.50	23.60	26.30	25.80	23.10	26.70	26.80	22.70	21.70
6	Turbidity	20.00	17.00	14.00	15.00	22.00	8.00	8.00	4.00	3.00	30.00	3.58	10.00	21.00	8.00
7	Colour	291.00	18.70	35.20	31.00	12.80	16.60	25.60	19.00	6.00	10.00	15.00	16.70	23.40	20.70
8	Fluoride	1.10	0.87	0.98	1.20	0.74	0.58	0.88	1.20	0.25	0.13	0.54	0.33	0.21	0.41
9	Acidity	28.00	26.00	35.00	33.00	25.00	51.00	29.00	0.00	10.00	18.00	24.00	11.00	16.00	9.00
10	Alkalinity	188.00	198.00	482.00	488.00	601.00	105.00	68.00	96.00	44.00	252.00	92.00	147.00	210.00	166.00
11	Total Hardness	587.00	580.00	745.00	735.00	155.00	338.00	374.00	176.00	144.00	268.00	224.00	189.00	256.00	201.00
12	Ca- Hardness	127.05	120.75	284.55	452.00	128.10	284.55	291.90	46.40	32.00	220.00	44.00	117.00	152.00	98.00
13	Mg-Hardness	459.95	459.25	460.45	283.00	26.90	53.45	82.10	129.60	112.00	48.00	180.00	72.00	104.00	103.00
14	COD	12.00	20.00	17.00	19.00	14.00	17.00	9.00	56.00	31.84	29.00	23.00	30.00	48.00	21.00
15	DO	2.19	4.97	3.58	4.57	4.97	5.26	0.00	6.10	6.20	3.90	6.40	5.70	4.60	3.80
16	BOD	0.40	2.38	1.39	1.59	2.78	1.09	1.78	21.00	6.00	9.00	6.00	4.80	1.80	2.90
17	Chloride	588.61	273.96	247.00	300.76	89.33	157.82	253.11	372.00	168.00	172.00	200.00	212.00	243.99	178.00
18	Ammonical Nitrogen	1.06	0.83	1.90	2.70	0.39	0.29	0.67	0.22	1.09	2.46	2.13	1.07	1.84	0.77
19	Total Kjeldahl Nitrogen	1.34	0.96	0.73	0.41	0.50	0.45	0.90	0.00	0.29	0.87	0.45	0.99	1.14	0.63
20	Nitrate	0.61	0.68	1.35	1.80	0.43	0.34	3.97	1.56	0.78	0.57	0.66	1.34	1.98	0.85
21	Phosphate	0.38	0.52	0.26	0.23	0.17	0.16	0.19	0.24	0.57	1.45	0.38	0.74	1.12	0.48
22	Sulphate	0.00	0.00	0.00	0.00	245.00	298.00	198.00	200.90	115.00	155.94	745.00	210.00	132.30	147.00
23	Total Coliform	0.00	0.00	0.00	0.00	39.00	33.00	20.00	29.00	36.00	14.00	43.00	10.00	13.00	19.00
24	Fecal Coliforms	0.00	0.00	0.00	0.00	20.00	11.00	8.00	11.00	11.00	10.00	25.00	8.00	4.00	10.00

Table 34 Result Table for Bapod Lake

Sr No	Parameters	Sep-18	Dec-18	Mar-19	Jun-19	Sep-19	Dec-19	Mar-20	Jun-20	Sep-20	Dec-20	Mar-21	Jun-21	Sep-21	Dec-21
1	pH	7.30	7.34	7.08	8.30	7.47	7.89	7.01	7.70	8.00	7.54	7.64	7.90	7.69	7.23
2	TDS	483.00	1015.00	997.00	425.00	515.00	687.00	800.00	950.00	1104.00	1000.00	1044.00	896.00	523.00	750.00
3	TSS	23.00	56.00	44.00	20.00	39.00	47.00	58.00	17.00	36.00	52.00	12.00	24.00	13.00	33.00
4	Conductivity	990.00	2240.00	1872.00	1014.00	987.00	1871.00	1541.00	1714.00	1941.00	2150.00	2100.00	1674.00	947.00	1974.00
5	Temperature	27.90	20.90	27.80	29.30	27.80	22.40	23.40	24.70	26.20	21.40	23.10	23.50	22.90	21.10
6	Turbidity	10.00	15.00	13.00	12.00	8.00	5.00	20.00	7.00	2.00	6.00	1.43	3.00	5.00	9.00
7	Colour	13.50	20.70	19.70	2.33	16.13	11.23	13.80	7.80	10.00	5.00	9.00	11.00	6.00	4.00
8	Fluoride	0.70	0.56	0.54	0.33	0.78	0.44	0.59	0.99	1.01	0.53	0.71	0.40	0.73	0.89
9	Acidity	12.00	15.00	23.00	21.00	17.00	11.00	15.00	9.00	0.00	0.00	8.00	10.00	12.00	14.00
10	Alkalinity	176.00	176.00	309.00	551.00	705.00	478.00	201.00	187.00	68.00	260.00	72.00	287.00	201.00	199.00
11	Total Hardness	330.00	326.00	620.00	283.00	310.00	215.00	110.00	231.00	252.00	584.00	516.00	315.00	245.00	289.00
12	Ca- Hardness	141.75	150.15	367.50	236.25	204.75	110.00	158.00	117.00	41.60	204.00	184.00	89.00	200.00	115.00
13	Mg-Hardness	188.25	175.85	252.50	46.75	105.25	105.00	-48.00	114.00	210.40	380.00	332.00	226.00	45.00	174.00
14	COD	38.00	60.00	96.00	32.00	20.00	24.00	38.00	40.00	9.55	18.00	128.00	27.00	68.00	48.00
15	DO	6.16	5.90	8.34	7.55	6.36	4.30	5.10	3.90	5.50	6.20	5.30	6.20	5.90	4.80
16	BOD	3.70	5.20	15.00	7.00	0.00	0.00	2.80	8.00	0.00	0.00	12.00	6.00	2.90	2.70
17	Chloride	89.33	92.31	135.99	262.05	67.50	89.00	74.00	117.00	128.00	123.00	142.00	158.00	129.90	134.00
18	Ammonical Nitrogen	1.12	1.45	2.87	2.99	1.01	0.89	0.74	2.08	1.77	0.45	0.88	1.08	1.58	1.10
19	Total Kjeledahl Nitrogen	0.31	0.71	0.24	0.48	0.59	0.12	0.23	1.23	0.12	0.12	0.14	0.74	0.55	0.88
20	Nitrate	2.58	1.78	2.14	1.16	4.00	3.14	2.88	1.41	0.78	0.00	0.45	1.87	0.43	1.12
21	Phosphate	0.36	0.58	0.12	0.41	0.13	0.19	0.88	1.00	0.40	0.33	0.18	1.40	1.70	0.99
22	Sulphate	0.00	0.00	0.00	0.00	89.00	102.00	147.00	89.00	165.14	174.25	123.00	78.00	53.20	64.00
23	Total Coliform	0.00	0.00	0.00	0.00	30.00	27.00	25.00	20.00	9.00	12.00	15.00	22.00	11.00	22.00
24	Fecal Coliforms	0.00	0.00	0.00	0.00	21.00	17.00	11.00	14	8.00	16.00	8.00	11.00	9.00	10.00

Table 35 Result Table for Danteshwar Lake

Sr No	Parameters	Sep-18	Dec-18	Mar-19	Jun-19	Sep-19	Dec-19	Mar-20	Jun-20	Sep-20	Dec-20	Mar-21	Jun-21	Sep-21	Dec-21
1	pH	7.60	7.60	8.40	8.02	7.80	7.47	Eichhornia Presence No Sampling		8.22	7.72	7.61	7.99	8.07	7.77
2	TDS	290.00	298.00	350.00	512.00	210.00	480.00			384.00	452.00	404.00	550.00	234.00	313.00
3	TSS	18.00	22.00	25.00	30.00	14.00	16.00			20.00	44.00	56.00	28.00	61.00	44.00
4	Conductivity	575.00	575.00	687.00	987.00	511.00	887.00			1014.00	1024.00	1138.00	1121.00	1853.00	990.00
5	Temperature	29.50	21.20	23.20	23.90	29.30	27.80			26.30	20.70	22.70	22.90	21.80	20.80
6	Turbidity	23.00	30.00	15.00	11.00	10.00	8.00			2.00	1.00	1.00	5.00	2.00	8.00
7	Colour	16.55	20.33	18.41	22.10	23.13	16.13			12.00	5.00	10.10	8.90	5.40	16.20
8	Fluoride	0.33	0.88	0.54	0.13	0.24	0.75			0.00	0.30	0.22	1.03	0.98	0.78
9	Acidity	10.00	12.00	8.00	6.00	2.00	17.00			0.00	0.00	8.00	14.00	11.00	9.00
10	Alkalinity	210.00	175.00	166.00	125.00	255.00	256.00			84.00	488.00	116.00	89.00	220.00	98.00
11	Total Hardness	190.00	199.00	100.00	78.00	110.00	310.00			92.00	236.00	168.00	120.00	200.00	140.00
12	Ca- Hardness	117.60	116.55	66.00	100.00	77.70	204.75			24.00	148.00	44.00	60.00	154.00	50.00
13	Mg-Hardness	72.40	82.45	34.00	22.00	32.30	105.25			68.00	88.00	124.00	60.00	46.00	90.00
14	COD	32.00	40.00	64.00	72.00	64.00	110.00			31.84	28.00	46.00	66.00	34.00	32.00
15	DO	4.50	3.97	2.80	3.30	3.77	6.36			4.30	3.10	1.80	3.50	6.20	5.80
16	BOD	1.78	2.18	5.00	10.00	1.50	2.50			9.00	13.50	6.00	8.00	2.80	0.00
17	Chloride	86.36	99.00	125.00	78.00	133.01	67.50			212.00	114.00	138.00	154.00	163.99	87.00
18	Ammonical Nitrogen	1.20	0.98	1.50	0.78	0.48	0.88			1.78	2.58	0.56	0.97	0.67	0.47
19	Total Kjeldahl Nitrogen	0.21	0.18	0.66	0.18	0.07	0.14			1.02	1.42	0.08	0.33	0.14	0.07
20	Nitrate	2.40	1.80	1.40	0.88	1.45	4.00			1.08	0.77	0.98	1.54	1.33	0.33
21	Phosphate	0.49	0.55	0.33	0.15	0.09	0.24			0.51	0.69	0.67	0.47	0.22	0.13
22	Sulphate	0.00	0.00	0.00	0.00	118.00	174.00			47.82	54.35	319.00	98.00	205.10	108.00
23	Total Coliform	0.00	0.00	0.00	0.00	45.00	40.00			39.00	12.00	6.00	20.00	7.00	19.00
24	Fecal Coliforms	0.00	0.00	0.00	0.00	30.00	33.00			24.00	19.00	8.00	10.00	2.00	11.00

Table 36 Result Table for Gorwa Lake

Sr No	Parameters	Sep-18	Dec-18	Mar-19	Jun-19	Sep-19	Dec-19	Mar-20	Jun-20	Sep-20	Dec-20	Mar-21	Jun-21	Sep-21	Dec-21
1	pH	8.03	7.48	8.50	9.10	8.98	9.01			7.73	8.41	8.28	8.24	7.99	7.87
2	TDS	569.33	704.00	676.00	874.00	610.00	890.00			244.00	292.00	264.00	351.00	212.00	311.00
3	TSS	35.00	30.00	23.00	40.00	26.00	44.00			16.00	24.00	20.00	18.00	27.00	18.00
4	Conductivity	941.00	1406.00	1274.00	1341.00	1008.00	1782.00			2681.00	700.00	798.00	888.00	579.00	987.00
5	Temperature	23.90	21.20	23.80	24.50	22.40	21.40			26.40	21.70	22.80	23.40	22.90	21.70
6	Turbidity	29.33	7.60	21.00	18.00	11.00	5.00			3.00	2.00	3.02	8.00	10.00	13.00
7	Colour	13.00	16.00	22.00	18.00	11.00	8.00			10.00	10.00	15.00	9.00	7.00	6.10
8	Fluoride	0.87	0.64	0.77	1.20	1.04	0.99			0.15	0.34	0.42	0.23	0.51	0.67
9	Acidity	0.00	32.00	10.00	8.00	12.00	6.00			0.00	2.00	8.00	6.00	7.00	3.00
10	Alkalinity	256.00	344.60	289.00	587.00	230.00	477.00			108.00	524.00	148.00	110.00	185.00	271.00
11	Total Hardness	102.00	265.60	187.00	245.00	174.00	156.00			88.00	172.00	116.00	170.00	220.00	134.00
12	Ca- Hardness	59.16	111.30	134.00	114.00	123.00	89.00			22.40	96.00	36.00	89.00	184.00	131.00
13	Mg-Hardness	42.84	154.30	53.00	131.00	51.00	67.00			65.60	76.00	80.00	81.00	36.00	3.00
14	COD	53.33	64.00	82.00	120.00	36.00	48.00			35.00	16.00	168.00	24.00	32.00	54.00
15	DO	3.01	3.30	4.10	5.50	3.80	4.30			3.80	5.30	5.70	6.10	3.40	3.10
16	BOD	1.21	13.00	10.00	15.00	8.40	4.50			12.00	0.00	0.00	4.80	1.80	6.10
17	Chloride	37.71	221.46	189.00	148.00	107.00	89.00			24.00	28.00	50.00	115.00	95.90	87.00
18	Ammonical Nitrogen	0.34	0.64	0.88	1.47	1.89	1.05			1.46	1.30	0.78	0.41	0.33	0.25
19	Total Kjeldahl Nitrogen	1.23	1.67	1.88	2.45	2.66	1.88			2.74	2.13	1.78	1.10	0.99	0.78
20	Nitrate	0.84	0.40	0.47	1.87	2.75	3.78			1.78	1.14	1.02	0.88	0.23	0.41
21	Phosphate	0.11	0.05	0.74	1.05	1.14	1.04			0.49	0.58	0.41	0.47	0.25	0.33
22	Sulphate	0.00	0.00	0.00	0.00	89.00	102.00			165.14	174.25	123.00	78.00	53.20	64.00
23	Total Coliform	0.00	0.00	0.00	0.00	30.00	27.00			9.00	12.00	15.00	22.00	11.00	22.00
24	Fecal Coliforms	0.00	0.00	0.00	0.00	21.00	17.00			8.00	16.00	8.00	11.00	9.00	10.00

Table 37 Result Table for Gotri Lake

Sr No	Parameters	Sep-18	Dec-18	Mar-19	Jun-19	Sep-19	Dec-19	Mar-20	Jun-20	Sep-20	Dec-20	Mar-21	Jun-21	Sep-21	Dec-21
1	pH	7.80	7.59	8.80	8.20	8.17	7.67	8.21	8.06	7.28	7.84	8.02	8.28	8.05	7.97
2	TDS	408.00	710.00	730.00	567.00	345.00	403.00	481.00	452.00	368.00	612.00	616.00	715.00	689.00	544.00
3	TSS	20.00	35.00	33.00	27.00	18.00	22.00	39.00	8.00	12.00	40.00	44.00	50.00	41.00	37.00
4	Conductivity	779.00	1478.00	1290.00	1147.00	774.00	478.00	1018.00	1120.00	1641.00	1532.00	1394.00	1410.00	1289.00	1140.00
5	Temperature	25.90	21.10	26.30	28.10	25.80	22.90	22.40	26.20	26.60	22.50	24.80	26.40	24.10	21.70
6	Turbidity	15.00	20.00	23.00	18.00	13.00	24.00	9.00	17.00	5.00	18.00	20.00	28.00	16.00	11.00
7	Colour	22.45	29.47	36.07	21.00	15.00	20.00	10.00	5.00	12.00	20.00	6.00	18.00	13.00	8.00
8	Fluoride	0.25	0.89	0.99	0.33	0.20	0.28	0.37	0.49	0.25	0.54	0.52	0.66	0.71	0.51
9	Acidity	7.80	31.20	16.00	22.00	27.00	16.00	33.00	0.00	10.00	22.00	14.00	19.00	23.00	8.00
10	Alkalinity	271.00	348.40	91.00	221.00	245.00	205.00	181.00	228.00	120.00	289.00	340.00	278.00	174.00	155.00
11	Total Hardness	216.00	264.60	276.00	288.00	228.00	193.00	269.00	212.00	132.00	312.00	256.00	227.00	210.00	174.00
12	Ca- Hardness	89.88	110.78	108.15	98.50	117.00	110.25	154.35	86.40	40.00	268.00	68.00	134.00	170.00	155.00
13	Mg-Hardness	126.12	153.82	167.85	189.50	111.00	82.75	114.65	125.60	92.00	44.00	188.00	93.00	40.00	19.00
14	COD	24.00	35.00	44.00	68.00	84.00	64.00	71.00	72.00	0.00	8.00	61.00	48.00	36.00	20.00
15	DO	1.81	3.75	7.15	6.99	5.99	6.36	4.97	5.20	2.40	2.80	6.60	6.90	2.80	4.80
16	BOD	1.48	2.54	2.78	3.58	2.99	4.97	2.98	10.00	0.00	0.00	8.70	5.50	0.90	3.40
17	Chloride	86.94	229.62	145.91	156.24	98.74	75.04	76.43	74.00	48.00	92.00	86.00	98.00	115.90	107.00
18	Ammonical Nitrogen	1.74	1.06	1.90	1.24	0.68	0.34	0.56	0.00	5.60	2.80	2.35	1.98	2.01	1.67
19	Total Kjeldahl Nitrogen	1.79	1.18	2.18	1.99	0.85	0.17	0.53	0.00	0.98	1.17	0.74	0.88	1.28	0.71
20	Nitrate	1.28	1.51	1.80	2.15	2.48	2.49	0.49	1.13	0.75	0.85	1.29	2.23	6.04	3.74
21	Phosphate	0.51	0.71	1.05	1.76	2.43	0.16	0.29	2.56	1.51	1.88	1.53	1.98	1.88	1.64
22	Sulphate	0.00	0.00	0.00	0.00	180.00	123.00	220.00	136.63	70.74	74.55	264.00	198.00	92.40	123.00
23	Total Coliform	0.00	0.00	0.00	0.00	35.00	28.00	40.00	21.00	22.00	19.00	10.00	21.00	23.00	29.00
24	Fecal Coliforms	0.00	0.00	0.00	0.00	22.00	12.00	28.00	11.00	9.00	15.00	6.00	11.00	10.00	17.00

Table 38 Result Table for Harni Lake

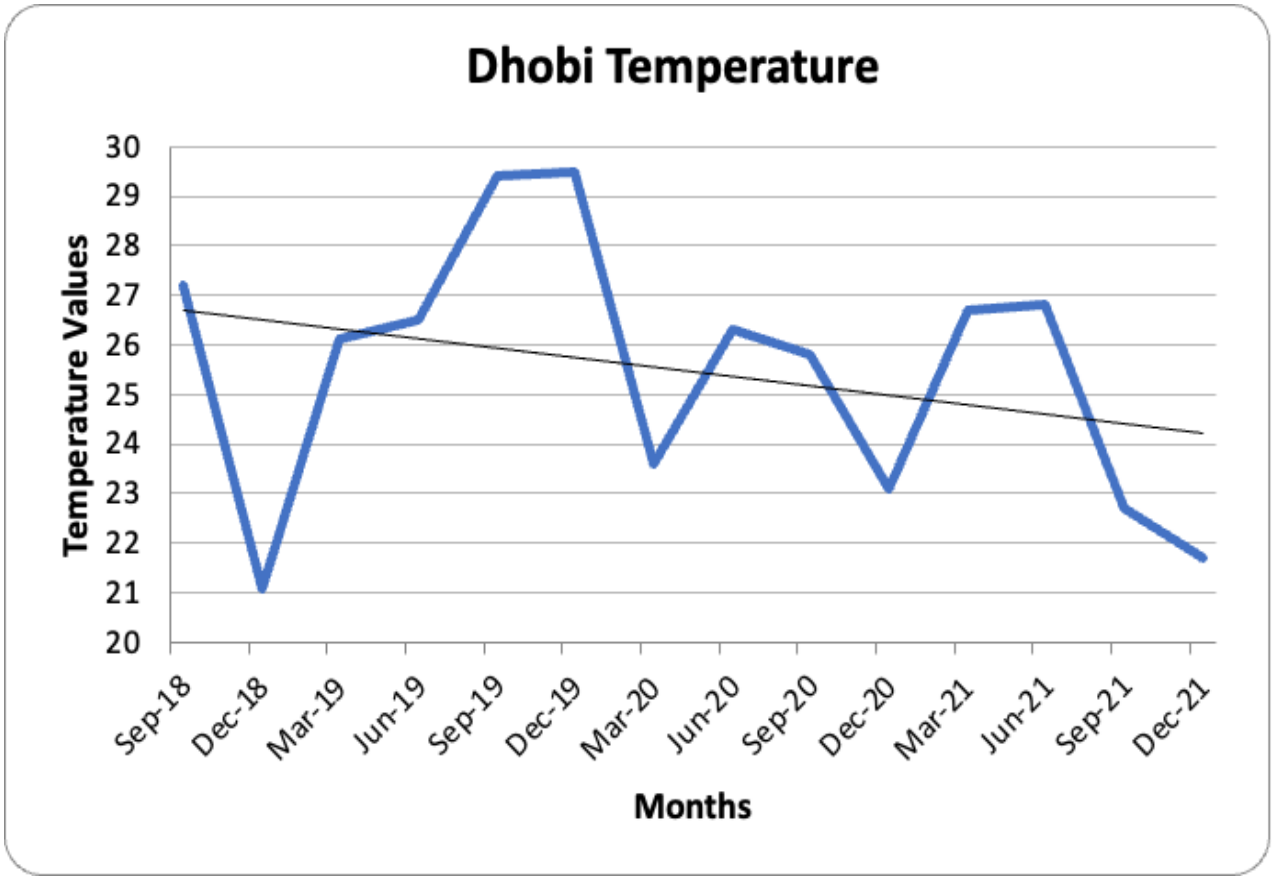
Sr No	Parameters	Sep-18	Dec-18	Mar-19	Jun-19	Sep-19	Dec-19	Mar-20	Jun-20	Sep-20	Dec-20	Mar-21	Jun-21	Sep-21	Dec-21
1	pH	7.48	7.51	8.20	7.72	7.66	7.98	8.47	7.50	7.31	7.40	7.90	7.84	8.25	7.98
2	TDS	550.00	300.00	700.00	616.00	754.00	400.00	714.00	687.00	564.00	484.00	580.00	432.00	650.00	567.00
3	TSS	81.00	41.00	74.00	95.00	147.00	89.00	18.00	12.00	24.00	32.00	32.00	150.00	218.00	174.00
4	Conductivity	741.00	451.00	1314.00	1220.00	1014.00	632.00	1147.00	1256.00	1098.00	1174.00	1226.00	874.00	1108.00	984.00
5	Temperature	26.70	21.70	20.40	28.80	26.73	23.80	23.13	26.30	25.40	22.40	25.10	26.10	23.70	21.40
6	Turbidity	20.00	11.00	30.00	15.00	25.00	20.00	35.00	7.00	1.00	3.00	0.60	15.00	10.00	23.00
7	Colour	5.60	3.00	9.70	7.40	12.72	9.64	11.99	5.00	6.00	5.00	2.00	9.00	13.30	8.00
8	Fluoride	0.23	0.12	0.23	0.74	0.10	0.41	0.57	0.73	0.33	0.00	0.59	0.34	0.67	0.89
9	Acidity	9.00	13.00	25.00	30.00	19.33	16.67	33.67	0.00	0.00	0.00	1.12	5.00	8.00	10.00
10	Alkalinity	242.00	246.00	325.00	345.00	293.33	357.00	110.33	104.00	140.00	416.00	140.00	123.00	184.00	151.00
11	Total Hardness	147.00	161.00	214.00	258.00	133.00	100.33	130.00	128.00	80.00	172.00	136.00	185.00	220.00	203.00
12	Ca- Hardness	123.90	103.95	130.20	145.50	95.25	82.60	113.05	22.40	24.00	152.00	40.00	114.00	164.00	124.00
13	Mg-Hardness	23.10	57.05	83.80	112.50	37.75	17.73	16.95	105.60	56.00	20.00	96.00	71.00	56.00	79.00
14	COD	20.00	25.00	17.00	32.00	28.00	47.00	50.00	68.00	7.56	8.00	120.00	17.00	12.00	18.00
15	DO	2.38	3.77	4.57	2.90	4.62	7.22	6.06	5.30	4.80	2.90	1.80	4.20	5.90	3.40
16	BOD	0.79	1.59	2.58	2.87	2.43	4.90	4.24	18.00	1.50	0.00	6.00	0.00	2.00	6.00
17	Chloride	145.91	149.88	207.53	256.45	159.21	80.07	93.64	146.00	106.00	104.00	120.00	165.00	143.90	134.00
18	Ammonical Nitrogen	2.41	2.10	1.78	1.32	1.98	2.10	0.41	0.00	1.34	2.13	1.45	0.98	0.67	0.99
19	Total Kjeldahl Nitrogen	0.78	0.56	0.90	0.75	0.43	0.47	0.52	0.00	0.23	0.65	0.35	0.44	0.10	0.17
20	Nitrate	1.57	0.39	0.51	1.12	0.52	1.01	1.62	1.01	0.00	0.00	0.24	1.14	1.77	1.54
21	Phosphate	0.92	0.21	0.35	0.75	0.15	0.12	0.14	0.88	0.20	0.32	0.78	0.66	0.99	0.47
22	Sulphate	0.00	0.00	0.00	0.00	350.00	214.00	201.00	160.39	93.26	91.08	465.00	214.00	81.20	100.40
23	Total Coliform	0.00	0.00	0.00	0.00	35.00	40.00	27.00	27.00	34.00	7.00	4.00	20.00	9.00	29.00
24	Fecal Coliforms	0.00	0.00	0.00	0.00	18.00	20.00	11.00	15.00	22.00	11.00	7.00	14.00	3.00	17.00

Table 39 Result Table for Kamala Lake

Sr No	Parameters	Sep-18	Dec-18	Mar-19	Jun-19	Sep-19	Dec-19	Mar-20	Jun-20	Sep-20	Dec-20	Mar-21	Jun-21	Sep-21	Dec-21
1	pH	7.20	7.24	7.80	7.10	7.23	7.80	8.23	7.58	7.70	7.41	7.88	8.24	8.29	8.05
2	TDS	635.00	629.00	1171.00	430.00	372.00	410.00	333.00	574.00	632.00	592.00	524.00	447.00	312.00	241.00
3	TSS	15.00	19.00	22.00	14.00	27.00	30.00	27.00	33.00	28.00	32.00	32.00	35.00	22.00	14.00
4	Conductivity	1260.00	1275.00	2270.00	898.00	785.00	1141.00	866.00	1074.00	998.00	1360.00	1397.00	758.00	1107.00	574.00
5	Temperature	28.10	21.70	28.10	29.20	27.80	23.40	24.70	23.70	26.60	21.70	22.80	23.50	21.10	22.40
6	Turbidity	10.00	8.00	5.00	3.00	2.00	7.00	8.00	2.00	1.00	3.00	5.00	7.00	6.00	4.00
7	Colour	7.80	5.00	2.40	4.80	20.67	14.00	17.50	8.00	10.00	5.00	9.00	11.20	8.00	4.00
8	Fluoride	0.21	0.14	0.54	0.37	0.34	0.74	0.89	1.01	0.29	0.50	0.71	0.44	0.35	0.60
9	Acidity	14.00	12.00	8.00	22.00	15.00	10.00	4.00	13.00	0.00	5.00	3.00	17.00	11.00	9.00
10	Alkalinity	199.00	203.00	248.00	602.00	605.00	417.00	322.00	174.00	88.00	352.00	72.00	212.00	190.00	241.00
11	Total Hardness	303.00	283.00	495.00	193.00	188.00	211.00	189.00	102.00	44.00	188.00	124.00	98.00	205.00	114.00
12	Ca- Hardness	113.40	124.95	388.50	156.45	171.15	147.00	89.00	79.00	14.40	148.00	40.00	29.00	162.00	68.00
13	Mg-Hardness	189.60	158.05	106.50	36.55	16.85	64.00	100.00	23.00	29.60	40.00	84.00	69.00	43.00	46.00
14	COD	36.00	42.00	32.00	40.00	45.00	64.00	36.00	16.00	12.73	4.00	16.00	28.00	20.00	32.00
15	DO	5.56	5.76	7.55	6.75	6.95	5.90	5.40	4.80	5.10	4.90	5.70	6.50	6.10	6.20
16	BOD	2.18	1.98	3.77	2.38	3.50	6.00	9.00	15.00	6.00	0.00	0.00	4.00	5.00	2.80
17	Chloride	181.65	173.71	241.20	237.23	57.57	149.00	310.00	89.00	100.00	77.00	134.00	110.00	145.99	98.00
18	Ammonical Nitrogen	0.58	0.94	0.77	0.31	0.18	1.10	0.98	0.88	1.24	1.79	1.01	0.47	0.65	0.11
19	Total Kjeldahl Nitrogen	0.11	0.05	0.07	0.15	0.07	0.41	0.35	0.27	0.77	1.01	0.55	0.00	0.27	0.14
20	Nitrate	0.56	0.88	1.05	0.59	0.08	2.78	1.98	0.88	0.54	1.34	0.33	0.08	0.46	0.31
21	Phosphate	0.10	0.20	0.07	0.01	0.09	0.10	0.20	0.04	0.19	0.33	0.14	0.10	0.07	0.28
22	Sulphate	0.00	0.00	0.00	0.00	120.00	69.00	75.00	56.00	90.79	160.00	57.00	82.00	106.20	64.00
23	Total Coliform	0.00	0.00	0.00	0.00	15.00	11.00	16.00	25.00	29.00	10.00	2.00	10.00	14.00	9.00
24	Fecal Coliforms	0.00	0.00	0.00	0.00	8.00	5.00	7.00	14.00	18.00	5.00	4.00	4.00	6.00	3.00

Graphical representation for all 24 parameters are shown from Figure 18 to Figure 40. In a single graph an individual parameters for all nine lakes are shown in one figure. For eg Temperature analyzed for all lakes are grouped together and shown in Figure 18. Similarly for all 24 parameters graphs are grouped and clubbed in a single figure.

An example of how graph are plotted is shown in figure given below in enlarged form. Value for parameters are shown on Y-axis and Months are shown on X-axis.



From the graphs, a particular trend was seen for all parameters and lakes. The trend are shown in form of upward, downward or straight line trend. Details for the same are given in Table 40.

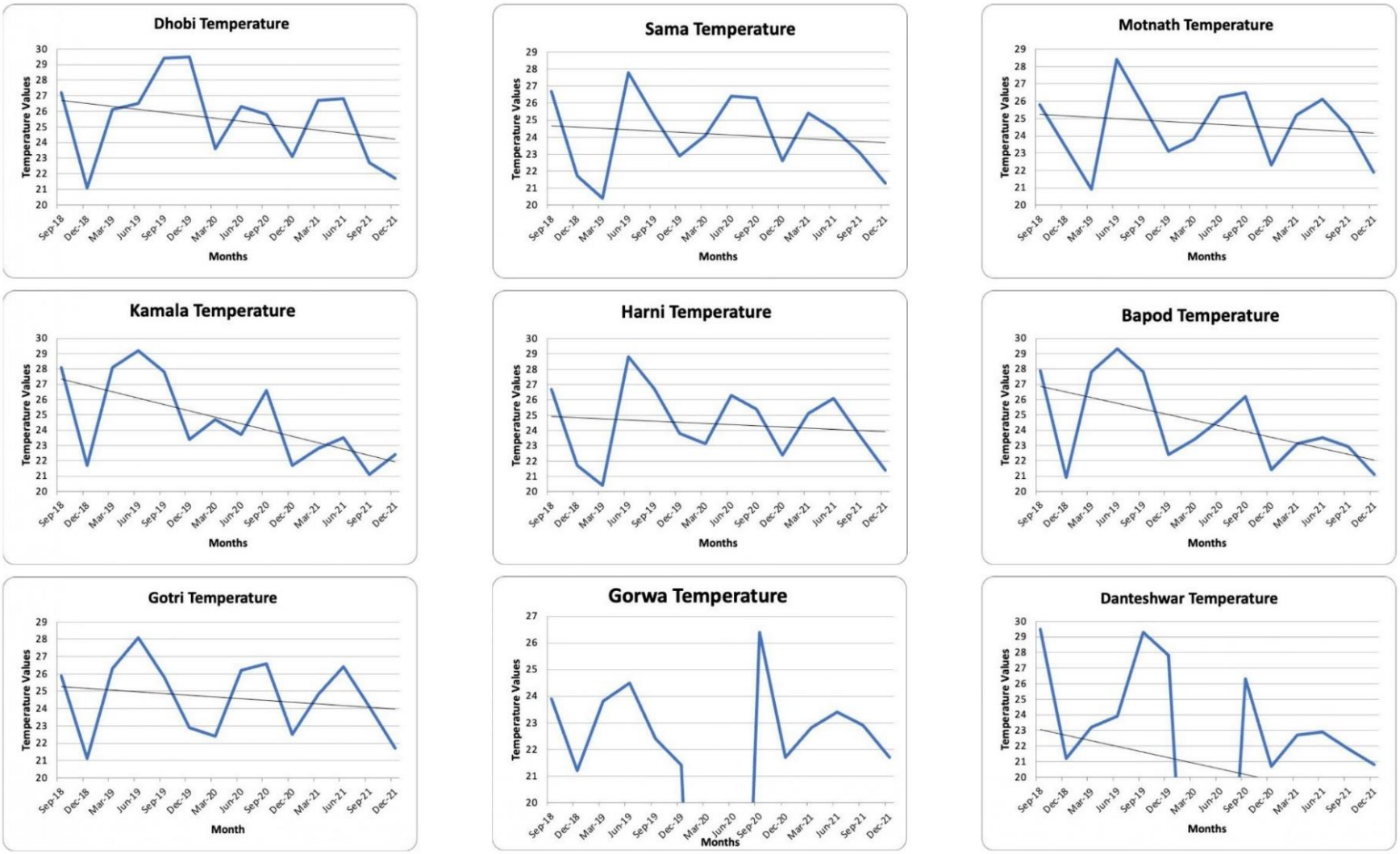


Figure 18 Trend of Temperature (˚C) for all nine lakes

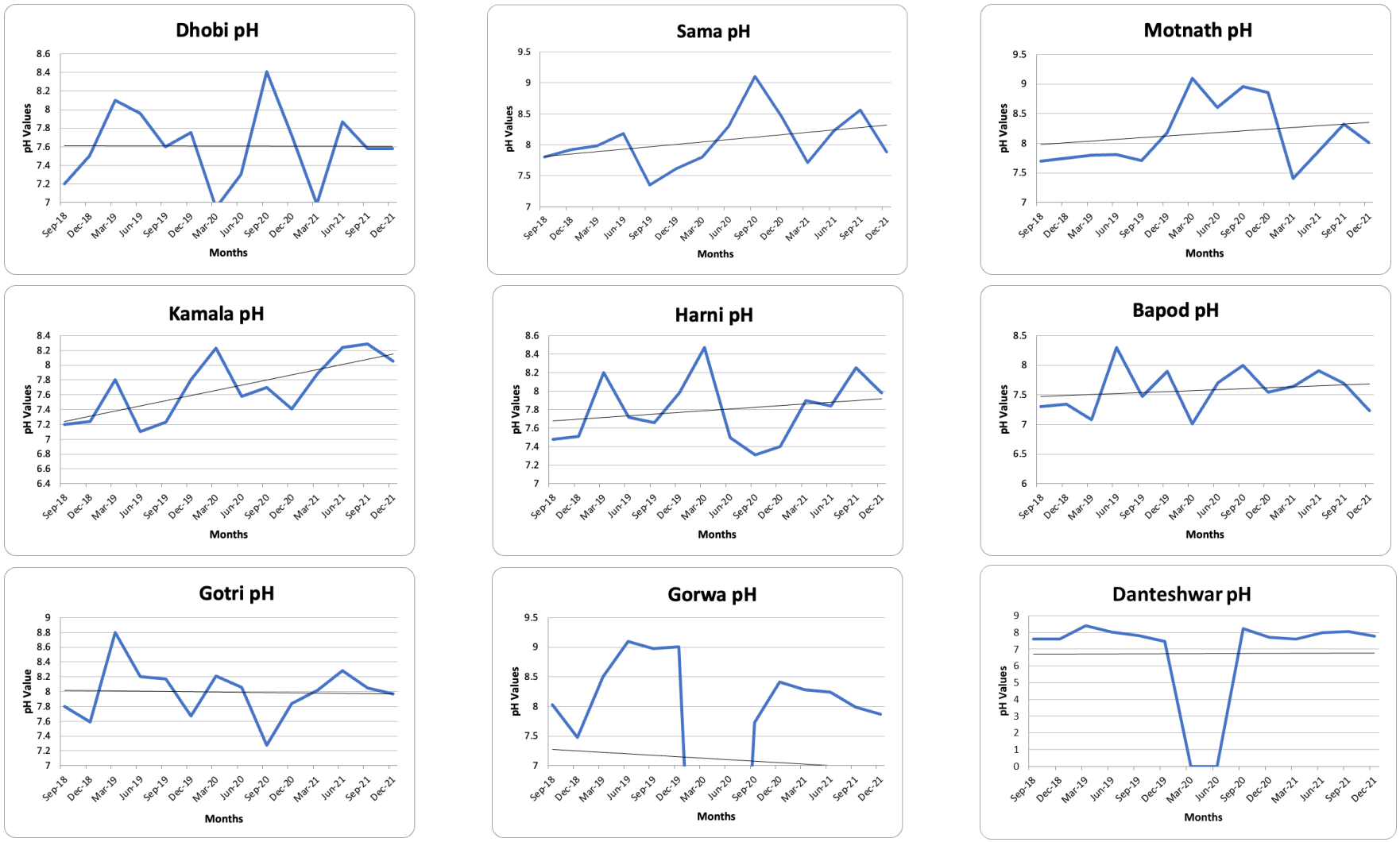


Figure 19 Trend of pH for all nine lakes

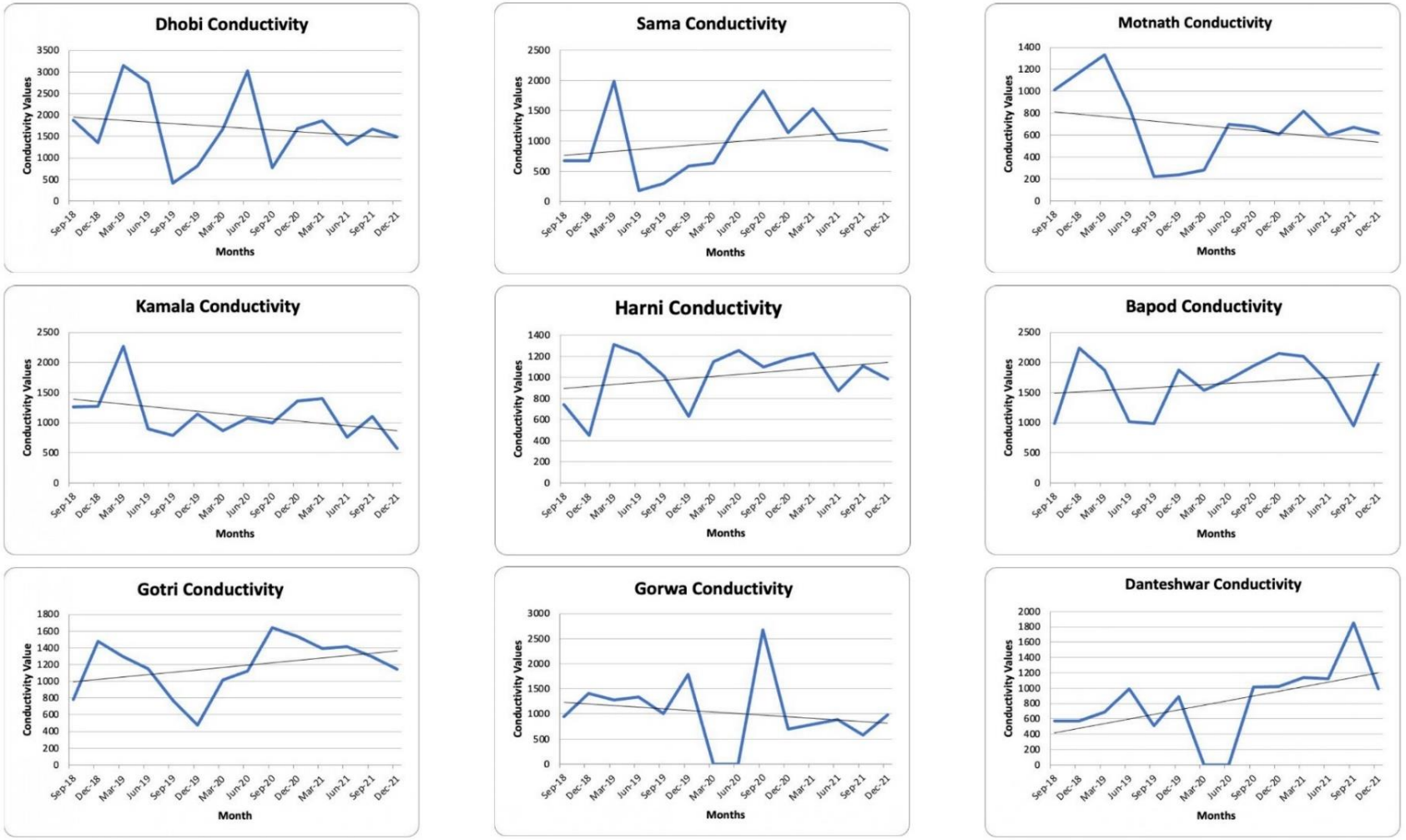


Figure 20 Trend of Conductivity (µS/cm) for all nine lakes

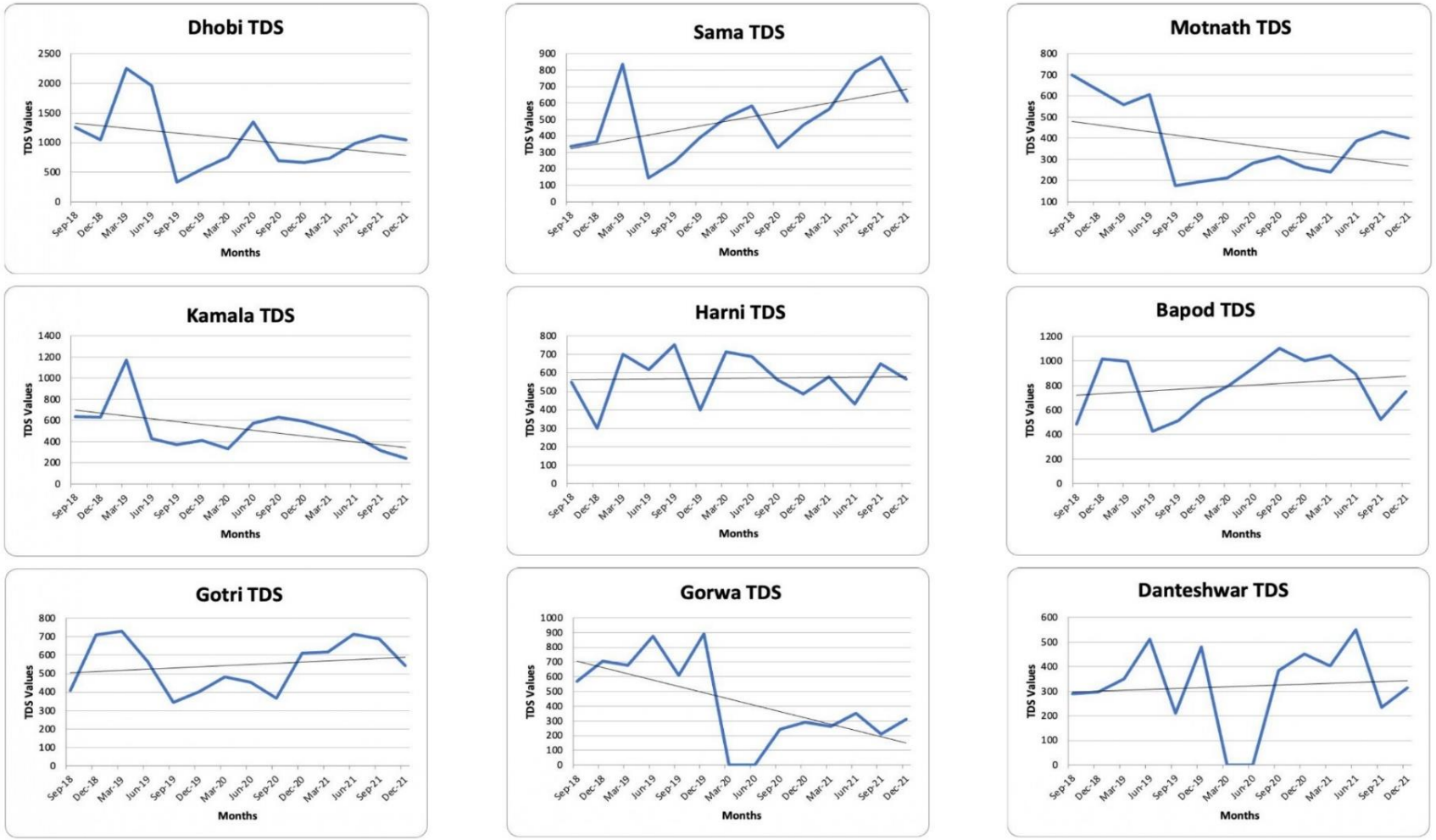


Figure 21 Trend of Total Dissolved Solids (TDS) (mg/L) for all nine lakes

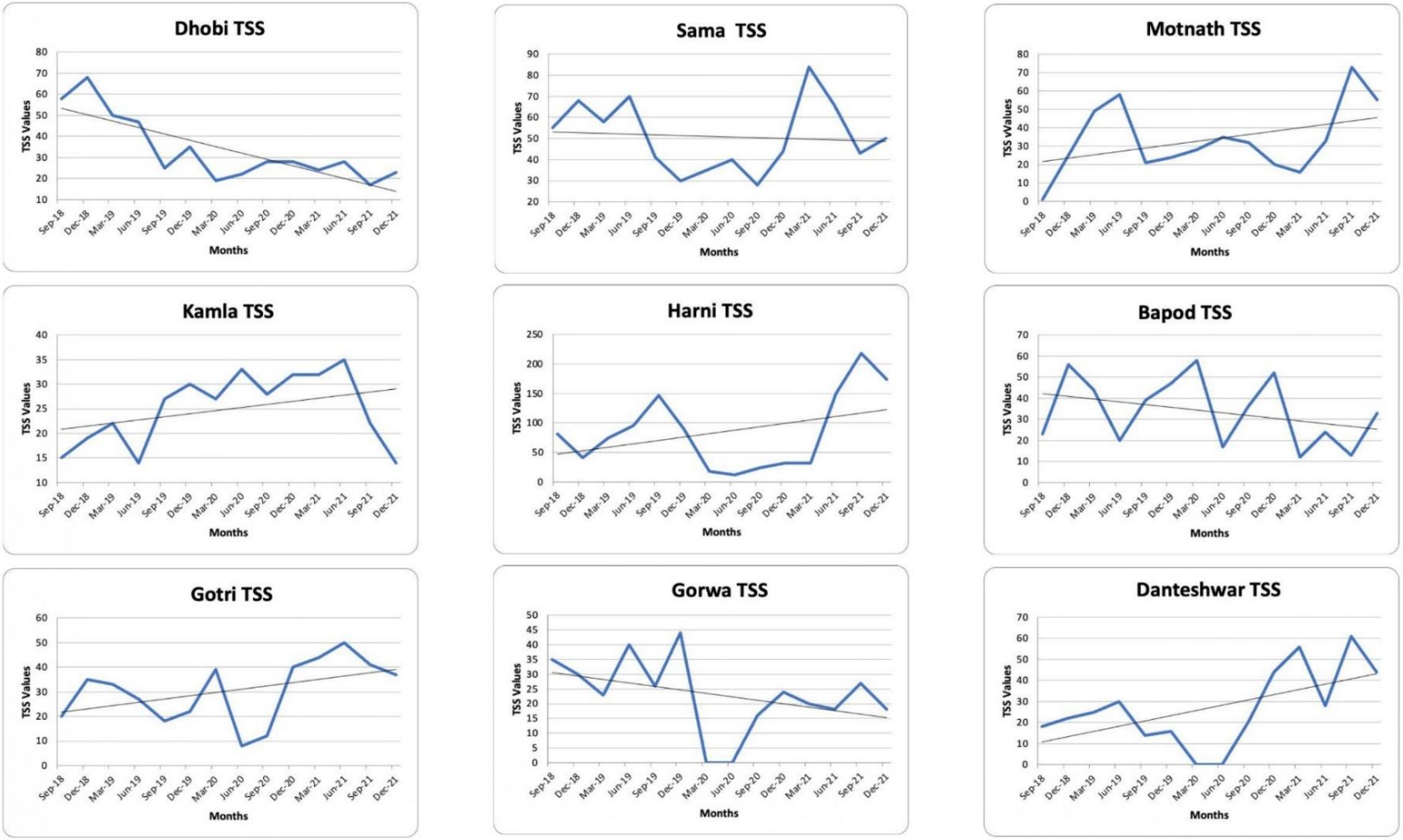


Figure 22 Trend of Total Suspended Solids (TSS) (mg/L) for all nine lakes

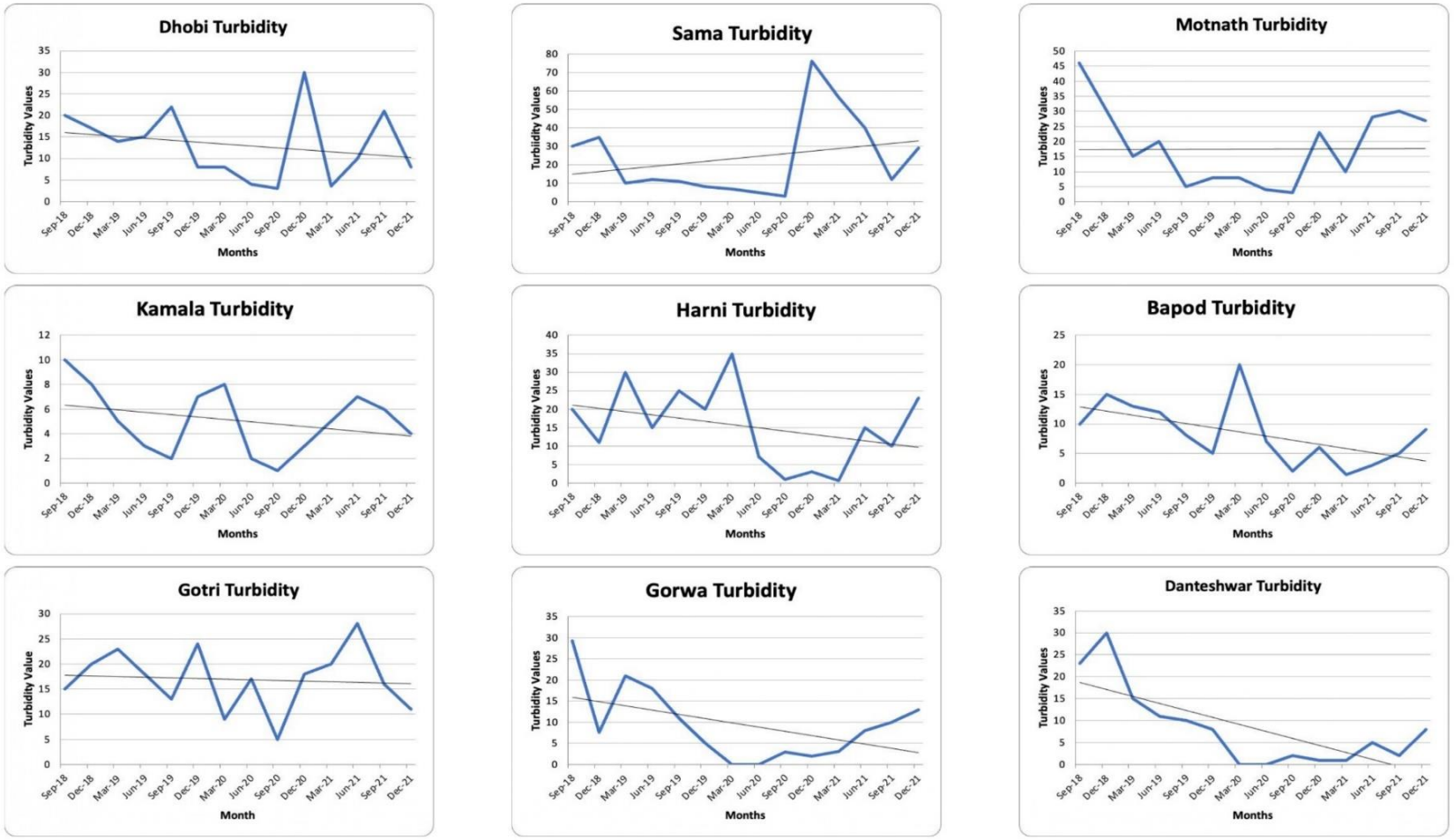


Figure 23 Trend of Turbidity (NTU) for all nine lakes

Figure 24 Trend of Color (Pt-Co) for all nine lakes

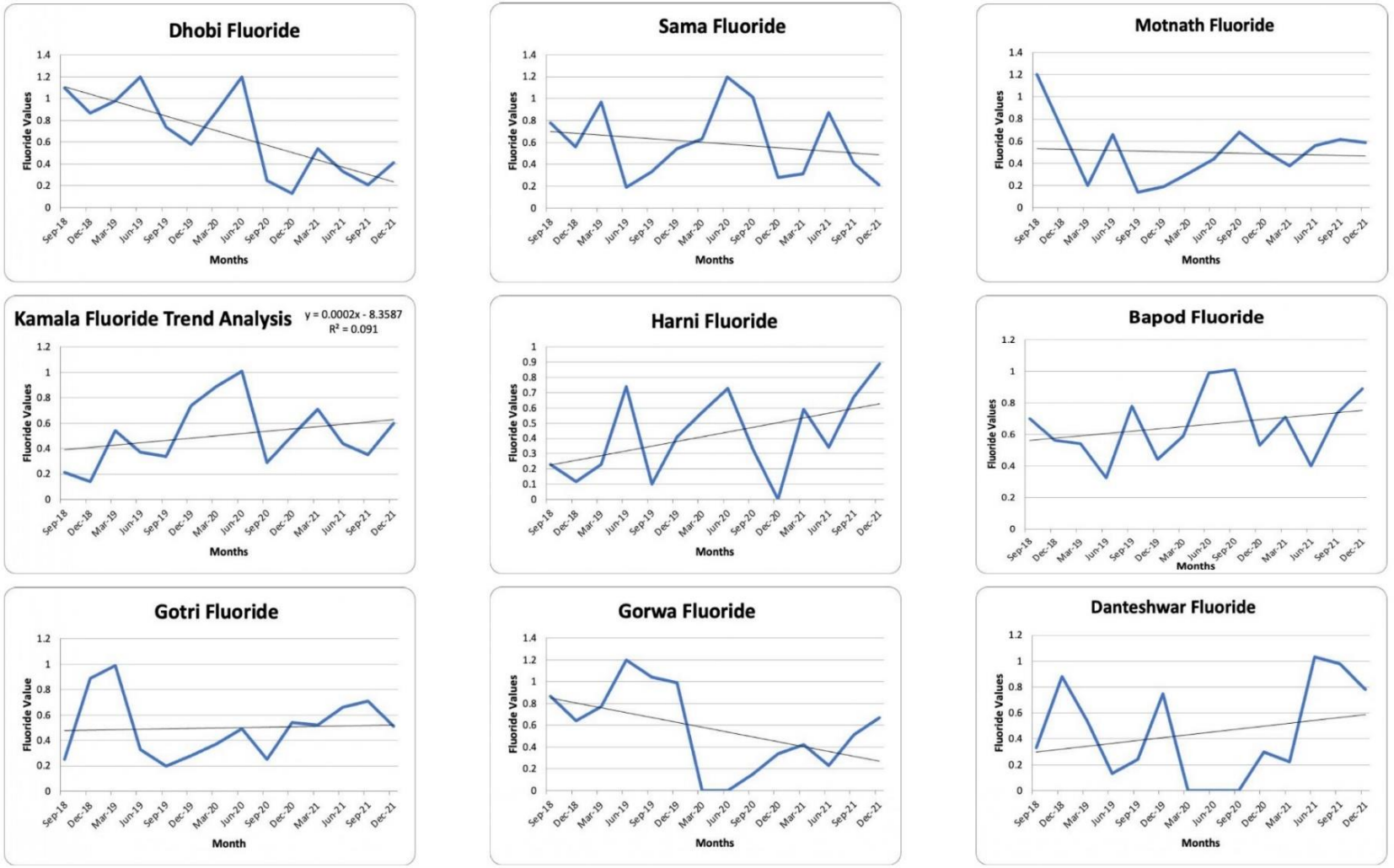


Figure 25 Trend of Fluoride (mg/L) for all nine lakes

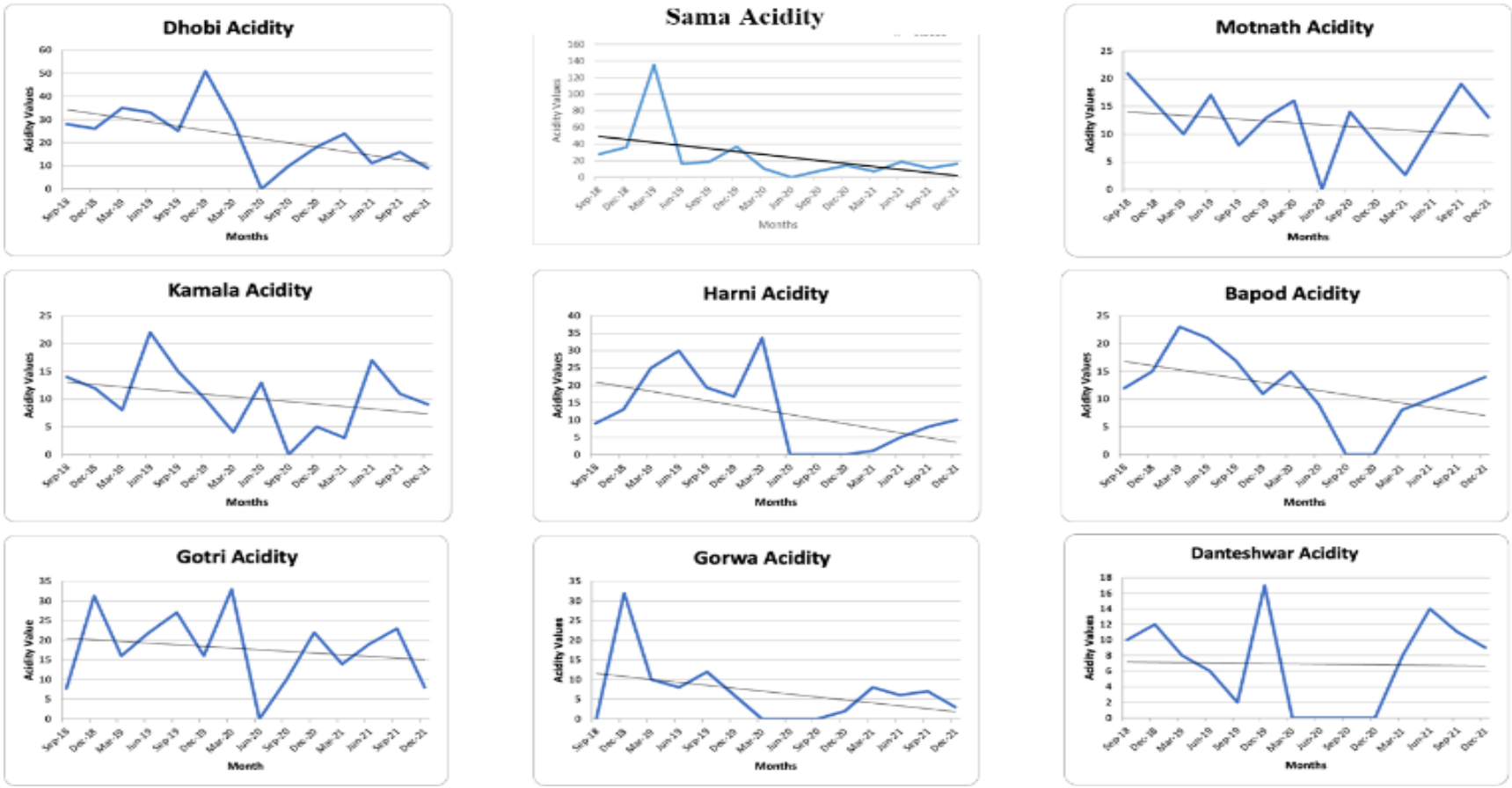


Figure 26 Trend of Acidity (mg/L) for all nine lakes

Figure 27 Trend of Alkalinity (mg/L) for all nine lakes

Figure 28 Trend of Total Hardness (mg/L) for all nine lakes

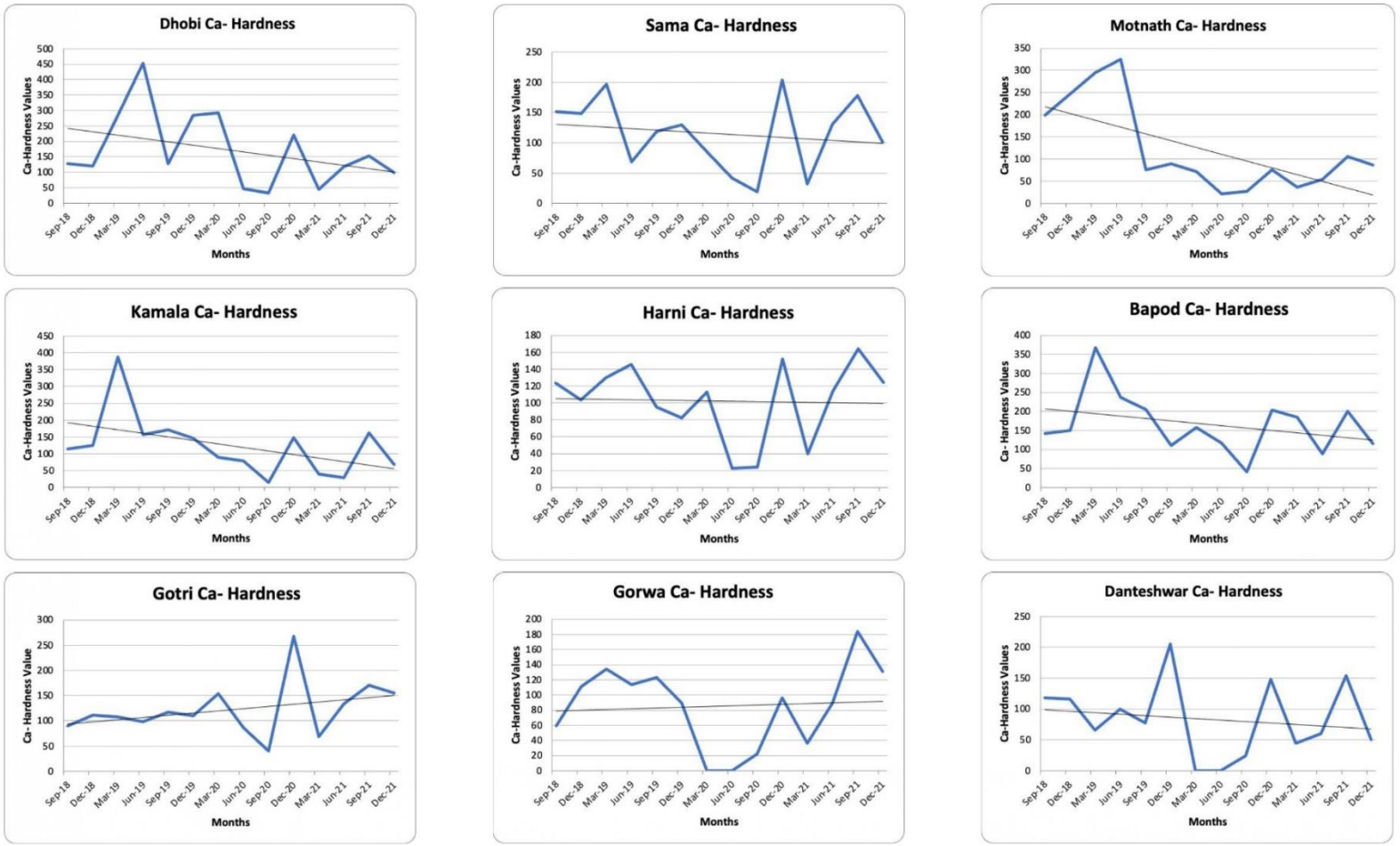


Figure 29 Trend of Ca- Hardness (mg/L) for all nine lakes

Figure 30 Trend of Mg- Hardness (mg/L) for all nine lakes

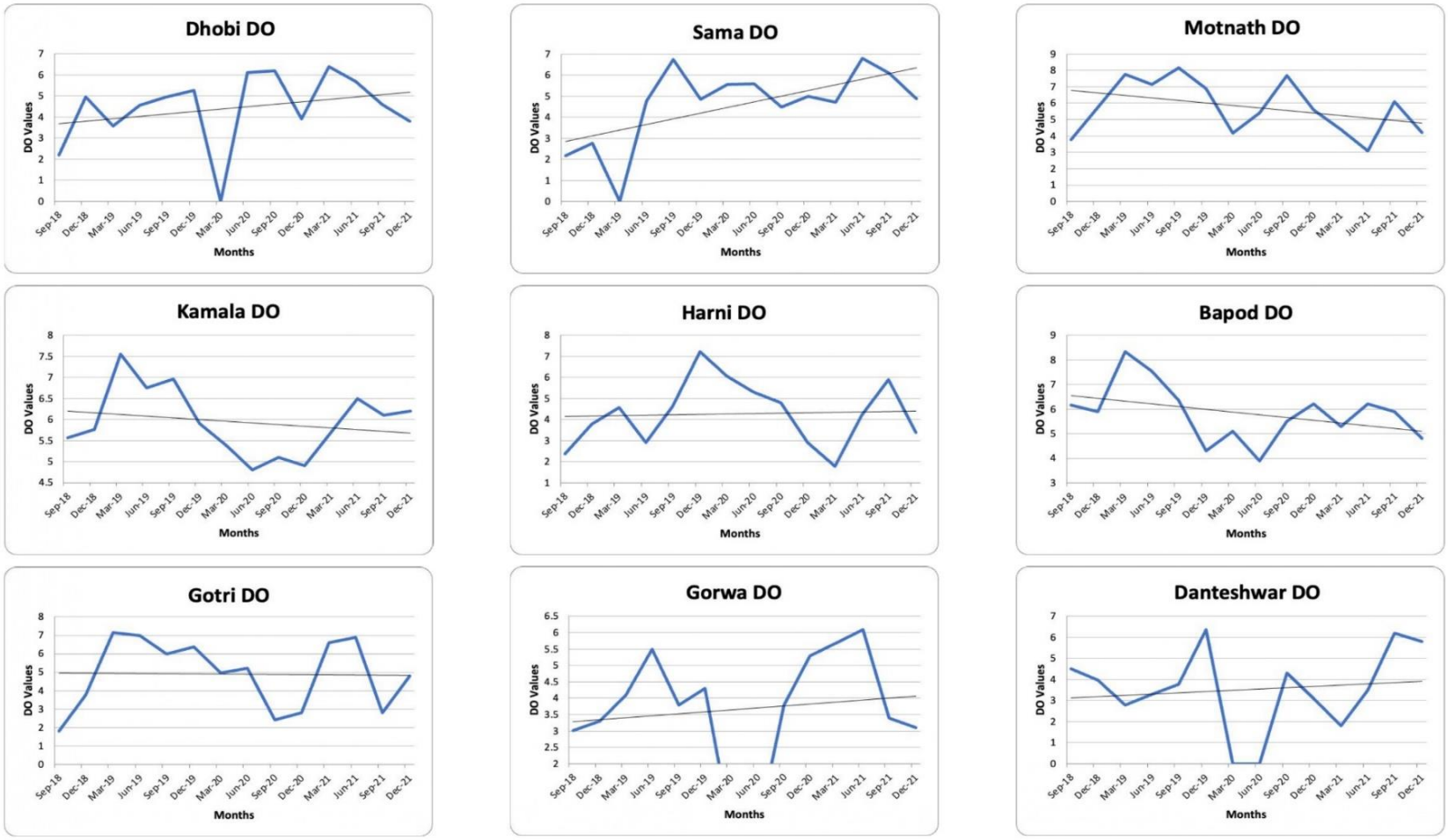


Figure 31 Trend of Dissolved Oxygen (mg/L) for all nine lakes

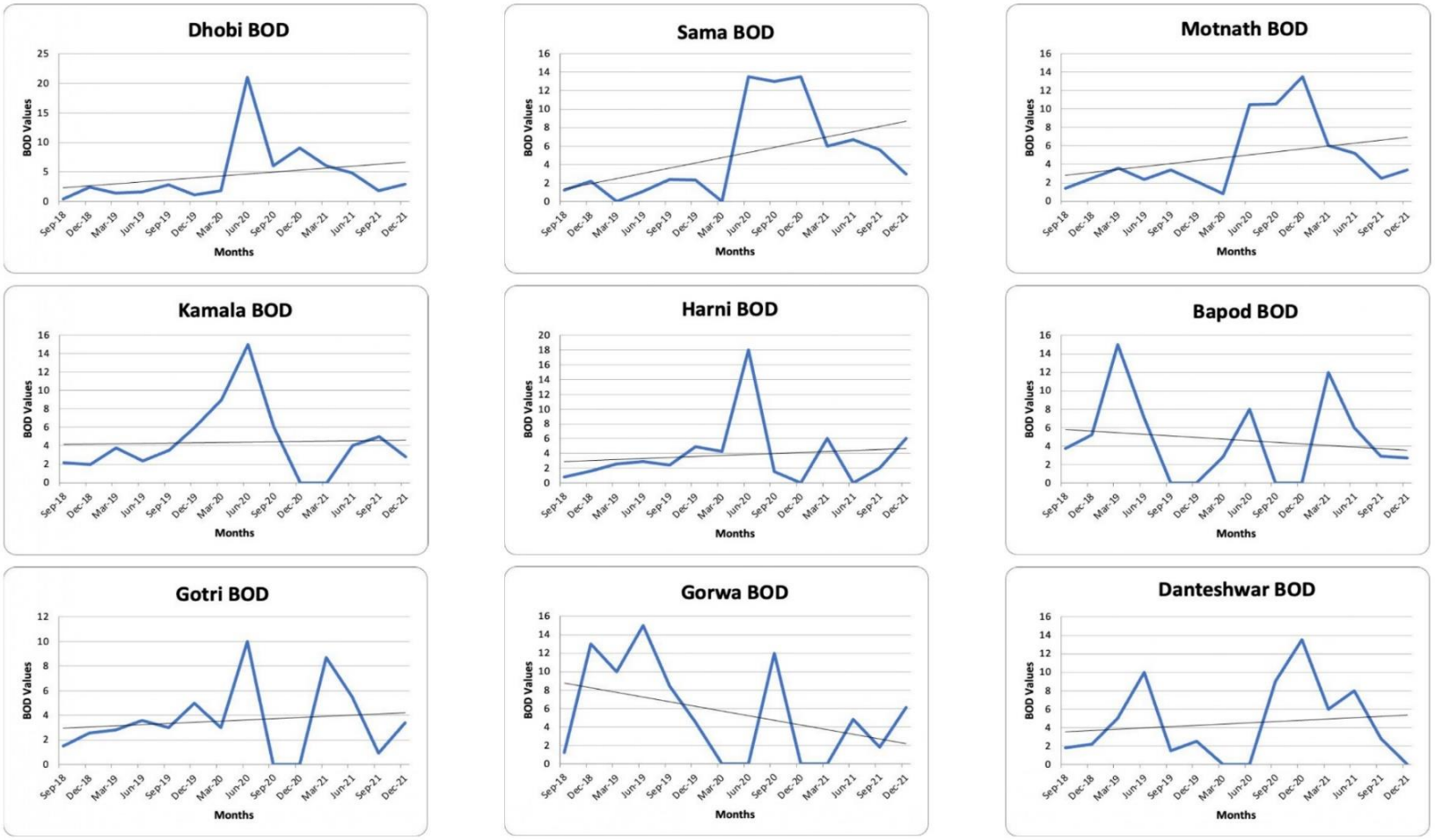


Figure 32 Trend of Biological Oxygen Demand (mg/L) for all nine lakes

Figure 33 Trend of Chloride (mg/L) for all nine lakes

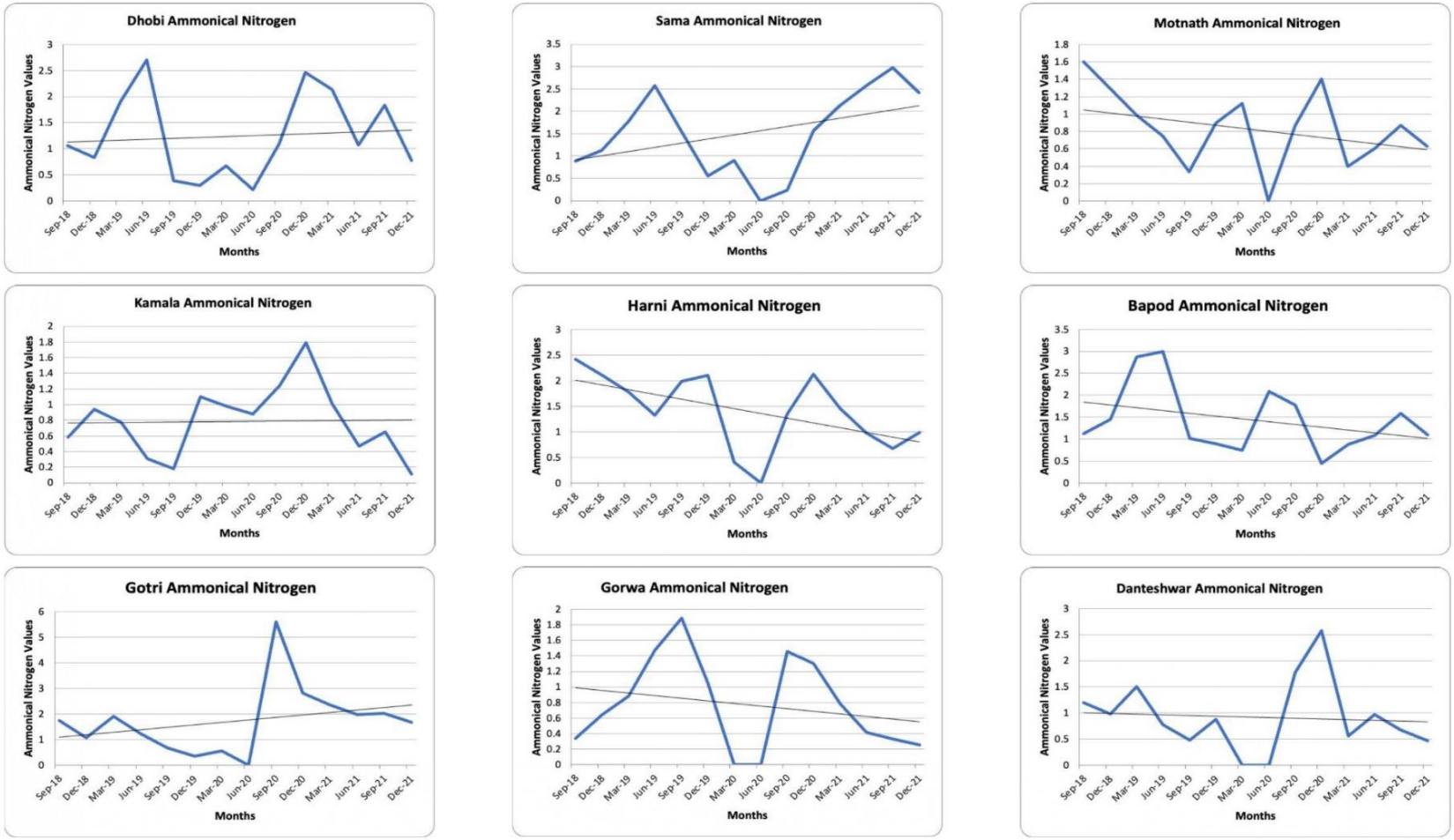


Figure 34 Trend of Ammonical Nitrogen (mg/L) for all nine lakes

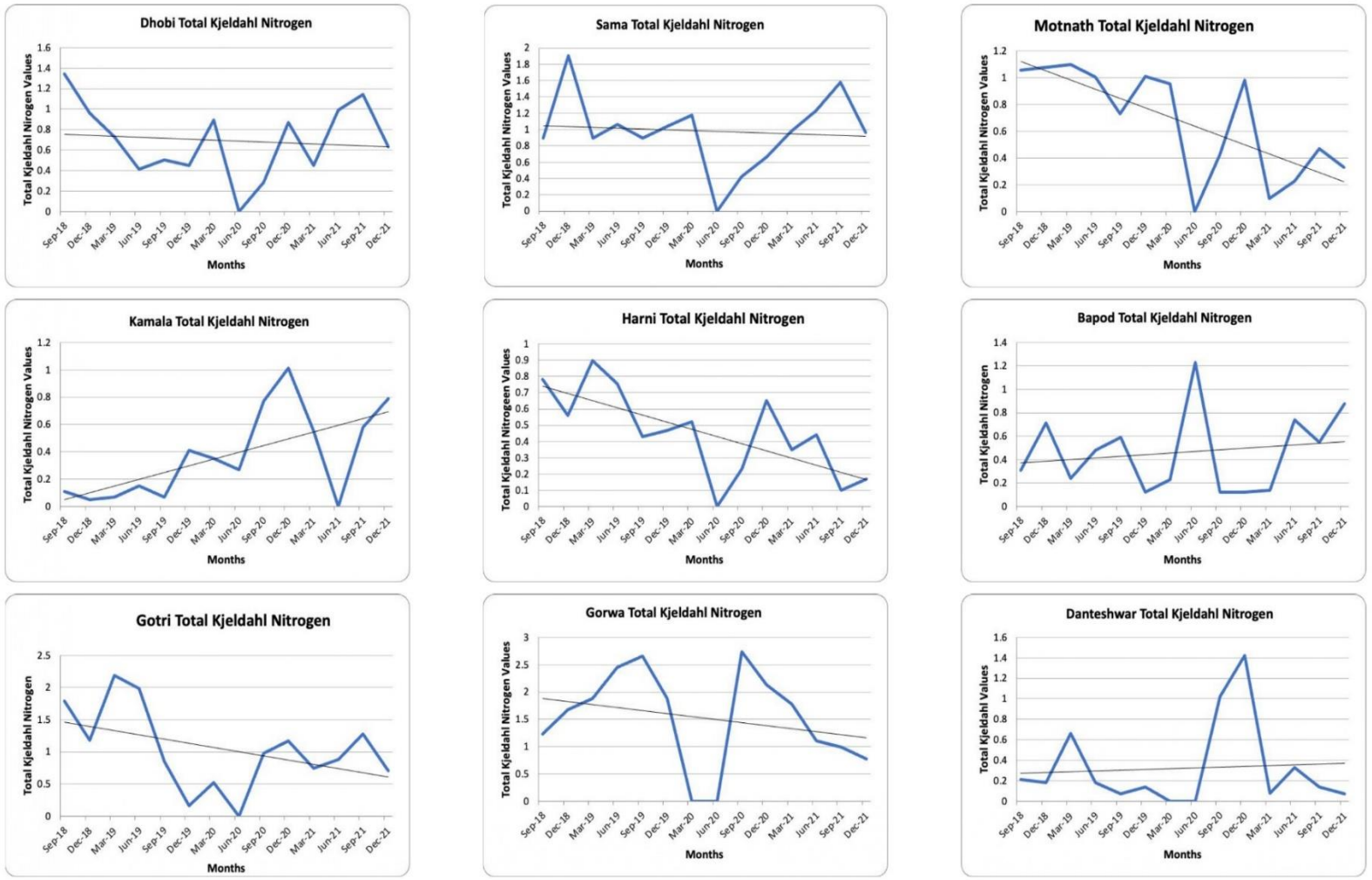


Figure 35 Trend of Total Kjeldahl Nitrogen (mg/L) for all nine lakes

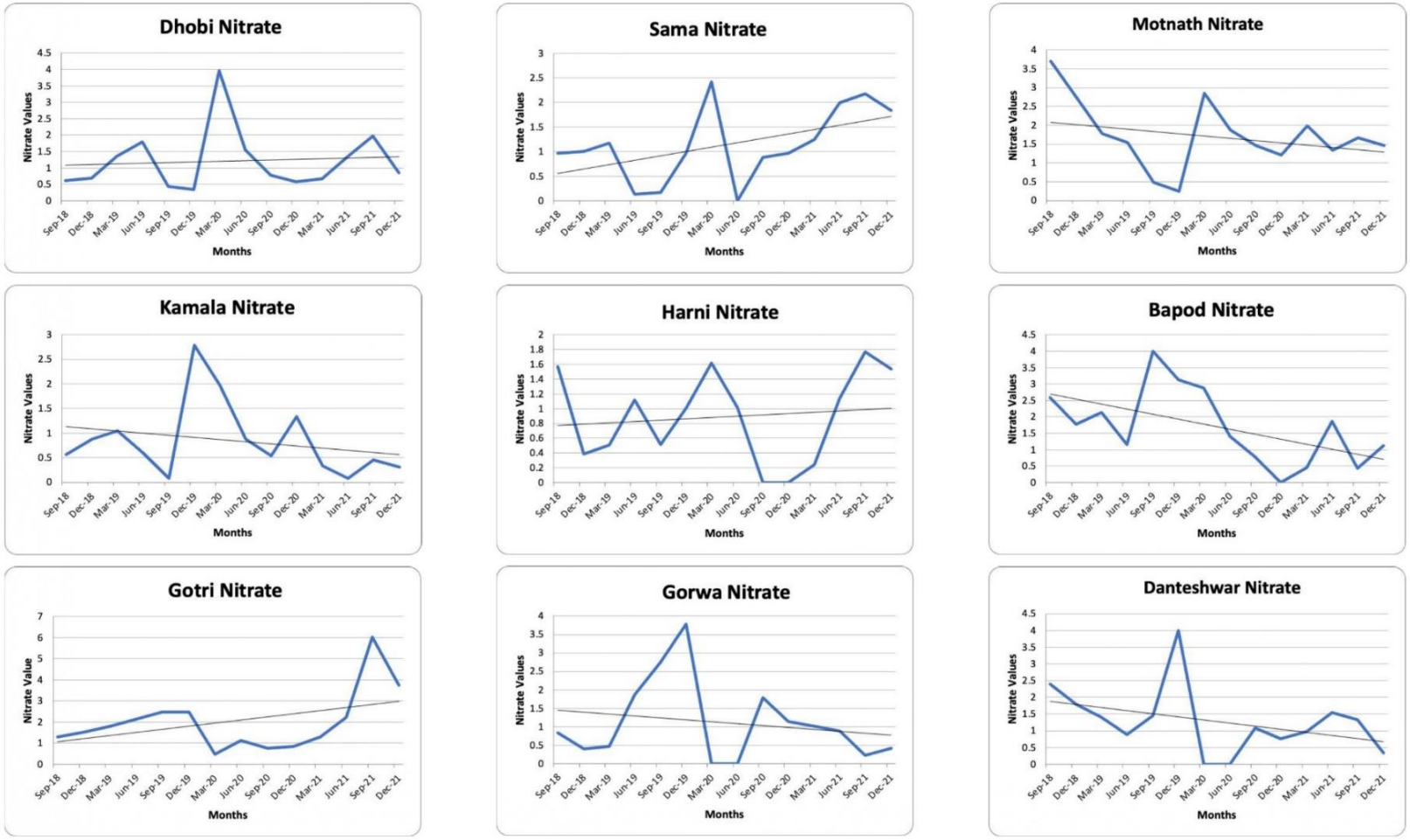


Figure 36 Trend of Nitrate (mg/L) for all nine lakes

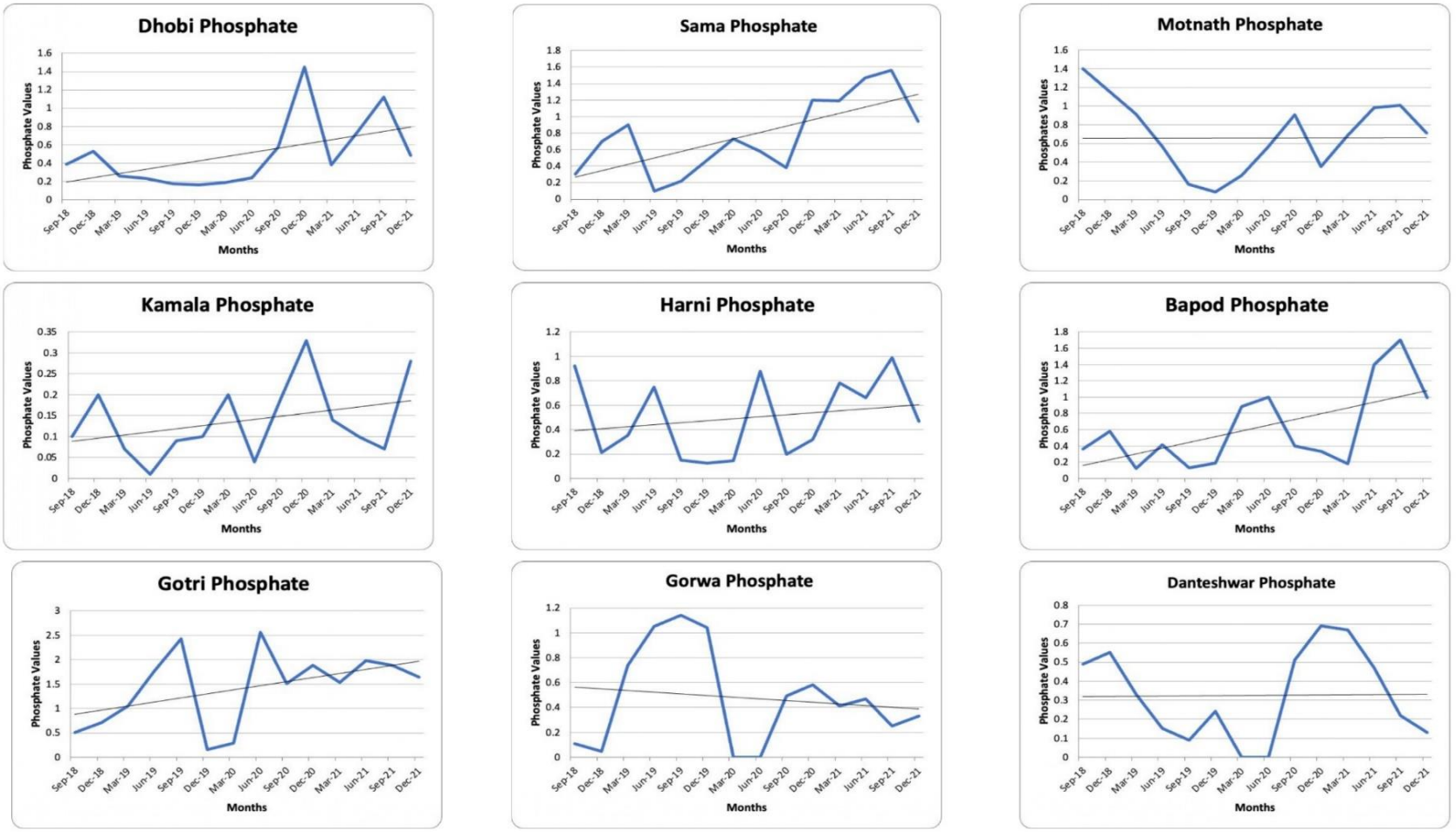


Figure 37 Trend of Phosphate (mg/L) for all nine lakes

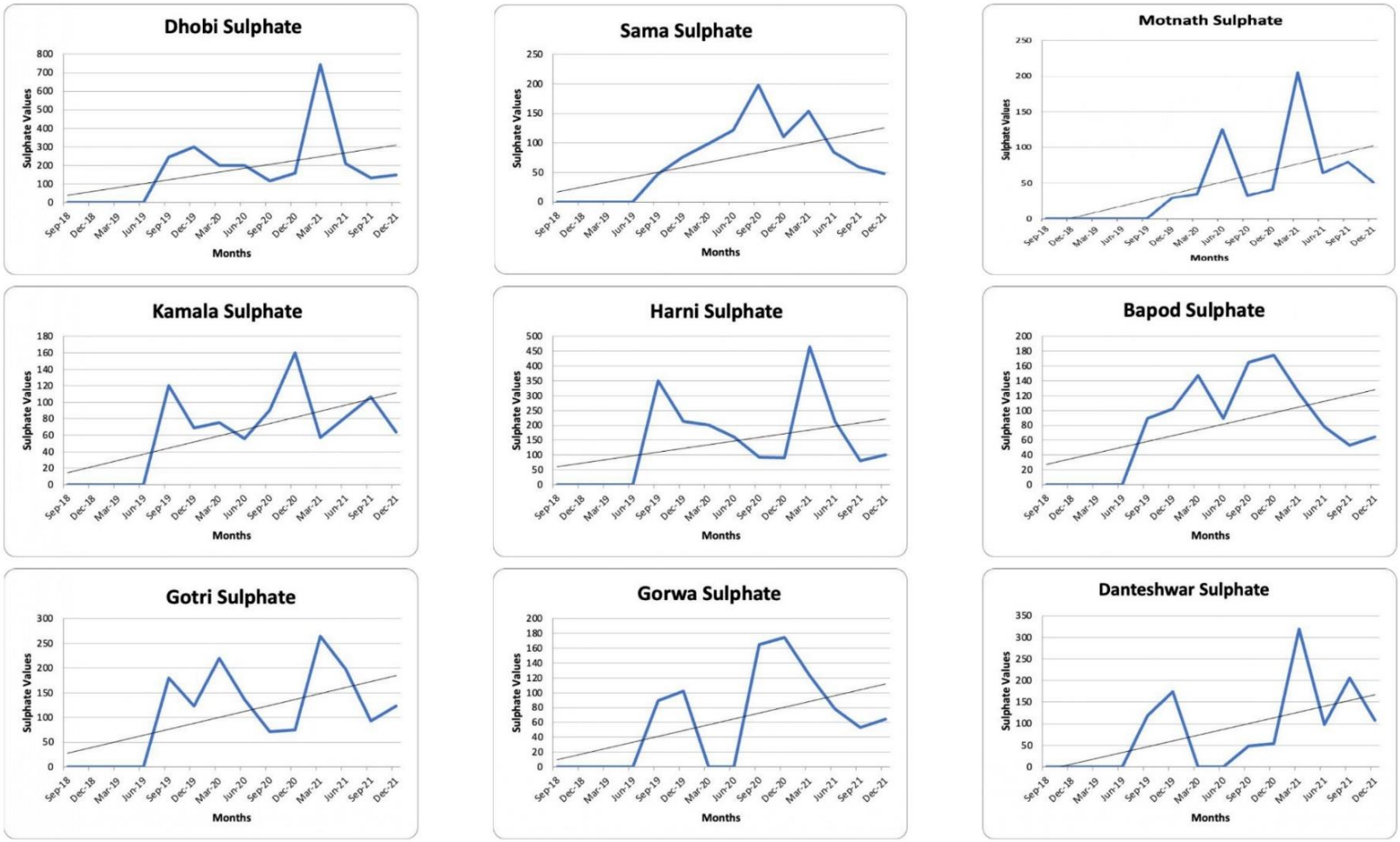


Figure 38 Trend of Sulphate (mg/L) for all nine lakes

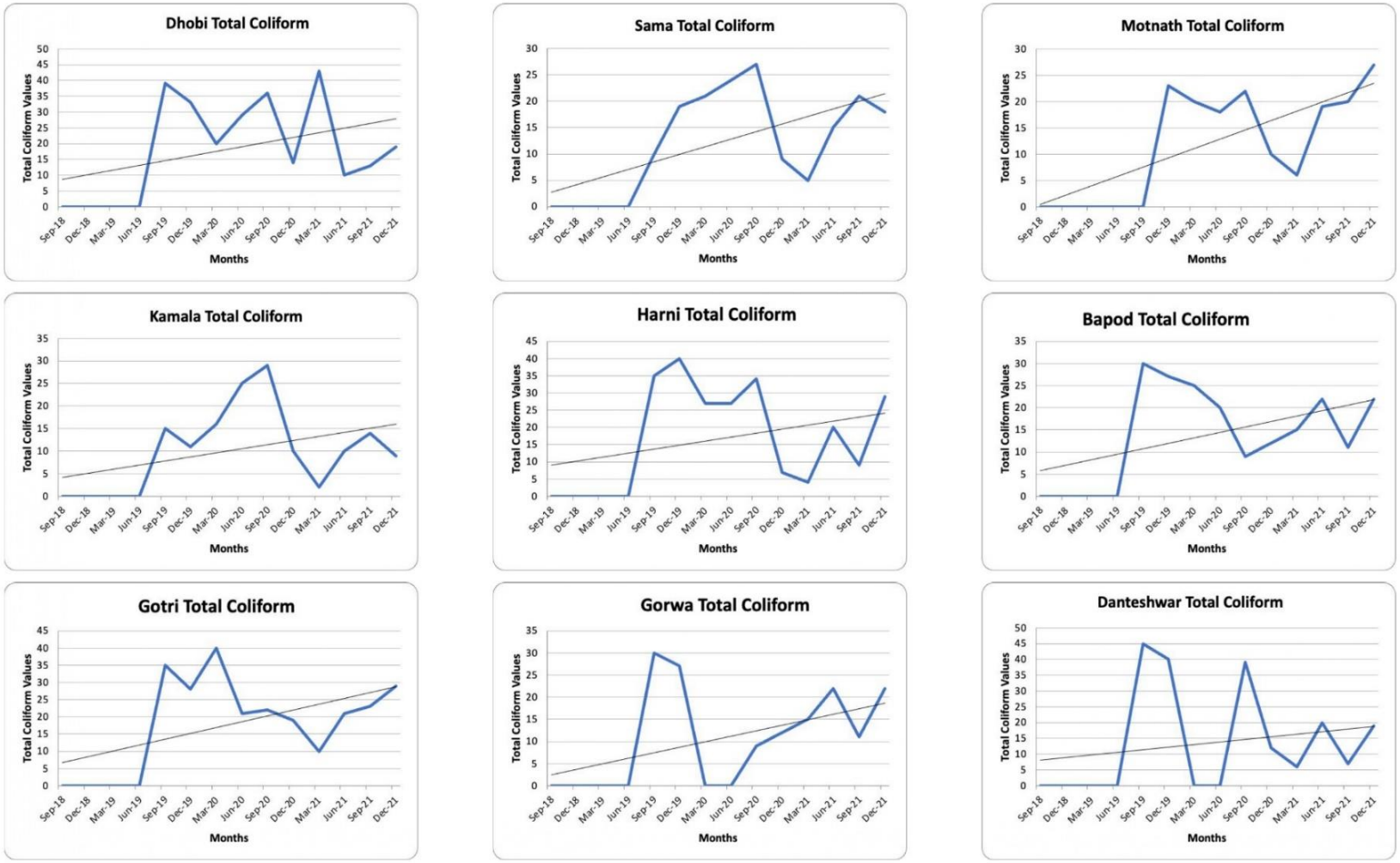


Figure 39 Trend of Total Coliform (MPN) for all nine lakes

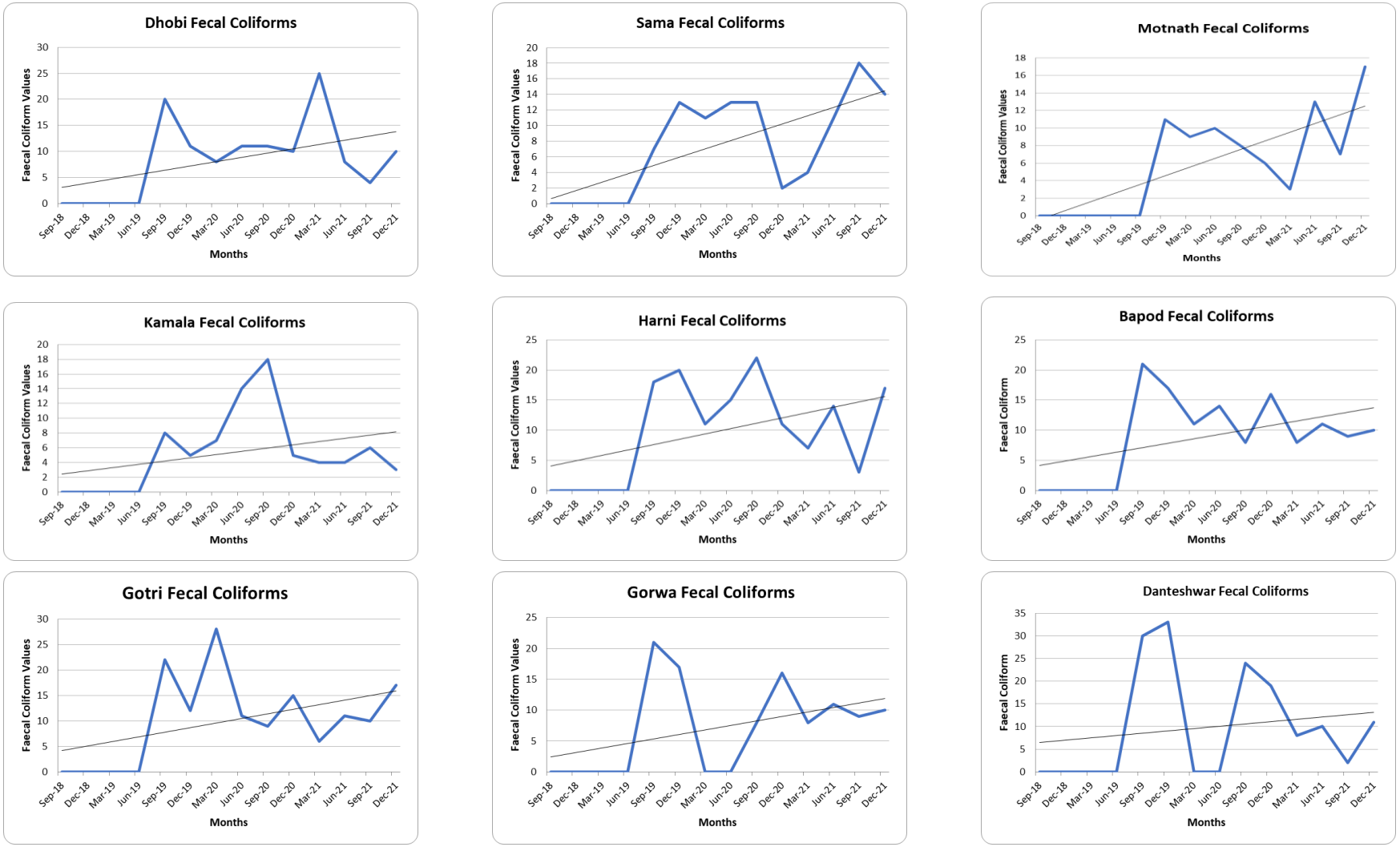


Figure 40 Trend of Fecal Coliform (MPN) for all nine lake

Table 40 Trend Assessment Table

Parameter	Kamala	Gorwa	Motnath	Sama	Gotri	Danteshwar	Harni	Bapod	Dhobi
pH	↑	↓	↑	↑	→	→	→	→	→
Conductivity	↓	↓	↓	↑	↑	↑	↑	→	↓
TDS	↓	↓	↓	↑	↑	→	→	↓	↓
TSS	↑	↓	↑	→	↑	↑	↑	↓	↓
Turbidity	↓	↓	→	↑	→	↓	↓	↓	↓
Color	→	↓	↑	→	↓	↓	↑	↓	↓
Fluoride	↑	↓	→	↓	→	↑	↑	↑	↓
Acidity	↓	↓	→	↓	→	→	↓	↓	↓
Alkalinity	↓	↓	↓	↓	→	→	↓	↓	↓
Total Hardness	↓	→	↓	→	→	→	→	→	↓
Ca-Hardness	↓	→	↓	→	↑	↓	→	↓	↓
Mg-Hardness	↓	↓	→	→	↓	↑	↑	↑	↓
DO	↓	↑	↓	↑	→	→	→	↓	↑
COD	↓	↓	→	↑	↓	→	↓	→	↑
BOD	→	↓	↑	↑	→	→	→	↓	↑
Chloride	↓	↓	↓	→	↓	↑	↓	→	↓
Ammonical Nitrogen	→	↓	↓	↑	↑	→	↓	↓	→
Total Nitrogen	↑	↓	↓	→	↓	→	↓	↑	→
Nitrate	↓	↓	→	↑	↑	↓	→	↓	→
Phosphate	↑	→	→	↑	↑	→	→	↑	↑
Sulphate	↑	↑	↑	↑	↑	↑	↑	↑	↑
Total Coliform	↑	↑	↑	↑	↑	↑	↑	↑	↑
Fecal Coliform	↑	↑	↑	↑	↑	↑	↑	↑	↑

↑ **Upward Trend** ↓ **Downward Trend** → **Linear Trend**

All lakes recorded huge variations in DO value. The decomposition of dumped food could be the cause of the lake's low DO. The presence of too many nutrients in the lake causes low dissolved oxygen, which impact fish survival. High nutrient values for nitrate and phosphate were observed for all samples, leading to the eutrophication status of the sample body. Among the nutrients that contribute to lakes' eutrophication, phosphorus is the most important because of its role as the principal indicating component. The introduction of phosphorus causes eutrophication into lakes by domestic waste and sewage. Due to eutrophication aesthetic beauty of the lake/pond also changes; pollutants in the system, such as turbid particles or suspended solids causing turbidity and the colour of the lake, reduce light transmission in the lake or water body. Urban discharge can be the main reason for such high turbidity values. pH is within the permissible limit, indicating the alkaline nature of the water body. Although it is unlikely that these relatively minor shifts in pH will have a direct impact on the aquatic life in the lake, they do have a significant effect on the availability and solubility of all chemical forms in the lake and may cause problems connected to nutrients. Phosphorus may become more soluble if the pH rises, which would make the element more accessible to plant growth but would also, result in an increased need over the long term for dissolved oxygen. The presence of total and fecal coliform in all indicates a significant influence of anthropogenic activities around these water bodies, making them unfit to use for drinking without any specific treatment.

Although across a study period, individual data shows some pattern, as shown in Table 10, overall disenable pattern could not be observed. The main reason for such uneven pattern is load of anthropogenic stress received by water bodies, mainly during festive seasons value goes high but here no such uniform pattern is observed as values are found high in June, December, and March also. Anthropogenic activities such as the dumping of biodegradable or non-biodegradable wastes such as plastic bags, plastic bottles, flowers, and photo frames are commonly observed in all the water bodies. Other activities like washing utensils, clothes, fishing, and sewage discharge are also observed adding to the pollution load in the water body. Direct and indirect anthropogenic sources are contributing to the contamination of the body leading to no specific trend pattern and solely depending on the human load received by water bodies. Water evaluation in terms of trend assessment and anthropogenic stress has become an important tool for knowing the actual status of a water body. Here from the results, it is known that anthropogenic intervention is on front load

increasing pollution load. Some of the parameters like the presence of total coliform, fecal coliform, and phosphate; and fluctuations in their obtained values prove that the water body is highly influential on the waste received by them.

As human load is the main factor for the pollution in studied lakes, activities which can reduce this load can be implemented for conservation purpose. More organized hawker zones, strick control on disposing of food waste in the lakes and educating people in surrounding through easy concepts can help to lower the burden received by water bodies via anthropogenic stress.

4.2 Water Quality Index Results

15 Indices are divided into 2 groups based on their scale of interpretation. Based on Increasing Scale: NSF index by CPCB, OIP Index, DOE Index, Dinius Index, Universal Index, Dhamija and Jain Index, Weighted Arithmetic Mean Index, NSF Original Index and Bascaron Index. Based on Decreasing indices: NEERI Index, Prati's Index, Integrated Water Index, New Water Quality Index and Nemerow Pollution Index.

Interpretation of 15 indices are shown in tables form where for a single lake three tables for interpretation are shown each containing a set of 5 indices. For eg. Sama lake has 3 tables i.e Table 41(a), (b) and (c) each having 5 set of indices and their interpretation. Similarly, for all other lakes three set of tables grouped in (a), (b) and (c) for a single lake are shown from Table 41 to Table 49.For Gorwa and Danteshwar lake, because of inaccessibility of lakes during Covid period, sampling was not done for a period of two months.

For both NSF index, we can see a difference in the interpretation of WQI. Except for Danteshwar and Gorwa Lake, all other Lakes show results of excellent water quality for NSF by CPCB with 4 parameters into the calculation and medium water quality for the original NSF Index by considering 9 parameters. NSF by CPCB Index is formed based on the original NSF index only taking into consideration additive function and increasing scale range for classification. The discrepancy is mainly due to the number of parameters that are taken for calculation. NSF index by CPCB includes dissolved oxygen, biological oxygen demand, fecal coliform, and pH whereas the original NSF index includes temperature, total phosphorus, nitrate, turbidity, and total solids along with the above four parameters, broadening the contribution of other parameters into polluting the water body. Turbidity being the physical parameter was not included in NSF by CPCB which is directly contributing to the decrease in index value because of the waste added into the water body by human activities. Danteshwar and Gorwa show medium water quality for both indices as two parameters common in both dominate the index value i.e., fecal coliform and dissolved oxygen.

For Overall index of pollution, except Bapod, Danteshwar and Kamala, the water quality interpretation is of medium quality for all other lakes. This index takes into account 13 parameters and a weightage factor which differentiate it with the original NSF Index. Here parameters are given weight between 1 to 4 based on their importance level in assessing water quality. For e.g., Turbidity is given weightage of 1 means of least importance and 4 to dissolved oxygen as the most important parameter. These weights are pre-decided for all 13 parameters by a cumulative expert panel vote. Here the water quality drops to class 3 medium water quality. As more parameters were taken into consideration a more detailed analysis was possible here as it can identify other parameters dominance also. For Bapod and Danteshwar, the value difference is very less as index value is more than 75, they are added in good water quality, but they are just 0.5 to 1 digit difference which even changed their interpretation to medium class on change in any parameters value or even weight.

For DOE index, except Kamala all other lakes are under medium water quality and Kamala is under Good water quality. The DOE index takes into consideration six parameters. Index takes COD and Ammonical nitrogen in index calculation. This index also includes a weightage method same as NSF original index where summation of weightage comes to 1. Even with 6 parameters this index gives interpretation similar to that of NSF – 9 parameters and OPI index. But interpretation can differ as phosphate, nitrate which plays an important role which were not taken into consideration. And similar to other indexes, this index does not allow addition of other parameters questioning the final interpretation.

For Dinius index, Bapod and Kamala lake are in the good water quality category whereas other lakes are under medium category. Dinius index takes similar parameters in account as other indices with addition of conductivity as a parameter for index calculation. This index also used the weightage factor into consideration. Turbidity and phosphate are not included in the list which if added would give a totally different picture of interpretation. This index takes into account a factor for calculation for index value.

Universal Index – For Sama, Gorwa and Danteshwar, water is of Medium quality and for all other lakes water is of good quality. This index includes physico-chemical plus heavy metal parameters into consideration. In this study we have taken only physico-chemical parameters for maintaining similarity in comparison with other parameters. This index includes rating plus weightage method. In other indices only one of the above methods is used i.e. either rating or weightage method. This helps in knowing the rating given for a particular parameter. But here also the same problem arises i.e. no liberty is given in modification of rating of parameters based on the study area, which many times gives an error in result interpretation.

For Dhamija and Jain index, Dhobi, Bapod, Gotri and Harni lakes show medium water quality whereas others show good water quality. This index takes into consideration 9 parameters for calculation and has a similar range interpretation as the original NSF index. This index is used for many lakes or pond water bodies but ideally they do not include important water surface parameters like BOD, phosphate, nitrate, total coliform and fecal coliform. The resultant index value obtained here indicates the water of good quality in absence of main parameters used for lake assessment. It also uses rating plus weightage method for calculation but modification or inclusion or deletion is not allowed, leading to an inaccurate interpretation for overall water body.

For weighted arithmetic mean index except Kamala, all other water bodies are considered as very bad under quality status of water bodies. This includes work in Association with standard values given for all parameters. Calculation is done in consideration with acceptable standard limits for selected parameters with their resultant value. This index allows the addition of as many parameters as you want to take for index calculation. A K-constant is used in calculation with unit weightage method. Drawback of this method is that not all selected parameters have a standard value, and the main question arises which standard to be used for assessing lake or river bodies. No specific standards are given and ultimately it is compared with drinking water standards. Also this index value increased threefold because of dominance of only one parameter, placing water quality under the worst category. This index is the most widely used index in India for both surface and groundwater.

Bascaron index has two variations one is subjective Bascaron index and other is objective Bascaron index. Both indices take into consideration a K-constant value. For subjective K values, the range is from 0.25, 0.5, 0.75 and 1, whereas in the objective Bascaron index, K is equal to 1 where 1 is constant for all calculations. The index includes a weightage method plus a percentage factor which helps in better interpretation. Percentage value range is from 0 to 100 in which 0 is for value having low importance or low value and 100 is ideal value indicating a good water quality. The K-constant also gives the flexibility to add a value based on ideal physical observation of the water body. Apparent aspect is added as a parameter which is of utmost importance as mostly urban and rural water bodies are contaminated by waste added to the water bodies by anthropogenic activities leading to increase in turbidity and also decreasing the aesthetic value of the water body. Water quality for all lakes is moderate for subjective Bascaron index as K is kept as 0.5 while for objective Bascoron index, water quality is good as K is equal to 1 which is constant.

In the NEERI index, a total of 13 parameters are used and only the sub index function which is common in all other indices for calculation. No rating or weightage method is used in this index. This index does not take phosphate as a main parameter for interpretation and a modification is also not possible. The range developed or used in this index sometimes doesn't take into account values smaller than the given range and even values greater than the given range for e.g., total hardness range. Except for Gorwa and Danteshwar, water quality is good for all other lakes. For Gorwa and Danteshwar, water quality is of bad or in heavily polluted class.

Prati's Index:

Except for Kamala, water quality for all lakes is medium water quality. This index was also known as Pollution index where sub-indices were directly proportional to the level of pollution of a parameter contributes. This index was divided into classes where class 1 includes a different set of parameters and class 2 includes a different set of parameters. Inclusion of many other parameters like chloroform extract, permanganate and ABS were taken into consideration for the first time in any index. No rating or weightage system is adopted. Phosphate is also not considered in the calculation.

In the Integrated water quality index, no inclusion of surface water parameters is seen. DO, BOD, turbidity and phosphate are not taken into consideration, but this index is suggested for surface water quality analysis. This index is known as the drinking water quality index as it includes only parameters which are important for drinking water analysis. For Sama, Gotri, Harni and Kamala, water is of good quality whereas for other lakes, water is of medium quality for Integrated water quality index.

The New water quality index only takes five parameters into consideration. This index works on the geometric function. Only 5 parameters justify the overall water quality resulting in deletion of many other parameters dominance in pollution load as they are not considered in WQI calculation. For all lakes, the resultant WQI value shows bad quality i.e., need management practices in relation to all other indices interpretation.

Nemerow index: This index is known as pollution index. This index mostly takes into consideration standard values as well as the weightage method for calculation. This index takes into consideration all important parameters for surface assessment. This is the most widely used index for surface water in the USA after NSF index. But as standard values are taken into account, dominance of only one parameter over others is seen as similar to Weighted arithmetic mean index. No weightage and sub index function is used in this index. Dhobi, Gorwa, Bapod, Harni and Gotri show medium water quality whereas Motnath, Danteshwar and Kamala show good water quality and Sama lake is classified under are:

From the above results we can see that all indices are given different set of interpretation for water quality for all the nine ponds. Reason for such discrepancy is mainly because

1. The indices used above fall under different classes based on of their purpose of development like public indices, specific indices, and planning indices. Public indices were created for general water quality assessment, regardless of the intended use of the water. The National Sanitation Foundation Water Quality Index is a practical illustration of how their evaluation process is often independent of the purpose and usage of the water reserve. Specific Indices: Indices specifically designed for use in a given application, including as drinking, irrigation, industry, or ecological preservation. Examples of such

indices are Prati's Index, Integrated Water quality index and Dinius Index. Planning indices are methods for evaluating water quality that were specifically created to help managers and policymakers support their choice Example of Planning index is Bascaron Index, universal index, NEERI Index and Overall pollution index. If we use a common index on a water body whose water is being used for a specific activity, the obtained results would not be able to justify the correct scenario as the parameters taken into account are those used for calculating a general index value (Parmar & Samnani, 2022).

2. Most of the model are based on Fixed and open system method leading to problem of Eclipsing, ambiguity, and rigidity (Akhtar et al., 2021).

Fixed system: Utilizing the WQI is limited to a predetermined set of parameters that the WQI developer has found to be the most suitable set of variables needed to calculate the final index value. Even while using a specified set of parameters allows the user to precisely examine and compare the water quality status among various sites, the technique is inflexible, which is a common issue with most water quality indices. A fixed system is rigid because it is incapable of accepting the addition of new parameters (Liou et al., 2004).

Open system: Because open systems are flexible, users can insert unique parameters. These WQIs eliminate stiffness and are flexible, but they provide a significant challenge when comparing the results from different monitoring locations. Such indices (open systems) should not be used as comparison tools unless the user mandates the use of the same set of criteria, particularly when prioritizing data based on pollution status and water quality classification.

This might become an issue if any crucial elements are accidentally left out of the index since the index will paint an image of the water quality that is different from the reality (Swamee & Tyagi, 2007).

Rigidity is observed in the case of the NSF index because the addition/deletion of more critical or less impacted parameters is not possible, leading to a problem in the interpretation of the status of a water body. For example, heavy metals and detergent parameters, which are reported to be present in many lakes and ponds, are not included in NSF. An aggregation technique becomes unclear when the index value is greater than the

critical level (unacceptable value). An ambiguous water quality index is one in which the total score indicates worse water quality than would be predicted from the sum of the individual component scores. Depending on how the weights are determined, this is a significant issue with weighted indices. There is ambiguity in many indices, such as the NSF, the overall water quality index and the weighted arithmetic index method. As the unit weight for selected parameters is defined even if the resultant value for that parameter is low, the index value for that particular parameter is also high as multiplied by the pre-defined unit weight. A case of eclipsing exists when one or more sub-indices reach the critical level (unacceptable value), but the index as a whole does not, especially a problem with the additive aggregation model, as in the Overall Pollution Index (Parmar & Samnani, 2023).

3. Unequal weightings are the most used ones because they may discriminate between the influence of different characteristics.

Table 41 Comparison between Interpretation of fifteen index for Sama Lake

(a)

NSF Index			NEERI INDEX		Overall Pollution Index		DOE Index		Dinius Index	
Month	**Value**	**Interpretation**	**Value**	**Interpretation**	**Value**	**Interpretation**	**Value**	**Interpretation**	**Value**	**Interpretation**
Sep-18	42.21	Bad	1.75	Acceptable	84.52	Good	67.16	Class III	61.77	Medium
Dec-18	44.52	Bad	1.72	Acceptable	70.85	Fair	66.54	Class III	53.07	Medium
Mar-19	35.75	Bad to Very Bad	3.33	Slightly Polluted	66.82	Fair	59.68	Class III	38.46	Bad
Jun-19	55.32	Medium to Good	1.02	Acceptable	80.55	Good	71.07	Class III	72.34	Good
Sep-19	88.24	Good to Excellent	1.28	Acceptable	82.56	Good	78.92	Class II	83.60	Good
Dec-19	76.94	Good to Excellent	1.02	Acceptable	76.45	Good	81.31	Class II	67.67	Medium
Mar-20	83.17	Good to Excellent	1.02	Acceptable	75.16	Good	84.70	Class II	70.82	Good
Jun-20	65.43	Good to Excellent	1.81	Acceptable	77.90	Good	76.30	Class III	71.45	Good
Sep-20	54.15	Medium to Good	1.96	Acceptable	77.86	Good	68.28	Class III	61.31	Medium
Dec-20	67.08	Good to Excellent	2.06	Slightly Polluted	63.00	Fair	65.56	Class III	59.93	Medium
Mar-21	74.24	Good to Excellent	1.39	Acceptable	65.15	Fair	67.81	Class III	70.87	Good
Jun-21	75.13	Good to Excellent	1.86	Acceptable	71.18	Fair	69.97	Class III	73.03	Good
Sep-21	72.14	Good to Excellent	1.72	Acceptable	54.74	Fair	71.68	Class III	64.77	Medium
Dec-21	74.04	Good to Excellent	1.16	Acceptable	67.94	Fair	74.32	Class III	62.14	Medium

(b)

Universal Index			Integrated Index		New Water Quality Index		Dhamija & Jain		Weighted Arithmetic Mean Method	
Month	**Value**	**Interpretation**	Value	Interpretation	Value	Interpretation	Value	Interpretation	Value	Interpretation
Sep-18	72.33	Fair	1.93	Good	0.28	Needs Management Practices	66.8	Medium	142.19	Unsuitable
Dec-18	68.42	Fair	1.46	Good	0.24	Needs Management Practices	64.4	Medium	290.63	Unsuitable
Mar-19	68.42	Fair	1.37	Good	0.50	Needs Management Practices	45.2	Bad	345.18	Unsuitable
Jun-19	82.58	Good	2.33	Marginal	0.47	Needs Management Practices	91.2	Good	57.62	Poor
Sep-19	87.60	Good	2.04	Marginal	0.61	Needs Management Practices	86.4	Good	101.04	Unsuitable
Dec-19	77.64	Good	1.47	Good	0.26	Needs Management Practices	83.2	Medium	191.32	Unsuitable
Mar-20	77.57	Good	1.14	Good	0.27	Needs Management Practices	81.6	Good	276.81	Unsuitable
Jun-20	65.23	Fair	1.80	Good	0.23	Needs Management Practices	79.2	Good	275.80	Unsuitable
Sep-20	61.28	Fair	2.77	Marginal	0.08	Needs Management Practices	81.6	Medium	202.41	Unsuitable
Dec-20	65.26	Fair	1.87	Good	0.10	Needs Management Practices	75.2	Medium	531.35	Unsuitable
Mar-21	67.21	Fair	2.03	Marginal	0.15	Needs Management Practices	73.6	Good	486.65	Unsuitable
Jun-21	73.87	Fair	0.80	Excellent	0.02	Needs Management Practices	79.2	Good	584.92	Unsuitable
Sep-21	70.16	Fair	0.84	Excellent	0.03	Needs Management Practices	74.8	Medium	597.53	Unsuitable
Dec-21	75.38	Good	1.23	Good	0.04	Needs Management Practices	78.4	Medium	372.71	Unsuitable

(c)

Nemerow Pollution Index			NSF index 9 Parameters		Bascaron Index		New Bascaron Index		Prati's Index	
Month	**Value**	**Interpretation**	Value	Interpretation	Value	Interpretation	Value	Interpretation	Value	Interpretation
Sep-18	6.26	Moderately polluted	65.88	Medium	33.55	Regular	54	Regular	2.03	Slightly Polluted
Dec-18	6.48	Moderately polluted	62.52	Medium	33.75	Regular	51.33	Regular	2.24	Slightly Polluted
Mar-19	4.73	Slightly Polluted	60.41	Medium	30.83	Bad	59.33	Regular	2.88	Slightly Polluted
Jun-19	4.95	Slightly Polluted	78.75	Good	38.75	Regular	70.66	Acceptable	2.42	Slightly Polluted
Sep-19	4.75	Slightly Polluted	77.90	Good	40.83	Regular	82.66	Acceptable	1.73	Acceptable
Dec-19	4.58	Slightly Polluted	70.25	Good	40	Regular	76.66	Acceptable	1.53	Acceptable
Mar-20	4.58	Slightly Polluted	71.46	Good	38.61	Regular	78	Acceptable	1.38	Acceptable
Jun-20	4.66	Slightly Polluted	62.05	Medium	34.3	Regular	64	Acceptable	2.46	Slightly Polluted
Sep-20	4.15	Slightly Polluted	61.28	Medium	33.33	Regular	63.32	Acceptable	3.02	Slightly Polluted
Dec-20	8.00	Moderately polluted	57.01	Medium	29.44	Bad	40	Regular	3.25	Slightly Polluted
Mar-21	7.37	Moderately polluted	60.04	Medium	31.11	Regular	54.66	Regular	2.78	Slightly Polluted
Jun-21	7.09	Moderately polluted	60.24	Medium	33.47	Regular	62	Acceptable	2.81	Slightly Polluted
Sep-21	5.23	Moderately polluted	61.10	Medium	33.88	Regular	64.66	Acceptable	2.74	Slightly Polluted
Dec-21	6.46	Moderately polluted	61.72	Medium	34.58	Regular	60	Regular	2.21	Slightly Polluted

Table 42 Comparison between Interpretation of fifteen index Motnath Lake

(a)

	NSF Index		NEERI INDEX		Overall Pollution Index		DOE Index		Dinius Index	
Month	**Value**	**Interpretation**	**Value**	**Interpretation**	**Value**	**Interpretation**	**Value**	**Interpretation**	**Value**	**Interpretation**
Sep-18	52.55	Medium to Good	1.43	Acceptable	73.11	Fair	74.50	Class III	67.52	Medium
Dec-18										
Mar-19	59.84	Medium to Good	1.97	Acceptable	75.58	Good	75.00	Class III	74.48	Good
Jun-19	63.13	Good to Excellent	1.94	Acceptable	77.16	Good	79.58	Class II	87.70	Good
Sep-19	77.97	Good to Excellent	1.38	Acceptable	85.49	Good	81.38	Class II	86.63	Good
Dec-19	81.26	Good to Excellent	1.44	Acceptable	83.30	Good	81.63	Class II	71.21	Good
Mar-20	66.47	Good to Excellent	1.30	Acceptable	74.15	Good	74.77	Class III	54.51	Medium
Jun-20	63.89	Good to Excellent	1.66	Acceptable	68.74	Fair	75.80	Class III	67.97	Medium
Sep-20	64.17	Good to Excellent	2.15	Slightly Polluted	70.93	Fair	69.42	Class III	76.38	Good
Dec-20	64.32	Good to Excellent	2.10	Slightly Polluted	69.24	Fair	70.87	Class III	59.37	Medium
Mar-21	75.47	Good to Excellent	1.22	Acceptable	69.14	Fair	72.40	Class III	72.63	Good
Jun-21	61.52	Medium to Good	1.76	Acceptable	65.52	Fair	70.01	Class III	63.86	Medium
Sep-21	80.90	Good to Excellent	1.38	Acceptable	72.46	Fair	75.16	Class III	69.31	Medium
Dec-21	68.26	Good to Excellent	1.16	Acceptable	70.63	Fair	74.87	Class III	58.96	Medium

(b)

Universal Index			Integrated Index		New Water Quality Index		Dhamija & Jain		Weighted Arithmatic Mean Method	
Month	**Value**	**Interpretation**	Value	Interpretation	Value	Interpretation	Value	Interpretation	Value	Interpretation
Sep-18	68.79	Fair	1.07	Good	0.34	Needs Management Practices	64.40	Medium	547.15	Unsuitable
Dec-18										
Mar-19	86.63	Good	1.36	Good	0.33	Needs Management Practices	64.80	Medium	354.15	Unsuitable
Jun-19	86.36	Good	1.35	Good	0.41	Needs Management Practices	69.60	Medium	231.71	Unsuitable
Sep-19	93.70	Good	2.45	Marginal	0.80	Needs Management Practices	89.60	Good	79.70	Very Poor
Dec-19	92.04	Good	1.86	Good	0.69	Needs Management Practices	84.80	Good	50.40	Poor
Mar-20	72.25	Fair	2.84	Marginal	0.30	Needs Management Practices	76.00	Good	116.31	Unsuitable
Jun-20	65.29	Fair	2.61	Marginal	0.30	Needs Management Practices	82.40	Good	254.07	Unsuitable
Sep-20	74.74	Good	2.06	Marginal	0.45	Needs Management Practices	83.20	Good	379.80	Unsuitable
Dec-20	67.95	Fair	2.12	Marginal	0.34	Needs Management Practices	72.00	Medium	201.60	Unsuitable
Mar-21	66.26	Fair	2.39	Marginal	0.09	Needs Management Practices	84.00	Good	278.31	Unsuitable
Jun-21	64.05	Fair	1.75	Good	0.24	Needs Management Practices	77.60	Good	396.33	Unsuitable
Sep-21	79.47	Good	1.29	Good	0.18	Needs Management Practices	79.20	Good	400.91	Unsuitable
Dec-21	72.21	Fair	1.32	Good	0.05	Needs Management Practices	75.20	Good	294.43	Unsuitable

(c)

Nemerow Pollution Index			NSF index 9 Parameters		Bascaron Index		New Bascaron Index		Prati's Index	
Month	**Value**	**Interpretation**	Value	Interpretation	Value	Interpretation	Value	Interpretation	Value	Interpretation
Sep-18	7.09	Moderately polluted	61.09	Medium	31.18	Regular	54	Regular	60.00	Regular
Dec-18										
Mar-19	6.48	Moderately polluted	70.93	Good	38.61	Regular	59.33	Regular	85.32	Acceptable
Jun-19	5.36	Moderately polluted	69.75	Medium	38.88	Regular	70.66	Acceptable	79.32	Acceptable
Sep-19	3.95	Slightly Polluted	73.10	Good	44.44	Regular	82.66	Acceptable	89.32	Acceptable
Dec-19	4.44	Slightly Polluted	78.00	Good	41.52	Regular	76.66	Acceptable	84.00	Acceptable
Mar-20	4.48	Slightly Polluted	66.56	Medium	38.05	Regular	78	Acceptable	71.32	Acceptable
Jun-20	4.45	Slightly Polluted	71.28	Good	39.58	Regular	64	Acceptable	63.32	Acceptable
Sep-20	3.79	Slightly Polluted	62.50	Medium	38.61	Regular	63.32	Acceptable	75.32	Acceptable
Dec-20	6.14	Moderately polluted	64.16	Medium	33.05	Regular	40	Regular	50.00	Regular
Mar-21	4.70	Slightly Polluted	69.95	Medium	36.11	Regular	54.66	Regular	63.32	Acceptable
Jun-21	6.28	Moderately polluted	55.99	Medium	34.44	Regular	62	Acceptable	50.00	Regular
Sep-21	6.42	Moderately polluted	64.80	Medium	35.41	Regular	64.66	Acceptable	66.00	Acceptable
Dec-21	6.37	Moderately polluted	62.12	Medium	35.55	Regular	60	Regular	60.00	Regular

Table 43 Comparison between Interpretation of fifteen index for Dhobi Lake

(a)

NSF Index			NEERI INDEX		Overall Pollution Index		DOE Index		Dinius Index	
Month	**Value**	**Interpretation**	**Value**	**Interpretation**	**Value**	**Interpretation**	**Value**	**Interpretation**	**Value**	**Interpretation**
Sep-18	46.45	Bad	3.09	Slightly Polluted	69.76	Fair	67.56	Class III	70.31	Good
Dec-18	59.19	Medium to Good	1.91	Acceptable	79.17	Good	77.47	Class II	66.11	Medium
Mar-19	48.81	Bad	2.57	Slightly Polluted	74.92	Good	69.70	Class III	63.45	Medium
Jun-19	55.01	Medium to Good	2.48	Slightly Polluted	77.38	Good	72.05	Class III	69.98	Medium
Sep-19	75.53	Good to Excellent	1.18	Acceptable	84.93	Good	83.46	Class II	83.86	Good
Dec-19	80.39	Good to Excellent	1.49	Acceptable	74.25	Good	84.66	Class II	83.86	Good
Mar-20	56.31	Medium to Good	3.15	Slightly Polluted	71.13	Fair	66.00	Class III	25.95	Bad
Jun-20	73.57	Good to Excellent	2.70	Slightly Polluted	73.49	Fair	71.60	Class III	83.84	Good
Sep-20	74.75	Good to Excellent	1.49	Acceptable	71.19	Fair	76.52	Class II	71.88	Good
Dec-20	62.76	Good to Excellent	1.62	Acceptable	58.25	Fair	64.34	Class III	62.65	Medium
Mar-21	78.76	Good to Excellent	1.88	Acceptable	65.85	Fair	77.46	Class II	60.32	Medium
Jun-21	78.13	Good to Excellent	1.61	Acceptable	60.05	Fair	77.52	Class II	76.81	Good
Sep-21	80.13	Good to Excellent	1.46	Acceptable	65.07	Fair	72.80	Class III	66.53	Medium
Dec-21	71.24	Good to Excellent	1.15	Acceptable	68.36	Fair	75.34	Class III	61.38	Medium

(b)

Universal Index			Integrated Index		New Water Quality Index		Dhamija & Jain		Weighted Arithmetic Mean Method	
Month	**Value**	**Interpretation**	Value	Interpretation	Value	Interpretation	Value	Interpretation	Value	Interpretation
Sep-18	69.90	Fair	4.44	Poor	0.43	Needs Management Practices	40.00	Bad	203.37	Unsuitable
Dec-18	77.42	Good	4.41	Poor	0.13	Needs Management Practices	56.00	Medium	219.04	Unsuitable
Mar-19	75.59	Good	5.70	Unsuitable	0.17	Needs Management Practices	36.80	Bad	125.63	Unsuitable
Jun-19	75.88	Good	4.39	Poor	0.02	Needs Management Practices	41.60	Bad	116.38	Unsuitable
Sep-19	80.81	Good	1.58	Good	0.36	Needs Management Practices	88.00	Good	97.23	Very Poor
Dec-19	81.87	Good	0.99	Excellent	0.33	Needs Management Practices	73.60	Medium	78.58	Very Poor
Mar-20	73.40	Fair	0.67	Excellent	0.00	Needs Management Practices	56.80	Medium	92.41	Very Poor
Jun-20	70.31	Fair	1.30	Good	0.21	Needs Management Practices	80.80	Good	177.36	Unsuitable
Sep-20	73.67	Fair	1.76	Good	0.38	Needs Management Practices	88.80	Good	237.06	Unsuitable
Dec-20	61.79	Fair	0.68	Excellent	0.35	Needs Management Practices	65.60	Medium	573.92	Unsuitable
Mar-21	76.56	Good	1.96	Good	0.30	Needs Management Practices	73.60	Medium	167.67	Unsuitable
Jun-21	73.26	Fair	0.52	Excellent	0.19	Needs Management Practices	79.20	Good	297.40	Unsuitable
Sep-21	74.53	Good	0.38	Excellent	0.11	Needs Management Practices	67.60	Medium	427.64	Unsuitable
Dec-21	74.17	Good	0.82	Excellent	0.03	Needs Management Practices	68.00	Medium	197.43	Unsuitable

(c)

Nemerow Pollution Index			NSF index 9 Parameters		Bascaron Index		New Bascaron Index		Prati's Index	
Month	**Value**	**Interpretation**	Value	Interpretation	Value	Interpretation	Value	Interpretation	Value	Interpretation
Sep-18	5.82	Moderately polluted	64.32	Medium	26.31	Bad	54.66	Regular	2.99	Slightly Polluted
Dec-18	5.65	Moderately polluted	72.57	Good	30.26	Bad	68.00	Acceptable	2.06	Slightly Polluted
Mar-19	5.98	Moderately polluted	70.01	Good	25.52	Bad	63.32	Acceptable	2.50	Slightly Polluted
Jun-19	5.82	Moderately polluted	57.63	Medium	25.39	Bad	66.00	Acceptable	2.57	Slightly Polluted
Sep-19	6.00	Moderately polluted	69.50	Medium	35.69	Regular	62.66	Acceptable	1.35	Acceptable
Dec-19	4.65	Slightly Polluted	74.07	Good	37.19	Regular	75.66	Acceptable	1.32	Acceptable
Mar-20	4.99	Slightly Polluted	56.53	Medium	28.75	Bad	55.32	Regular	2.35	Slightly Polluted
Jun-20	5.33	Moderately polluted	67.36	Medium	32.08	Regular	63.32	Acceptable	3.64	Slightly Polluted
Sep-20	4.21	Slightly Polluted	66.85	Medium	35.19	Regular	74.00	Acceptable	2.26	Slightly Polluted
Dec-20	6.63	Moderately polluted	55.25	Medium	26.38	Bad	50.66	Regular	3.03	Slightly Polluted
Mar-21	4.62	Slightly Polluted	69.04	Medium	33.54	Regular	75.32	Acceptable	2.19	Slightly Polluted
Jun-21	4.88	Slightly Polluted	66.72	Medium	33.61	Regular	67.32	Acceptable	2.14	Slightly Polluted
Sep-21	6.21	Moderately polluted	65.86	Medium	31.52	Regular	64.66	Acceptable	2.45	Slightly Polluted
Dec-21	4.98	Slightly Polluted	63.73	Medium	33.02	Regular	70.00	Acceptable	1.90	Acceptable

Table 44 Comparison between Interpretation of fifteen index for Bapod Lake

(a)

NSF Index			NEERI INDEX		Overall Pollution Index		DOE Index		Dinius Index	
Month	**Value**	**Interpretation**	**Value**	**Interpretation**	**Value**	**Interpretation**	**Value**	**Interpretation**	**Value**	**Interpretation**
Sep-18	65.40	Good to Excellent	1.50	Acceptable	88.60	Good	79.01	Class II	87.94	Good
Dec-18	61.70	Medium to Good	1.63	Acceptable	70.34	Fair	71.35	Class III	71.81	Good
Mar-19	50.64	Medium to Good	2.69	Slightly Polluted	63.73	Fair	59.65	Class III	71.27	Good
Jun-19	52.60	Medium to Good	2.21	Slightly Polluted	77.73	Good	71.52	Class III	87.67	Good
Sep-19	87.68	Good to Excellent	1.34	Acceptable	90.48	Good	83.77	Class II	86.59	Good
Dec-19	74.13	Good to Excellent	1.02	Acceptable	74.54	Good	76.75	Class II	61.31	Medium
Mar-20	78.64	Good to Excellent	1.03	Acceptable	64.71	Fair	76.15	Class III	47.58	Bad
Jun-20	44.45	Bad	1.42	Acceptable	68.15	Fair	65.41	Class III	65.75	Medium
Sep-20	82.54	Good to Excellent	1.33	Acceptable	86.06	Good	81.79	Class II	73.22	Good
Dec-20	87.23	Good to Excellent	1.68	Acceptable	67.61	Fair	85.79	Class II	71.62	Good
Mar-21	70.01	Good to Excellent	2.11	Slightly Polluted	79.20	Good	65.31	Class III	69.59	Medium
Jun-21	78.09	Good to Excellent	1.67	Acceptable	60.89	Fair	78.70	Class II	71.44	Good
Sep-21	82.57	Good to Excellent	1.23	Acceptable	80.56	Good	74.53	Class III	71.28	Good
Dec-21	79.03	Good to Excellent	1.24	Acceptable	78.10	Good	73.94	Class III	69.18	Medium

(b)

Universal Index			Integrated Index		New Water Quality Index		Dhamija & Jain		Weighted Arithmetic Mean Method	
Month	**Value**	**Interpretation**	Value	Interpretation	Value	Interpretation	Value	Interpretation	Value	Interpretation
Sep-18	81.27	Good	1.87	Good	0.36	Needs Management Practices	64.40	Medium	157.98	Unsuitable
Dec-18	74.10	Good	1.68	Good	0.16	Needs Management Practices	60.40	Medium	244.67	Unsuitable
Mar-19	85.71	Good	3.64	Poor	0.49	Needs Management Practices	50.40	Medium	113.24	Unsuitable
Jun-19	79.42	Good	0.58	Excellent	0.47	Needs Management Practices	73.60	Medium	188.11	Unsuitable
Sep-19	87.10	Good	1.12	Good	0.42	Needs Management Practices	64.80	Medium	64.77	Poor
Dec-19	78.55	Good	1.15	Good	0.06	Needs Management Practices	68.80	Medium	82.28	Very Poor
Mar-20	76.11	Good	3.94	Poor	0.04	Needs Management Practices	81.20	Medium	343.67	Unsuitable
Jun-20	61.79	Fair	1.09	Good	0.15	Needs Management Practices	70.40	Medium	402.43	Unsuitable
Sep-20	80.03	Good	2.54	Marginal	0.20	Needs Management Practices	75.20	Good	158.71	Unsuitable
Dec-20	83.62	Good	4.17	Poor	0.26	Needs Management Practices	50.40	Medium	130.69	Unsuitable
Mar-21	71.28	Fair	3.34	Poor	0.20	Needs Management Practices	64.40	Medium	119.68	Unsuitable
Jun-21	72.37	Fair	2.00	Good	0.06	Needs Management Practices	68.00	Medium	532.30	Unsuitable
Sep-21	78.63	Good	0.81	Excellent	0.07	Needs Management Practices	79.60	Medium	629.35	Unsuitable
Dec-21	75.16	Good	1.52	Good	0.04	Needs Management Practices	65.60	Medium	377.91	Unsuitable

(c)

Nemerow Pollution Index			NSF index 9 Paramaeters		Bascaron Index		New Bascaron Index		Prati's Index	
Month	**Value**	**Interpretation**	Value	Interpretation	Value	Interpretation	Value	Interpretation	Value	Interpretation
Sep-18	4.71	Slightly Polluted	73.38	Good	34.47	Regular	70.66	Acceptable	1.84	Acceptable
Dec-18	5.74	Moderately polluted	71.47	Good	31.18	Regular	26.56	Bad	2.55	Slightly Polluted
Mar-19	5.33	Moderately polluted	68.56	Medium	29.47	Bad	62.66	Acceptable	4.36	Polluted
Jun-19	4.88	Slightly Polluted	71.59	Good	35.52	Regular	76.00	Acceptable	3.04	Slightly Polluted
Sep-19	4.84	Slightly Polluted	78.81	Good	37.91	Regular	84.00	Acceptable	1.35	Acceptable
Dec-19	4.83	Slightly Polluted	68.80	Medium	35.97	Regular	81.32	Acceptable	1.80	Acceptable
Mar-20	5.97	Moderately polluted	62.85	Medium	31.18	Regular	64.00	Acceptable	1.96	Acceptable
Jun-20	5.03	Moderately polluted	57.15	Medium	32.08	Regular	64.00	Acceptable	2.85	Slightly Polluted
Sep-20	4.80	Slightly Polluted	74.16	Good	34.07	Regular	82.66	Acceptable	1.66	Acceptable
Dec-20	4.73	Slightly Polluted	76.90	Good	35.39	Regular	86.66	Acceptable	1.15	Acceptable
Mar-21	5.08	Moderately polluted	65.74	Medium	32.08	Regular	66.66	Acceptable	3.65	Slightly Polluted
Jun-21	4.76	Slightly Polluted	64.60	Medium	35.83	Regular	77.32	Acceptable	2.04	Slightly Polluted
Sep-21	4.90	Slightly Polluted	67.22	Medium	38.88	Regular	82.66	Acceptable	2.27	Slightly Polluted
Dec-21	4.79	Slightly Polluted	63.21	Medium	30.13	Bad	60.00	Regular	2.16	Slightly Polluted

Table 45 Comparison between Interpretation of fifteen index for Danteshwar Lake

(a)

NSF Index			NEERI INDEX		Overall Pollution Index		DOE Index		Dinius Index	
Month	**Value**	**Interpretation**	**Value**	**Interpretation**	**Value**	**Interpretation**	**Value**	**Interpretation**	**Value**	**Interpretation**
Sep-18	56.73	Medium to Good	1.02	Acceptable	76.02	Good	76.30	Class III	81.85	Good
Dec-18	53.26	Medium to Good	1.04	Acceptable	84.16	Good	72.78	Class III	60.79	Medium
Mar-19	37.71	Bad	1.86	Acceptable	71.18	Fair	58.41	Class III	51.59	Medium
Jun-19	36.33	Bad to Very Bad	1.32	Acceptable	69.91	Fair	59.64	Class III	58.25	Medium
Sep-19	67.96	Good to Excellent	0.91	Excellent	76.28	Good	72.16	Class III	76.20	Good
Dec-19	82.90	Good to Excellent	1.44	Acceptable	88.21	Good	74.73	Class III	86.62	Good
Mar-20										
Jun-20	0.00		0.00							
Sep-20	58.88	Medium to Good	1.46	Acceptable	70.78	Fair	67.40	Class III	66.31	Medium
Dec-20	54.06	Medium to Good	2.24	Slightly Polluted	67.47	Fair	56.18	Class III	55.24	Medium
Mar-21	56.36	Medium to Good	2.11	Slightly Polluted	64.60	Fair	58.15	Class III	54.10	Medium
Jun-21	60.09	Medium to Good	1.21	Acceptable	79.74	Good	62.05	Class III	57.84	Medium
Sep-21	86.75	Good to Excellent	1.33	Acceptable	90.38	Good	78.49	Class II	66.97	Medium
Dec-21	84.70	Good to Excellent	1.07	Acceptable	90.87	Good	82.89	Class II	66.53	Medium

(b)

Universal Index			Integrated Index		New Water Quality Index		Dhamija & Jain		Weighted Arithmetic Mean Method	
Month	**Value**	**Interpretation**	Value	Interpretation	Value	Interpretation	Value	Interpretation	Value	Interpretation
Sep-18	76.28	Good	1.44	Good	0.17	Needs Management Practices	81.60	Good	204.30	Unsuitable
Dec-18	74.04	Good	1.34	Good	0.06	Needs Management Practices	76.80	Good	235.00	Unsuitable
Mar-19	66.78	Fair	1.62	Good	0.11	Needs Management Practices	72.80	Medium	159.18	Unsuitable
Jun-19	65.53	Fair	3.16	Poor	0.01	Needs Management Practices	78.40	Good	106.85	Unsuitable
Sep-19	79.79	Good	1.68	Good	0.19	Needs Management Practices	76.80	Good	55.27	Poor
Dec-19	85.32	Good	1.16	Good	0.42	Needs Management Practices	68.00	Medium	111.34	Unsuitable
Mar-20										
Jun-20										
Sep-20	64.93	Fair	1.77	Good	0.13	Needs Management Practices	85.60	Good	224.98	Unsuitable
Dec-20	59.26	Fair	0.88	Excellent	0.11	Needs Management Practices	71.60	Medium	303.77	Unsuitable
Mar-21	60.79	Fair	1.94	Good	0.47	Needs Management Practices	68.80	Medium	269.82	Unsuitable
Jun-21	62.21	Fair	1.18	Good	0.03	Needs Management Practices	81.60	Good	214.05	Unsuitable
Sep-21	84.68	Good	1.21	Good	0.31	Needs Management Practices	79.60	Good	103.58	Unsuitable

Dec-21	84.71	Good	1.94	Good	0.36	Needs Management Practices	89.60	Good	64.23	Poor

(c)

Nemerow Pollution Index			**NSF index 9 Paramaeters**		**Bascaron Index**		**New Bascaron Index**		**Prati's Index**	
Month	**Value**	**Interpretation**	Value	Interpretation	Value	Interpretation	Value	Interpretation	Value	Interpretation
Sep-18	4.64	Slightly Polluted	72.60	Good	33.68	Regular	60.66	Regular	1.87	Acceptable
Dec-18	6.36	Moderately polluted	69.88	Medium	34.73	Regular	62.66	Acceptable	2.04	Slightly Polluted
Mar-19	5.35	Moderately polluted	63.90	Medium	32.50	Regular	54.00	Regular	3.17	Slightly Polluted
Jun-19	5.10	Moderately polluted	64.75	Medium	33.62	Regular	52.00	Regular	3.21	Slightly Polluted
Sep-19	4.77	Slightly Polluted	76.17	Good	39.02	Regular	68.66	Acceptable	2.12	Slightly Polluted
Dec-19	4.82	Slightly Polluted	69.25	Medium	36.80	Regular	79.32	Acceptable	2.49	Slightly Polluted
Mar-20										
Jun-20									0.00	
Sep-20	4.06	Slightly Polluted	56.35	Medium	33.28	Regular	64.00	Acceptable	2.97	Slightly Polluted
Dec-20	4.23	Slightly Polluted	58.13	Medium	32.10	Regular	58.00	Regular	3.55	Slightly Polluted
Mar-21	4.53	Slightly Polluted	57.84	Medium	34.86	Regular	62.66	Acceptable	2.83	Slightly Polluted
Jun-21	4.64	Slightly Polluted	56.92	Medium	35.13	Regular	64.66	Acceptable	3.11	Slightly Polluted
Sep-21	4.19	Slightly Polluted	77.92	Good	37.22	Regular	82.66	Acceptable	1.95	Acceptable
Dec-21	4.22	Slightly Polluted	77.34	Good	40.39	Regular	86.66	Acceptable	1.38	Acceptable

Table 46 Comparison between Interpretation of fifteen index for Gorwa Lake

(a)

NSF Index			NEERI INDEX		Overall Pollution Index		DOE Index		Dinius Index	
Month	**Value**	**Interpretation**	**Value**	**Interpretation**	**Value**	**Interpretation**	**Value**	**Interpretation**	**Value**	**Interpretation**
Sep-18	46.35	Bad	1.59	Acceptable	85.27	Good	68.44	Class III	56.94	Medium
Dec-18	39.18	Bad	1.78	Acceptable	66.18	Fair	59.93	Class III	59.30	Medium
Mar-19	37.64	Bad	1.72	Acceptable	73.53	Fair	61.89	Class III	57.60	Medium
Jun-19	40.35	Bad	2.41	Slightly Polluted	65.70	Fair	56.52	Class III	61.28	Medium
Sep-19	52.33	Medium to Good	1.68	Acceptable	70.89	Fair	61.62	Class III	50.96	Medium
Dec-19	60.79	Medium to Good	1.49	Acceptable	69.81	Fair	65.87	Class III	51.32	Medium
Mar-20										
Jun-20										
Sep-20	61.05	Medium to Good	1.41	Acceptable	69.25	Fair	64.52	Class III	69.06	Medium
Dec-20	76.49	Good to Excellent	1.19	Acceptable	77.94	Good	81.18	Class II	60.01	Medium
Mar-21	81.82	Good to Excellent	1.09	Acceptable	78.76	Good	72.43	Class III	64.63	Medium
Jun-21	76.90	Good to Excellent	1.40	Acceptable	77.27	Good	82.75	Class II	67.80	Medium
Sep-21	68.11	Good to Excellent	1.02	Acceptable	77.67	Good	73.64	Class III	57.48	Medium
Dec-21	61.17	Medium to Good	1.78	Acceptable	71.73	Fair	67.65	Class III	55.27	Medium

(b)

Universal Index			Integrated Index		New Water Quality Index		Dhamija & Jain		Weighted Arithmetic Mean Method	
Month	**Value**	**Interpretation**	Value	Interpretation	Value	Interpretation	Value	Interpretation	Value	Interpretation
Sep-18	76.69	Good	1.72	Good	0.08	Needs Management Practices	76.00	Good	75.21	Very Poor
Dec-18	69.44	Fair	1.02	Good	0.05	Needs Management Practices	59.20	Medium	79.44	Very Poor
Mar-19	62.42	Fair	0.67	Excellent	0.05	Needs Management Practices	75.20	Good	328.50	Unsuitable
Jun-19	58.45	Fair	1.24	Good	0.05	Needs Management Practices	68.80	Medium	459.26	Unsuitable
Sep-19	58.11	Fair	1.10	Good	0.17	Needs Management Practices	67.20	Medium	461.74	Unsuitable
Dec-19	64.37	Fair	1.24	Good	0.09	Needs Management Practices	65.60	Medium	408.10	Unsuitable
Mar-20										
Jun-20										
Sep-20	63.55	Fair	2.82	Marginal	0.11	Needs Management Practices	84.80	Good		
Dec-20	77.94	Good	1.77	Good	0.30	Needs Management Practices	84.80	Good	220.23	Unsuitable
Mar-21	80.85	Good	2.43	Marginal	0.36	Needs Management Practices	87.20	Good	160.78	Unsuitable
Jun-21	77.00	Good	1.29	Good	0.35	Needs Management Practices	88.80	Good	199.70	Unsuitable
Sep-21	75.13	Good	1.51	Good	0.07	Needs Management Practices	73.20	Medium	113.09	Unsuitable

Dec-21	65.54	Fair	2.48	Marginal	0.09	Needs Management Practices	80.00	Good	159.01	Unsuitable

(c)

Nemerow Pollution Index			**NSF index 9 Parameters**		**Bascaron Index**		**New Bascaron Index**		**Prati's Index**	
Month	**Value**	**Interpretation**	Value	Interpretation	Value	Interpretation	Value	Interpretation	Value	Interpretation
Sep-18	6.46	Moderately polluted	68.24	Medium	35.73	Regular	60.00	Regular	2.16	Slightly Polluted
Dec-18	5.05	Moderately polluted	65.03	Medium	31.05	Regular	52.66	Regular	3.39	Slightly Polluted
Mar-19	6.03	Moderately polluted	58.52	Medium	30.92	Bad	49.32	Regular	3.49	Slightly Polluted
Jun-19	5.78	Moderately polluted	59.46	Medium	28.15	Bad	46.00	Regular	4.71	Polluted
Sep-19	5.30	Moderately polluted	51.29	Medium	33.75	Regular	61.32	Acceptable	3.32	Slightly Polluted
Dec-19	4.97	Slightly Polluted	52.25	Medium	33.33	Regular	72.66	Acceptable	2.93	Slightly Polluted
Mar-20										
Jun-20										
Sep-20	3.95	Slightly Polluted	64.80	Medium	31.05	Regular	62.66	Acceptable	2.88	Slightly Polluted
Dec-20	4.33	Slightly Polluted	73.65	Good	37.32	Regular	84.00	Acceptable	1.61	Acceptable
Mar-21	4.53	Slightly Polluted	75.10	Good	41.88	Regular	87.32	Acceptable	3.19	Slightly Polluted
Jun-21	4.51	Slightly Polluted	67.96	Medium	38.75	Regular	74.00	Acceptable	1.62	Acceptable
Sep-21	4.85	Slightly Polluted	68.57	Medium	39.58	Regular	70.66	Acceptable	1.79	Acceptable
Dec-21	5.04	Moderately polluted	62.30	Medium	35.39	Regular	56.66	Regular	2.33	Slightly Polluted

Table 47 Comparison between Interpretation of fifteen index for Gotri Lake

(a)

NSF Index			NEERI INDEX		Overall Pollution Index		DOE Index		Dinius Index	
Month	**Value**	**Interpretation**	**Value**	**Interpretation**	**Value**	**Interpretation**	**Value**	**Interpretation**	**Value**	**Interpretation**
Sep-18	40.68	Bad	1.87	Acceptable	71.48	Fair	63.16	Class III	58.27	Medium
Dec-18	51.62	Medium to Good	1.32	Acceptable	76.63	Good	70.84	Class III	59.80	Medium
Mar-19	56.10	Medium to Good	1.91	Acceptable	77.34	Good	72.88	Class III	74.17	Good
Jun-19	59.47	Medium to Good	1.74	Acceptable	67.18	Fair	73.55	Class III	82.48	Good
Sep-19	76.90	Good to Excellent	1.41	Acceptable	61.45	Fair	75.68	Class III	72.83	Good
Dec-19	81.58	Good to Excellent	1.39	Acceptable	76.01	Good	78.12	Class II	73.41	Good
Mar-20	70.17	Good to Excellent	1.43	Acceptable	75.86	Good	72.42	Class III	61.35	Medium
Jun-20	66.13	Good to Excellent	1.64	Acceptable	57.09	Fair	76.87	Class II	71.37	Good
Sep-20	68.35	Good to Excellent	1.51	Acceptable	66.81	Fair	67.90	Class III	68.88	Medium
Dec-20	66.49	Good to Excellent	1.87	Acceptable	59.45	Fair	67.51	Class III	55.53	Medium
Mar-21	76.40	Good to Excellent	2.00	Slightly Polluted	61.87	Fair	66.71	Class III	74.66	Good
Jun-21	76.10	Good to Excellent	1.85	Acceptable	57.69	Fair	70.93	Class III	77.30	Good
Sep-21	65.23	Good to Excellent	1.73	Acceptable	68.85	Fair	63.56	Class III	56.53	Medium
Dec-21	71.87	Good to Excellent	1.16	Acceptable	65.70	Fair	74.71	Class III	61.58	Medium

(b)

Universal Index			Integrated Index		New Water Quality Index		Dhamija & Jain		Weighted Arithmetic Mean Method	
Month	**Value**	**Interpretation**	Value	Interpretation	Value	Interpretation	Value	Interpretation	Value	Interpretation
Sep-18	70.33	Fair	1.58	Good	0.45	Needs Management Practices	64.00	Medium	206.77	Unsuitable
Dec-18	71.85	Fair	0.99	Excellent	0.11	Needs Management Practices	59.20	Medium	288.06	Unsuitable
Mar-19	82.38	Good	1.53	Good	0.22	Needs Management Practices	69.60	Medium	417.45	Unsuitable
Jun-19	82.62	Good	1.63	Good	0.05	Needs Management Practices	70.40	Medium	661.54	Unsuitable
Sep-19	78.91	Good	1.45	Good	0.45	Needs Management Practices	80.00	Good	892.70	Unsuitable
Dec-19	81.05	Good	1.25	Good	0.50	Needs Management Practices	84.80	Good	97.52	Very Poor
Mar-20	79.72	Good	1.18	Good	0.23	Needs Management Practices	73.20	Medium	130.11	Unsuitable
Jun-20	65.89	Fair	1.55	Good	0.64	Needs Management Practices	80.00	Good	967.41	Unsuitable
Sep-20	68.42	Fair	2.17	Marginal	0.61	Needs Management Practices	70.40	Medium	548.86	Unsuitable
Dec-20	68.42	Fair	1.16	Good	0.72	Needs Management Practices	53.60	Medium	692.88	Unsuitable
Mar-21	71.58	Fair	2.08	Marginal	0.01	Needs Management Practices	71.20	Medium	598.08	Unsuitable

Jun-21	77.24	Good	0.95	Excellent	0.20	Needs Management Practices	76.80	Good	754.83	Unsuitable
Sep-21	66.78	Fair	0.84	Excellent	0.70	Needs Management Practices	62.00	Medium	695.99	Unsuitable
Dec-21	74.11	Good	1.36	Good	0.22	Needs Management Practices	78.00	Good	613.59	Unsuitable

(c)

Nemerow Pollution Index			**NSF index 9 Paramaeters**		**Bascaron Index**		**New Bascaron Index**		**Prati's Index**	
Month	**Value**	**Interpretation**	Value	Interpretation	Value	Interpretation	Value	Interpretation	Value	Interpretation
Sep-18	5.27	Moderately polluted	64.06	Medium	33.22	Regular	59.32	Regular	2.34	Slightly Polluted
Dec-18	5.95	Moderately polluted	65.06	Medium	32.50	Regular	58.66	Regular	2.34	Slightly Polluted
Mar-19	5.88	Moderately polluted	65.27	Medium	33.95	Regular	64.66	Acceptable	2.62	Slightly Polluted
Jun-19	5.55	Moderately polluted	67.68	Medium	32.12	Regular	68.66	Acceptable	2.54	Slightly Polluted
Sep-19	5.32	Moderately polluted	60.41	Medium	32.01	Regular	70.32	Acceptable	2.35	Slightly Polluted
Dec-19	6.16	Moderately polluted	69.20	Medium	36.25	Regular	63.32	Acceptable	1.95	Acceptable
Mar-20	4.58	Slightly Polluted	65.72	Medium	36.38	Regular	72.66	Acceptable	2.36	Slightly Polluted
Jun-20	5.74	Moderately polluted	60.02	Medium	36.25	Regular	57.32	Regular	2.38	Slightly Polluted
Sep-20	4.73	Slightly Polluted	61.68	Medium	33.88	Regular	72.00	Acceptable	2.58	Slightly Polluted
Dec-20	5.77	Moderately polluted	57.96	Medium	32.91	Regular	62.66	Acceptable	2.26	Slightly Polluted
Mar-21	5.94	Moderately polluted	63.27	Medium	30.69	Bad	63.32	Acceptable	3.05	Slightly Polluted
Jun-21	6.32	Moderately polluted	61.55	Medium	32.01	Regular	63.32	Acceptable	2.72	Slightly Polluted
Sep-21	5.78	Moderately polluted	53.90	Medium	32.63	Regular	64.66	Acceptable	2.69	Slightly Polluted
Dec-21	5.22	Moderately polluted	60.02	Medium	35.34	Regular	72.66	Acceptable	2.20	Slightly Polluted

Table 48 Comparison between Interpretation of fifteen index for Kamala Lake

(a)

NSF Index			NEERI INDEX		Overall Pollution Index		DOE Index		Dinius Index	
Month	**Value**	**Interpretation**	**Value**	**Interpretation**	**Value**	**Interpretation**	**Value**	**Interpretation**	**Value**	**Interpretation**
Sep-18	63.98	Good to Excellent	1.36	Acceptable	79.33	Good	82.23	Class II	87.33	Good
Dec-18	65.65	Good to Excellent	1.25	Acceptable	79.97	Good	79.98	Class II	73.83	Good
Mar-19	60.17	Medium to Good	2.68	Slightly Polluted	78.41	Good	80.82	Class II	88.66	Good
Jun-19	66.80	Good to Excellent	1.45	Acceptable	85.49	Good	84.43	Class II	68.56	Medium
Sep-19	86.17	Good to Excellent	1.35	Acceptable	80.72	Good	83.38	Class II	92.45	Excellent
Dec-19	79.63	Good to Excellent	1.40	Acceptable	87.91	Good	72.69	Class III	70.99	Good
Mar-20	68.94	Good to Excellent	1.89	Acceptable	82.98	Good	72.68	Class III	67.41	Medium
Jun-20	65.10	Good to Excellent	1.63	Acceptable	82.88	Good	71.28	Class III	69.19	Medium
Sep-20	71.68	Good to Excellent	1.09	Acceptable	73.66	Fair	77.94	Class II	75.48	Good
Dec-20	84.59	Good to Excellent	0.99	Excellent	76.84	Good	82.05	Class II	68.16	Medium
Mar-21	86.69	Good to Excellent	1.01	Acceptable	92.75	Good	83.63	Class II	68.29	Medium
Jun-21	82.81	Good to Excellent	1.44	Acceptable	80.94	Good	80.98	Class II	69.82	Medium
Sep-21	78.27	Good to Excellent	1.43	Acceptable	80.29	Good	81.34	Class II	63.54	Medium
Dec-21	85.57	Good to Excellent	1.15	Acceptable	81.53	Good	87.07	Class II	68.17	Medium

(b)

Universal Index			Integrated Index		New Water Quality Index		Dhamija & Jain		Weighted Arithmetic Mean Method	
Month	**Value**	**Interpretation**	Value	Interpretation	Value	Interpretation	Value	Interpretation	Value	Interpretation
Sep-18	85.08	Good	1.48	Good	0.30	Needs Management Practices	68.00	Medium	55.89	Poor
Dec-18	83.07	Good	1.20	Good	0.31	Needs Management Practices	70.40	Medium	88.68	Very Poor
Mar-19	93.72	Good	1.49	Good	0.41	Needs Management Practices	62.40	Medium	51.16	Poor
Jun-19	93.45	Good	0.55	Excellent	0.51	Needs Management Practices	79.60	Good	20.45	Excellent
Sep-19	90.54	Good	1.84	Good	0.55	Needs Management Practices	84.40	Good	54.77	Poor
Dec-19	78.52	Good	0.88	Excellent	0.36	Needs Management Practices	79.60	Good	74.15	Poor
Mar-20	71.40	Fair	0.88	Excellent	0.33	Needs Management Practices	78.40	Good	124.22	Unsuitable
Jun-20	74.12	Good	1.54	Good	0.26	Needs Management Practices	81.60	Good	82.10	Very Poor
Sep-20	73.45	Fair	2.27	Marginal	0.30	Needs Management Practices	94.40	Good	99.08	Very Poor
Dec-20	79.09	Good	1.07	Good	0.19	Needs Management Practices	78.00	Good	128.27	Unsuitable
Mar-21	84.01	Good	1.52	Good	0.30	Needs Management Practices	90.40	Good	65.08	Poor
Jun-21	86.47	Good	1.97	Good	0.49	Needs Management Practices	87.20	Good	65.95	Poor
Sep-21	82.86	Good	1.13	Good	0.39	Needs Management Practices	81.20	Good	57.54	Poor

Dec-21	84.10	Good	1.84	Good	0.48	Needs Management Practices	87.20	Good	123.30	Unsuitable

(c)

Nemerow Pollution Index			**NSF index 9 Paramaeters**		**Bascaron Index**		**New Bascaron Index**		**Prati's Index**	
Month	**Value**	**Interpretation**	Value	Interpretation	Value	Interpretation	Value	Interpretation	Value	Interpretation
Sep-18	4.88	Slightly Polluted	77.62	Good	35.52	Regular	73.32	Acceptable	1.57	Acceptable
Dec-18	5.10	Moderately polluted	78.34	Good	36.57	Regular	82.00	Acceptable	1.78	Acceptable
Mar-19	4.84	Slightly Polluted	76.86	Good	36.47	Regular	90.66	Acceptable	2.00	Acceptable
Jun-19	4.37	Slightly Polluted	81.53	Good	40.65	Regular	89.32	Acceptable	1.49	Acceptable
Sep-19	4.52	Slightly Polluted	76.10	Good	42.50	Regular	82.66	Acceptable	1.43	Acceptable
Dec-19	4.82	Slightly Polluted	72.61	Good	70.83	Acceptable	70.00	Acceptable	2.58	Slightly Polluted
Mar-20	4.64	Slightly Polluted	67.78	Medium	32.50	Regular	62.00	Acceptable	2.81	Slightly Polluted
Jun-20	4.74	Slightly Polluted	64.82	Medium	35.83	Regular	64.00	Acceptable	2.68	Slightly Polluted
Sep-20	4.61	Slightly Polluted	68.66	Medium	35.26	Regular	71.12	Acceptable	1.95	Acceptable
Dec-20	4.86	Slightly Polluted	74.23	Good	36.57	Regular	86.66	Acceptable	1.52	Acceptable
Mar-21	4.68	Slightly Polluted	79.79	Good	39.05	Regular	88.00	Acceptable	1.42	Acceptable
Jun-21	4.55	Slightly Polluted	73.17	Good	40.13	Regular	76.66	Acceptable	1.64	Acceptable
Sep-21	4.19	Slightly Polluted	73.41	Good	36.38	Regular	74.00	Acceptable	1.76	Acceptable
Dec-21	4.22	Slightly Polluted	76.14	Good	41.84	Regular	86.66	Acceptable	1.23	Acceptable

Table 49 Comparison between Interpretation of fifteen index for Harni Lake

(a)

NSF Index			NEERI INDEX		Overall Pollution Index		DOE Index		Dinius Index	
Month	**Value**	**Interpretation**	**Value**	**Interpretation**	**Value**	**Interpretation**	**Value**	**Interpretation**	**Value**	**Interpretation**
Sep-18	45.48	Bad	1.62	Acceptable	69.87	Fair	61.19	Class III	66.24	Medium
Dec-18	53.53	Medium to Good	0.87	Excellent	79.35	Good	70.22	Class III	61.82	Medium
Mar-19	52.11	Medium to Good	1.36	Acceptable	72.80	Fair	72.00	Class III	56.31	Medium
Jun-19	45.56	Bad	2.05	Slightly Polluted	78.79	Good	62.10	Class III	71.45	Good
Sep-19	74.05	Good to Excellent	1.24	Acceptable	67.56	Fair	65.26	Class III	74.23	Good
Dec-19	75.99	Good to Excellent	1.59	Acceptable	78.30	Good	69.09	Class III	75.64	Good
Mar-20	75.89	Good to Excellent	1.54	Acceptable	71.29	Fair	78.71	Class II	65.31	Medium
Jun-20	67.49	Good to Excellent	1.93	Acceptable	72.46	Fair	73.61	Class III	77.88	Good
Sep-20	77.90	Good to Excellent	0.83	Excellent	78.72	Good	81.56	Class II	75.97	Good
Dec-20	70.94	Good to Excellent	1.47	Acceptable	76.82	Good	70.96	Class III	60.72	Medium
Mar-21	54.88	Medium to Good	2.22	Slightly Polluted	61.10	Fair	50.05	Class IV	55.79	Medium
Jun-21	74.53	Good to Excellent	1.09	Acceptable	73.55	Fair	69.56	Class III	68.88	Medium
Sep-21	83.64	Good to Excellent	1.32	Acceptable	71.25	Fair	73.69	Class III	67.46	Medium
Dec-21	60.54	Medium to Good	1.25	Acceptable	78.66	Good	60.04	Class III	54.98	Medium

(b)

Universal Index			Integrated Index		New Water Quality Index		Dhamija & Jain		Weighted Arithmetic Mean Method	
Month	**Value**	**Interpretation**	Value	Interpretation	Value	Interpretation	Value	Interpretation	Value	Interpretation
Sep-18	68.42	Fair	1.16	Good	0.40	Needs Management Practices	66.40	Medium	349.95	Unsuitable
Dec-18	76.70	Good	1.26	Good	0.18	Needs Management Practices	75.20	Good	93.58	Very Poor
Mar-19	77.86	Good	0.47	Excellent	0.10	Needs Management Practices	74.40	Medium	161.94	Unsuitable
Jun-19	68.42	Fair	0.45	Excellent	0.26	Needs Management Practices	53.20	Medium	298.51	Unsuitable
Sep-19	80.21	Good	0.92	Excellent	0.19	Needs Management Practices	72.00	Medium	85.45	Very Poor
Dec-19	87.02	Good	1.95	Good	0.56	Needs Management Practices	84.00	Good	83.35	Very Poor
Mar-20	81.94	Good	1.67	Good	0.34	Needs Management Practices	90.40	Good	99.81	Very Poor
Jun-20	66.21	Fair	1.92	Good	0.12	Needs Management Practices	84.80	Good	391.90	Unsuitable
Sep-20	80.03	Good	1.99	Good	0.25	Needs Management Practices	84.00	Good	84.89	Very Poor
Dec-20	72.14	Fair	1.38	Good	0.13	Needs Management Practices	65.20	Medium	121.96	Unsuitable
Mar-21	60.79	Fair	1.65	Good	0.49	Needs Management Practices	63.20	Medium	311.04	Unsuitable
Jun-21	73.26	Fair	0.86	Excellent	0.04	Needs Management Practices	67.20	Good	253.89	Unsuitable
Sep-21	78.63	Good	0.71	Excellent	0.16	Needs Management Practices	71.60	Medium	379.23	Unsuitable
Dec-21	65.37	Fair	0.79	Excellent	0.07	Needs Management Practices	67.20	Medium	216.23	Unsuitable

(c)

Nemerow Pollution Index			NSF index 9 Paramaeters		Bascaron Index		New Bascaron Index		Prati's Index	
Month	**Value**	**Interpretation**	Value	Interpretation	Value	Interpretation	Value	Interpretation	Value	Interpretation
Sep-18	5.88	Moderately polluted	61.72	Medium	33.55	Regular	58.66	Regular	2.66	Slightly Polluted
Dec-18	4.93	Slighty Polluted	75.98	Good	38.95	Regular	74.66	Acceptable	2.29	Slightly Polluted
Mar-19	6.40	Moderately polluted	70.76	Good	34.44	Regular	66.00	Acceptable	2.45	Slightly Polluted
Jun-19	5.27	Moderately polluted	61.61	Medium	33.47	Regular	60.00	Regular	2.86	Slightly Polluted
Sep-19	6.20	Moderately polluted	66.75	Medium	35.69	Regular	63.32	Acceptable	2.67	Slightly Polluted
Dec-19	5.92	Moderately polluted	69.48	Medium	37.77	Regular	68.66	Acceptable	2.76	Slightly Polluted
Mar-20	6.68	Moderately polluted	67.80	Medium	33.68	Regular	62.00	Acceptable	1.98	Acceptable
Jun-20	4.83	Slightly Polluted	59.87	Medium	37.61	Regular	62.00	Acceptable	2.91	Slightly Polluted
Sep-20	4.73	Slightly Polluted	73.60	Good	39.44	Regular	83.32	Acceptable	1.49	Acceptable
Dec-20	4.76	Slightly Polluted	67.43	Medium	37.91	Regular	78.00	Acceptable	1.93	Acceptable
Mar-21	3.94	Slightly Polluted	55.74	Medium	33.33	Regular	64.66	Acceptable	3.94	Slightly Polluted
Jun-21	5.32	Moderately polluted	65.34	Medium	35.97	Regular	72.00	Acceptable	2.18	Slightly Polluted
Sep-21	4.99	Slightly Polluted	69.82	Medium	37.91	Regular	76.00	Acceptable	2.19	Slightly Polluted
Dec-21	6.14	Moderately polluted	55.88	Medium	31.11	Regular	54.00	Regular	2.88	Slightly Polluted

4.3 Modified Water Quality Index Results

Modification in index is a concept used in the study period to to see if the selected index just by changing the weightage factor involved in index calculations can predict the actual status of water bodies in relation with the analysis performed and field survey carried out during sampling period.

A study on modication in index calculations was conducted for a one-year data set of 3 lakes namely Harni Lake, Gotri Lake and Sama Lake, by using three indices i.e., National Sanitation Foundation Index (NSF), Overall Water Quality Index (OQW) and Overall Index of Pollution (OIP) also known as NEERI index to analyse the overall change in the value based on the modification.

In this case, index values for the identical data set are generated after adjusting the unit weight component used by both the NSF and OQW indices. For the NSF and OQW index, the weightage of pH, temperature, DO, BOD, fecal coliform, total coliform, nitrate, phosphate, turbidity, and sulphate have been changed as shown in Table 50.

The unit weight for pH, fecal coliform, and nitrate was lowered from their initial allotment because of low-value variability. For pH, the value remains within the acceptable range and does not exceed or reduce the standard range. Even the presence of either fecal coliform or total coliform is considered unacceptable. However, comparing a year's assessment values does not exceed the two-digit value factor and always falls in the accepted range given by individual indices. Because none of the three sample bodies contained nitrate concentrations of more than three milligrams per liter (mg/L) or fluoride concentrations greater than one milligram per liter (mg/L), the unit weight for these two elements was accordingly lowered.

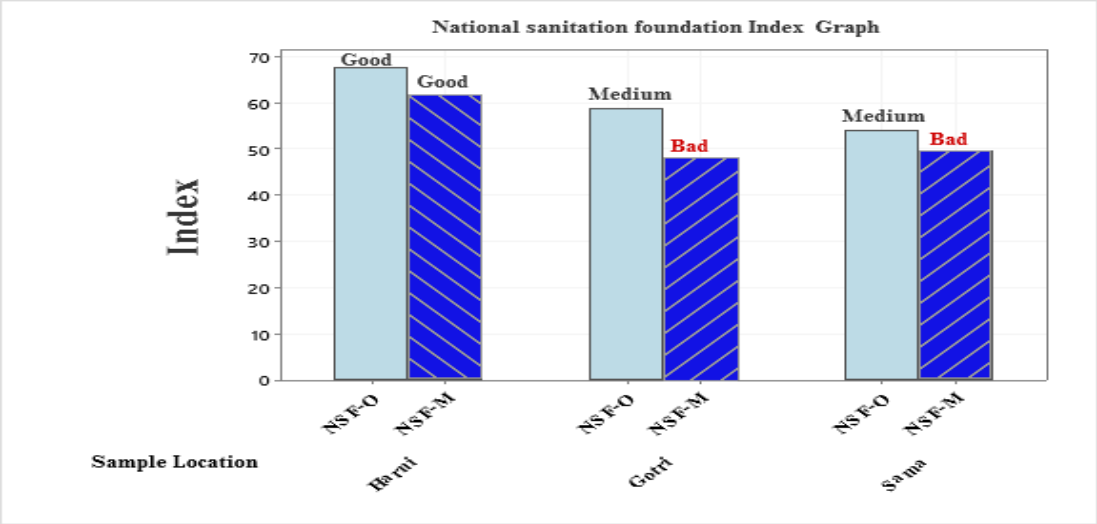
Each parameter, temperature, dissolved oxygen, phosphate, turbidity, and sulphate, now has a higher unit weight in the modified index. Changes in one parameter might be seen in the other, as temperature and DO have an inverse relationship. Climatic conditions in India keep changing, particularly in Gujarat, where hot summers are very common and uncertain natural calamities lower the temperature all of a sudden, adding to the sudden quality and changes in water bodies. Phosphate and turbidity are the two main parameters that contribute the most to the deteriorating water quality, as their values are comparatively higher when compared with standard values. No particular Indian standard is prescribed for phosphate but compared with the WHO standard value

(0.4); the obtained values are higher than the standard range. For urban lake body assessment, phosphate and turbidity play an important role, as increased phosphate levels lead to eutrophication, which increases the turbid levels, leading to higher turbidity values and a low aesthetic value for a particular water body.

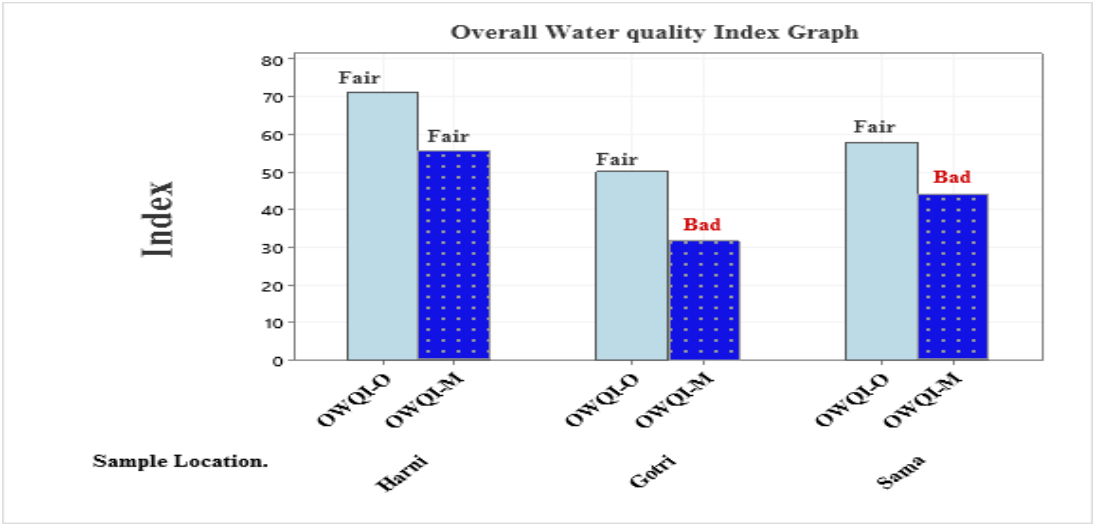
Table 50 Original and modified weightage values for NSF and OWQ Index

Parameters	*NSF INDEX - O*	*NSF INDEX - M*	*OWQ INDEX - O*	*OWQ INDEX – M*
pH	0.11	0.08	1	1
TDS			3	3
Colour			2	2
Temperature	0.10	0.17		
DO	0.17	0.20	4	4
Total Solids	0.07	0.07		
Five days BOD	0.11	0.06	2	4
Sulphates			2	3
Total Hardness			1	1
Chloride			1	1
Total Coliform			4	3
Fecal Coliform	0.16	0.08		
Turbidity	0.08	0.08	1	4
Fluoride			3	1
Nitrate	0.10	0.07	3	1
Phosphate	0.10	0.19	2	4

After modification in unit weight for the selected parameter for both indices, individual WQI was computed to compare the results with the original index value. Figure 40(I) shows that the resultant NSF WQI status for Harni remains the same for both original and modified: for Gotri and Sama, water status changes from medium to bad due to changes in parameters contributing to pollution of the water body changes and given higher weightage resulting in its actual assessment in interpreting water body through WQI. From Figure 40(II) resultant OWQI status for Harni remains fair class, but the modified index value is lower than the original one, indicating that if even one parameter value increases in future, water quality can slip to the bad water condition. In the case of Gotri and Sama, water status changes from fair to bad, and for Harni, index value variation is huge between original and modified, resulting in a slight increase in any parameter that can change it to heavily polluted water body class.



(I)



(II)

Figure 41 : (I)- NSF Original Index (O) and Modified Index(M) comparison graph for three sample bodies.
(II)- OWQ Original Index(O) and Modified Index(M) comparison graph for three sample bodies

There are limited modifications that may be made to the NEERI index for the Overall Pollution Index (OPI), aside from changing the range categorization. Due to the lack of a unit weight system and the computation's sole dependence on the sub-index equation, the OPI index, for instance, has a nitrate range of less than 20 mg/L; however, when the index is applied, where the nitrate level is

between 2 mg/L and 10 mg/L, this range is insufficient to adequately explain the impact of nitrate on that specific water body. Water quality assessment in terms of WQI has become one of the critical issues for the sustainability index of the world. The quality of a single lake water body falls under three different classes, starting from acceptable quality to unsuitable quality, using other indices, which do not define the actual quality of the water body, giving varying interpretations. The current scarcity of freshwater indicates the use of lake water for domestic or industrial applications; hence, decisions should be based on this understanding and require modifications in the computation of WQIs.

With modifications in the indices according to the parameter dominance and pollution of the water body, prediction of the actual status of the water body was observed compared to the WQI calculated with a pre-decided range and parameter weightage. Two modified indices showed different results when compared with the actual ones. From the obtained value, the result value might fall under the same range, e.g., 50–70, predicting good water, with the original index calculation value going up to 69, and for modified, it comes to 51, giving a clear indication that water quality might go under 50 and fall into the poor category if the water body is not maintained or protected correctly.

Depending on the pollution load experienced by the body of water, the universal contamination range of chosen parameters needs to be adjusted. Parameters are reportedly added or removed depending on the type of the body of water, its geographical location, and anthropological effects; depending on the pollution load received by the lake, the range of weightage and sub-index values change accordingly. WQI creation should include incorporating critical lake metrics, establishing their standard values, and other lake/pond features, which may identify the actual water quality and the treatment processes necessary before water use.

Based on the results obtained from one year study period, modification for all 15 index used was carried out in form of weightage or range, majority in index having weightage factor to all nine lakes and their individual index was calculated. From the index calculation steps or method used, a modification area is identified for each index listed in Table 51. After identifying the modification area, which are the parameters that needs modifications are identified. As from results we can report that TDS and BOD values are higher, but the weightage given to that particular parameters for index calculation is low, resulting in giving more weightage to parameters that are not dominating the water bodies giving varying index interpretation. Parameters dominating the

water bodies and index calculation are identified are identified given in Table 52 to 54. Change in unit weight for dominant parameters for index having weightage factor are given in Table 55(a,b,c).

Table 51 Index Modification Area

Index	Modification Area
NSF Index	Change in weightage
NEERI Index	Change in range
Overall Water Pollution Index	Weightage change and range change
DOE Index	Range and weightage
Dinius Index	Range and weightage
Prati Index	Range
Universal Index	Weightage and 0-100 range classification
Integrated WQI	Drinking water Index with limited parameter
New Water Quality Index	Range
Dhamija & Jain	Weightage and 0-100 range classification
Weighted Arithmetic Mean Method	Phosphate, BOD and turbidity
Nemerow Pollution Index	-
NSF Index 9 parameters	Change in weightage
Bascaron Index	Weightage and 0-100 range classification
Objective Bascaron Index	Weightage and 0-100 range classification

Modification in seven indices and their interpretation are presented from Table 55 to 63.A single table is grouped in seven classes (a), (b),(c),(d),(e),(f) and (g).For eg. For Sama lake, modification is suggested for seven indices namely NSF index, Overall water quality index, DOE index, Dhamija and Jain index, Universal Index, NSF index for 9 parameters and Bascaron index. The change in interpretation is given in form of tables where (a) includes interpretation for NSF index,(b)interpretation for Overall water quality index,(c) includes interpretation for DOE index,(d) includes interpretation for Dhamija and Jain index,(e) includes interpretation for Universal Index,(f) includes interpretation for NSF index for 9 parameters and (g) includes interpretation for Bascaron index. Similarly for all other lakes interpretation is presentation in tables below.

Resultant index value after using modified weightages for all nine lakes for 4 year study period in shown in Table 55 to 63.

Table 52 Dominating parameter list for Sama, Motnath and Dhobi Lake

Index	Dominating Parameters for Sama Lake	Dominating Parameters for Motnath Lake	Dominating Parameters for Dhobi Lake
NSF Index	Fecal Coliform, DO, pH	Fecal Coliform, DO, Ph	Fecal Coliform, DO, pH
NEERI Index	BOD, Total Hardness, Turbidity, pH and Chloride	BOD, Total Hardness, Turbidity, pH and Chloride	BOD, Total Hardness, TDS and Chloride
Overall Water Pollution Index	Total Coliform, Nitrate, TDS, DO, Color	Total Coliform, Nitrate, TDS, DO, Color	Total Coliform, Nitrate, TDS, DO, Color
DOE Index	DO, BOD, TSS	DO, BOD, TSS	DO, BOD, TSS
Dinius Index	DO, pH, Temperature	DO, pH, Temperature	DO, pH, Temperature
Prati Index	Ammonical Nitrogen, BOD, TSS	Ammonical Nitrogen, BOD, DO	Ammonical Nitrogen, BOD, DO and COD
Universal Index	Total coliform, nitrate, Fluoride	Total coliform, nitrate, Fluoride	Total coliform, nitrate, Fluoride
Integrated WQI	Total Hardness, Mg-Hardness and chloride	Total Hardness, Ca-Hardness and chloride	Total Hardness, Ca-Hardness and Mg-Hardness
New Water Quality Index	Conductivity and Turbidity	Conductivity and Turbidity	Conductivity and Turbidity
Dhamija & Jain	pH, Mg-Hardness and DO	pH, Mg-Hardness and DO	pH, Mg-Hardness and DO
Weighted Arithmetic Mean Method	Phosphate, BOD and turbidity	Phosphate, BOD and turbidity	Phosphate, BOD and turbidity
Nemerow Pollution Index	Turbidity, TS and Phosphate	Turbidity, TS and Phosphate	TS, turbidity, DO and BOD
NSF Index 9 parameters	DO, Fecal Coliform and Nitrate	DO, Fecal Coliform and Nitrate	DO, coliform, nitrate and pH
Bascaron Index	Conductivity, Total coliform, Turbidity. DO and BOD. Main parameters: Aspect Value	Conductivity, Total coliform, Turbidity. DO and BOD. Main parameters: Aspect Value	Conductivity, total coliform, turbidity. DO and BOD. Main parameters: Aspect Value
Objective Bascaron Index	DO, BOD and turbidity	DO, BOD and turbidity	DO, BOD and turbidity

Table 53 Dominating parameter list for Harni,Kamala and Bapod Lake

Index	Dominating Parameters for Harni Lake	Dominating Parameters for Kamala Lake	Dominating Parameters for Bapod Lake
NSF Index	BOD, DO, pH	Fecal Coliform, DO, pH	BOD, DO, pH
NEERI Index	BOD, Total Hardness, pH	BOD, Total Hardness, pH	BOD, Total Hardness, pH
Overall Water Pollution Index	Total Coliform, Nitrate, DO, TDS	Total Coliform, Nitrate, DO, TDS	Total Coliform, Sulphate, Nitrate, DO, Color
DOE Index	DO, BOD, pH	DO, BOD, TSS	DO, BOD, TSS
Dinius Index	DO, pH, Temperature	DO, pH, Temperature	DO, pH, Temperature
Prati Index	Ammonical Nitrogen, TSS, COD	Ammonical Nitrogen, BOD, COD	Ammonical Nitrogen, BOD, COD
Universal Index	Total coliform, nitrate, Fluoride	Total coliform, nitrate, Fluoride	Total coliform, nitrate, Fluoride
Integrated WQI	Mg-Hardness, Chloride and Hardness	Ca-Hardness, Chloride and Hardness	Chloride and Mg-Hardness
New Water Quality Index	Conductivity and Turbidity	Conductivity and Turbidity	Conductivity Fecal Coliform and DO
Dhamija & Jain	pH, Ca-Hardness and Mg-Hardness	pH, DO and Mg-Hardness	pH, TSS, Chloride and DO
Weighted Arithmetic Mean Method	Phosphate, BOD and turbidity	Phosphate, BOD and turbidity	Phosphate, BOD and turbidity
Nemerow Pollution Index	TS, turbidity and DO	TS, turbidity and Temperature	TS, turbidity, Phosphate and Temperature
NSF Index 9 parameters	DO, coliform and Nitrate	DO, coliform and Nitrate	DO, coliform, nitrate and pH
Bascaron Index	Conductivity, Total coliform, Turbidity. And BOD Main parameters: Aspect Value	Conductivity, Total coliform, Turbidity. And BOD Main parameters: Aspect Value	Conductivity, Total coliform, Turbidity. DO Main parameters: Aspect Value
Objective Bascaron Index	DO, BOD and turbidity	DO, BOD and turbidity	DO, BOD and turbidity

Table 54 Dominating parameter list for Danteshwar, Gorwa and Gotri Lake

Index	Dominating Parameters for Danteshwar Lake	Dominating Parameters for Gorwa Lake	Dominating Parameters for Gotri Lake
NSF Index	BOD, DO, pH	Fecal Coliform, DO, pH	BOD, DO, pH
NEERI Index	BOD, Total Hardness, pH	BOD, Total Hardness, pH	BOD, Total Hardness, pH
Overall Water Pollution Index	Total coliform, Sulphate, Nitrate, DO, TDS	Total coliform, Nitrate, DO, TDS	Total coliform, Nitrate, DO, TDS
DOE Index	DO, BOD, TSS	DO, BOD, TSS	DO, BOD, TSS
Dinius Index	DO, pH, Temperature	DO, pH, Temperature	DO, pH, Temperature
Prati Index	Ammonical Nitrogen, BOD, COD and DO	Ammonical Nitrogen, BOD, COD	Ammonical Nitrogen, BOD, COD
Universal Index	Total coliform, nitrate, Fluoride	Total coliform, nitrate, Fluoride	Total coliform, nitrate, Fluoride
Integrated WQI	TDS, Chloride and Hardness	TDS, Chloride and Hardness	Mg-Hardness, Chloride and Hardness
New Water Quality Index	Conductivity Fecal coliform and Turbidity	Conductivity Fecal coliform and Turbidity	Conductivity Fecal coliform and Turbidity
Dhamija & Jain	pH, Ca-Hardness and Mg- Hardness	pH, Ca-Hardness and Mg- Hardness and DO	pH, Ca-Hardness and DO
Weighted Arithmetic Mean Method	Phosphate, BOD and turbidity	Phosphate, BOD and turbidity	Phosphate, BOD and turbidity
Nemerow Pollution Index	TS, turbidity and Temperature	TS, turbidity and Temperature	TS, turbidity and Phosphate
NSF Index 9 parameters	DO, coliform and pH	DO, coliform and Nitrate	DO, coliform and pH
Bascaron Index	Conductivity, Total coliform, Turbidity. Main parameters: Aspect Value	Conductivity, Total coliform, Turbidity. And DO Main parameters: Aspect Value	Conductivity, Total coliform, Turbidity. And BOD Main parameters: Aspect Value
Objective Bascaron Index	DO, BOD and turbidity	DO, BOD and turbidity	DO, BOD and turbidity

Table 55 Modification in Weightages of Selected Indexes

(I)

NSF Index		
Parameters	**Original Weightage**	**Modified Weightage**
pH	0.22	0.11
DO	0.31	0.28
BOD	0.19	0.09
Fecal Coliforms	0.28	0.30
DOE Index		
Parameters	**Original Weightage**	**Modified Weightage**
DO	0.22	0.30
BOD	0.19	0.25
COD	0.16	0.06
Ammonical Nitrogen	0.15	0.10
TSS	0.16	0.20
pH	0.12	0.09
Overall Pollution Index		
Parameters	**Original Weightage**	**Modified Weightage**
Turbidity	1	4
Colour	2	2
TDS	3	3
pH	1	1
DO	4	4
BOD	2	4
Total Hardness	1	1
Chloride	1	1
Flouride	3	1
Nitrate	3	1
Total Phosphate	2	4
Sulphate	2	3
Total Coliform	4	3

(II)

NSF Index 9 Parameters		
Parameters	**Original Weightage**	**Modified Weightage**
DO	0.17	0.20
BOD	0.11	0.06
Coliform	0.16	0.08
pH	0.11	0.08
Temperature	0.10	0.17
Total phosphate	0.10	0.19
Nitrates	0.10	0.07
Turbidity	0.09	0.08
Total solids	0.08	0.07
Universal Index		
Parameters	**Original Weightage**	**Modified Weightage**
BOD	2	2
Nitrate	3	4
DO	4	4
Flouride	3	4
Phosphate	2	4
Total Coliform	4	4
pH	1	1
Dhamija & Jain		
Parameters	**Original Weightage**	**Modified Weightage**
pH	0.16	0.20
Total Solids	0.08	0.06
TSS	0.08	0.06
Total Hardness	0.08	0.06
Ca- Hardness	0.12	0.07
Mg-Hardness	0.16	0.20
DO	0.16	0.20
Chloride	0.08	0.08
Alkalinity	0.08	0.07

(III)

Bascaron Index		
Parameters	**Original Weightage**	**Modified Weightage**
pH	1	1
BOD	3	3
DO	4	4
Temperature	1	3
Total Coliforms	3	2
Colour	2	1
Turbidity	4	2
Total Hardness	1	1
TDS	2	2
Nitrates	2	1
Ammonia	3	2
Chloride	1	1
Conductivity	4	1
Magnesium	1	1
Phosphorus	1	4
Calcium Hardness	1	1
Apparent Aspect	2	4
Sulphate	**2**	**2**

Table 56 Sama lake Modified Index Result

(a) Sama lake Modified Index Result Table for NSF Index

Sama Lake NSF Index				
	Modified Index Value		**Original Index Value**	
Month	**Value**	**Interpretation**	**Value**	**Interpretation**
Sep-18	23.45	Bad to Very Bad	42.21	Bad
Dec-18	26.42	Bad to Very Bad	44.52	Bad
Mar-19	17.41	Bad to Very Bad	35.75	Bad to Very Bad
Jun-19	36.25	Bad to Very Bad	55.32	Medium to Good
Sep-19	68.04	Good to Excellent	88.24	Good to Excellent
Dec-19	58.14	Medium to Good	76.94	Good to Excellent
Mar-20	63.05	Good to Excellent	83.17	Good to Excellent
Jun-20	54.32	Medium to Good	65.43	Good to Excellent
Sep-20	46.20	Bad	54.15	Medium to Good
Dec-20	57.26	Medium to Good	67.08	Good to Excellent
Mar-21	58.72	Medium to Good	74.24	Good to Excellent
Jun-21	60.75	Medium to Good	75.13	Good to Excellent
Sep-21	58.02	Medium to Good	72.14	Good to Excellent
Dec-21	56.58	Medium to Good	74.04	Good to Excellent

(b) Sama lake Modified Index Result Table for Overall Water Quality Index

Sama Lake Overall Water Quality Index				
	Modified Index Value		Original Index Value	
Month	Value	Interpretation	Value	Interpretation
Sep-18	78.79	Good	84.52	Good
Dec-18	69.55	Fair	70.85	Fair
Mar-19	61.38	Fair	66.82	Fair
Jun-19	84.95	Good	80.55	Good
Sep-19	84.97	Good	82.56	Good
Dec-19	78.74	Good	76.45	Good
Mar-20	76.96	Good	75.16	Good
Jun-20	68.44	Fair	77.90	Good
Sep-20	69.34	Fair	77.86	Good
Dec-20	52.14	Fair	63.00	Fair
Mar-21	56.92	Fair	65.15	Fair
Jun-21	52.78	Fair	71.18	Fair
Sep-21	46.95	Poor	54.74	Fair
Dec-21	62.33	Fair	67.94	Fair

(c) Sama lake Modified Index Result Table for DOE Index

Sama Lake DOE Index				
	Modified Index Value		Original Index Value	
Month	Value	Interpretation	Value	Interpretation
Sep-18	64.08	Class III	67.16	Class III
Dec-18	64.93	Class III	66.54	Class III
Mar-19	55.50	Class III	59.68	Class III
Jun-19	75.40	Class III	71.07	Class III
Sep-19	84.11	Class II	78.92	Class II
Dec-19	83.26	Class II	81.31	Class II
Mar-20	87.60	Class II	84.70	Class II
Jun-20	77.06	Class II	76.30	Class III
Sep-20	69.27	Class III	68.28	Class III
Dec-20	68.03	Class III	65.56	Class III
Mar-21	70.55	Class III	67.81	Class III
Jun-21	75.17	Class III	69.97	Class III
Sep-21	77.40	Class II	71.68	Class III
Dec-21	77.01	Class II	74.32	Class III

(d) Sama lake Modified Index Result Table for Dhamija and Jain Index

Sama Lake Dhamija and Jain				
	Modified Index Value		Original Index Value	
Month	Value	Interpretation	Value	Interpretation
Sep-18	67.10	Medium	66.8	Medium
Dec-18	65.30	Medium	64.4	Medium
Mar-19	42.50	Bad	45.2	Bad
Jun-19	91.60	Good	91.2	Good
Sep-19	89.20	Good	86.4	Good
Dec-19	85.20	Good	83.2	Medium
Mar-20	84.00	Good	81.6	Good
Jun-20	79.40	Good	79.2	Good
Sep-20	78.50	Good	81.6	Medium
Dec-20	82.40	Good	75.2	Medium
Mar-21	73.60	Medium	73.6	Good
Jun-21	82.20	Good	79.2	Good
Sep-21	77.90	Good	74.8	Medium
Dec-21	80.00	Good	78.4	Medium

(e) Sama lake Modified Index Result Table for Universal Index

Sama Lake Universal Index				
Month	Value	Interpretation	Value	Interpretation
Sep-18	71.68	Fair	72.33	Fair
Dec-18	65.22	Fair	68.42	Fair
Mar-19	65.22	Fair	68.42	Fair
Jun-19	83.12	Good	82.58	Good
Sep-19	84.93	Good	87.60	Good
Dec-19	74.70	Good	77.64	Good
Mar-20	72.77	Fair	77.57	Good
Jun-20	62.71	Fair	65.23	Fair
Sep-20	61.83	Fair	61.28	Fair
Dec-20	62.61	Fair	65.26	Fair
Mar-21	64.22	Fair	67.21	Fair
Jun-21	69.72	Fair	73.87	Fair
Sep-21	66.65	Fair	70.16	Fair
Dec-21	70.97	Fair	75.38	Good

(f) Sama lake Modified Index Result Table for NSF INDEX 9 parameters

Sama Lake NSF INDEX 9 parameters				
	Modified Index Value		Original Index Value	
Month	Value	Interpretation	Value	Interpretation
Sep-18	56.74	Medium	65.88	Medium
Dec-18	52.14	Medium	62.52	Medium
Mar-19	47.63	Bad	60.41	Medium
Jun-19	72.66	Good	78.75	Good
Sep-19	75.01	Good	77.90	Good
Dec-19	63.98	Medium	70.25	Good
Mar-20	64.00	Medium	71.46	Good
Jun-20	59.04	Medium	62.05	Medium
Sep-20	59.43	Medium	61.28	Medium
Dec-20	51.16	Medium	57.01	Medium
Mar-21	52.54	Medium	60.04	Medium
Jun-21	54.74	Medium	60.24	Medium
Sep-21	55.93	Medium	61.10	Medium
Dec-21	56.00	Medium	61.72	Medium

(g) Sama lake Modified Index Result Table for Bascaron Index

Sama Lake Bascaron Index				
	Modified Index Value		Original Index Value	
Month	Value	Interpretation	Value	Interpretation
Sep-18	32.92	Regular	33.55	Regular
Dec-18	32.64	Regular	33.75	Regular
Mar-19	30.42	Bad	30.83	Bad
Jun-19	35.42	Regular	38.75	Regular
Sep-19	37.64	Regular	40.83	Regular
Dec-19	36.53	Regular	40.00	Regular
Mar-20	35.56	Regular	38.61	Regular
Jun-20	31.39	Regular	34.30	Regular
Sep-20	30.97	Bad	33.33	Regular
Dec-20	29.03	Bad	29.44	Bad
Mar-21	29.72	Bad	31.11	Regular
Jun-21	31.67	Regular	33.47	Regular
Sep-21	31.67	Regular	33.88	Regular
Dec-21	33.89	Regular	34.58	Regular

Table 57 Motnath lake Modified Index Result Table

(a) Motnath lake Modified Index Result Table for NSF Index

Motnath Lake NSF Index				
	Modified Index Value		Original Index Value	
Month	Value	Interpretation	Value	Interpretation
Sep-18	32.64	Bad to Very Bad	52.55	Medium to Good
Dec-18				
Mar-19	40.74	Bad	59.84	Medium to Good
Jun-19	43.05	Bad	63.13	Good to Excellent
Sep-19	59.87	Medium to Good	77.97	Good to Excellent
Dec-19	63.54	Good to Excellent	81.26	Good to Excellent
Mar-20	51.96	Medium to Good	66.47	Good to Excellent
Jun-20	53.57	Medium to Good	63.89	Good to Excellent
Sep-20	54.90	Medium to Good	64.17	Good to Excellent
Dec-20	55.19	Medium to Good	64.32	Good to Excellent
Mar-21	59.19	Medium to Good	75.47	Good to Excellent
Jun-21	46.55	Bad	61.52	Medium to Good
Sep-21	64.04	Good to Excellent	80.90	Good to Excellent
Dec-21	51.84	Medium to Good	68.26	Good to Excellent

(b) Motnath lake Modified Index Result Table for Overall Water Quality Index

Motnath Lake Overall Water Quality Index				
	Modified Index Value		Original Index Value	
Month	Value	Interpretation	Value	Interpretation
Sep-18	54.64	Fair	73.11	Fair
Dec-18				
Mar-19	64.62	Fair	75.58	Good
Jun-19	68.22	Fair	77.16	Good
Sep-19	79.77	Good	85.49	Good
Dec-19	78.34	Good	83.30	Good
Mar-20	70.22	Fair	74.15	Good
Jun-20	59.98	Fair	68.74	Fair
Sep-20	60.19	Fair	70.93	Fair
Dec-20	57.16	Fair	69.24	Fair
Mar-21	58.69	Fair	69.14	Fair
Jun-21	53.34	Fair	65.52	Fair
Sep-21	60.76	Fair	72.46	Fair
Dec-21	60.29	Fair	70.63	Fair

(c) Motnath lake Modified Index Result Table for DOE Index

Motnath Lake DOE Index				
	Modified Index Value		Original Index Value	
Month	Value	Interpretation	Value	Interpretation
Sep-18	77.60	Class II	74.50	Class III
Dec-18				
Mar-19	81.59	Class II	75.00	Class III
Jun-19	83.98	Class II	79.58	Class II
Sep-19	86.93	Class II	81.38	Class II
Dec-19	86.66	Class II	81.63	Class II
Mar-20	77.01	Class II	74.77	Class III
Jun-20	78.10	Class II	75.80	Class III
Sep-20	74.91	Class III	69.42	Class III
Dec-20	73.01	Class III	70.87	Class III
Mar-21	76.91	Class II	72.40	Class III
Jun-21	68.64	Class III	70.01	Class III
Sep-21	80.95	Class II	75.16	Class III
Dec-21	75.32	Class III	74.87	Class III

(d) Motnath lake Modified Index Result Table for Universal Index

Motnath Lake Universal Index				
	Modified Index Value		Original Index Value	
Month	Value	Interpretation	Value	Interpretation
Sep-18	64.66	Fair	68.79	Fair
Dec-18	78.26	Good	73.68	Fair
Mar-19	80.26	Good	86.63	Good
Jun-19	81.15	Good	86.36	Good
Sep-19	90.42	Good	93.70	Good
Dec-19	91.65	Good	92.04	Good
Mar-20	71.97	Fair	72.25	Fair
Jun-20	63.79	Fair	65.29	Fair
Sep-20	70.43	Fair	74.74	Good
Dec-20	67.66	Fair	67.95	Fair
Mar-21	63.43	Fair	66.26	Fair
Jun-21	61.61	Fair	64.05	Fair
Sep-21	74.35	Good	79.47	Good
Dec-21	68.35	Fair	72.21	Fair

(e) Motnath lake Modified Index Result Table for Dhamija and Jain

Motnath Lake Dhamija and Jain				
	Modified Index Value		Original Index Value	
Month	Value	Interpretation	Value	Interpretation
Sep-18	65.3	Medium	64.40	Medium
Dec-18	60	Medium	68.00	Medium
Mar-19	70.6	Medium	64.80	Medium
Jun-19	76.6	Good	69.60	Medium
Sep-19	91.6	Excellent	89.60	Good
Dec-19	86.4	Good	84.80	Good
Mar-20	73	Medium	76.00	Good
Jun-20	82.6	Good	82.40	Good
Sep-20	81.3	Good	83.20	Good
Dec-20	70.4	Good	72.00	Medium
Mar-21	83.8	Good	84.00	Good
Jun-21	76.6	Good	77.60	Good
Sep-21	82.2	Good	79.20	Good
Dec-21	75.2	Good	75.20	Good

(f) Motnath lake Modified Index Result Table for NSF INDEX 9 parameters

Motnath Lake NSF INDEX 9 parameters				
	Modified Index Value		Original Index Value	
Month	Value	Interpretation	Value	Interpretation
Sep-18	49.82	Bad	61.09	Medium
Dec-18				
Mar-19	62.72	Medium	70.93	Good
Jun-19	62.44	Medium	69.75	Medium
Sep-19	71.54	Good	73.10	Good
Dec-19	76.17	Good	78.00	Good
Mar-20	63.62	Medium	66.56	Medium
Jun-20	64.87	Medium	71.28	Good
Sep-20	58.1	Medium	62.50	Medium
Dec-20	62.67	Medium	64.16	Medium
Mar-21	61.68	Medium	69.95	Medium
Jun-21	48.11	Bad	55.99	Medium
Sep-21	58.33	Medium	64.80	Medium
Dec-21	56.03	Medium	62.12	Medium

(g) Motnath lake Modified Index Result Table for Bascaron Index

Motnath Lake Bascaron Index				
	Modified Index Value		Original Index Value	
Month	Value	Interpretation	Value	Interpretation
Sep-18	31.25	Regular	31.18	Regular
Dec-18				
Mar-19	37.08	Regular	38.61	Regular
Jun-19	35.83	Regular	38.88	Regular
Sep-19	39.31	Regular	44.44	Regular
Dec-19	38.33	Regular	41.52	Regular
Mar-20	35.56	Regular	38.05	Regular
Jun-20	34.72	Regular	39.58	Regular
Sep-20	35.00	Regular	38.61	Regular
Dec-20	31.25	Regular	33.05	Regular
Mar-21	32.78	Regular	36.11	Regular
Jun-21	31.67	Regular	34.44	Regular
Sep-21	33.47	Regular	35.41	Regular
Dec-21	33.89	Regular	35.55	Regular

Table 58 Dhobi lake Modified Index Result Table

(a) Dhobi lake Modified Index Result Table for NSF Index

Dhobi Lake NSF Index				
	Modified Index Value		Original Index Value	
Month	Value	Interpretation	Value	Interpretation
Sep-18	25.55	Bad to Very Bad	46.45	Bad
Dec-18	38.68	Bad	59.19	Medium to Good
Mar-19	30.32	Bad to Very Bad	48.81	Bad
Jun-19	35.66	Bad to Very Bad	55.01	Medium to Good
Sep-19	56.87	Medium to Good	75.53	Good to Excellent
Dec-19	61.02	Medium to Good	80.39	Good to Excellent
Mar-20	39.46	Bad	56.31	Medium to Good
Jun-20	59.87	Medium to Good	73.57	Good to Excellent
Sep-20	60.48	Medium to Good	74.75	Good to Excellent
Dec-20	49.59	Medium to Good	62.76	Good to Excellent
Mar-21	61.41	Medium to Good	78.76	Good to Excellent
Jun-21	61.59	Medium to Good	78.13	Good to Excellent
Sep-21	61.29	Medium to Good	80.13	Good to Excellent
Dec-21	53.39	Medium to Good	71.24	Good to Excellent

(b) Dhobi lake Modified Index Result Table for Overall Water Quality Index

Dhobi Lake Overall Water Quality Index				
	Modified Index Value		Original Index Value	
Month	Value	Interpretation	Value	Interpretation
Sep-18	58.39	Fair	69.76	Fair
Dec-18	64.90	Fair	79.17	Good
Mar-19	64.12	Fair	74.92	Good
Jun-19	66.14	Fair	77.38	Good
Sep-19	69.15	Fair	84.93	Good
Dec-19	69.38	Fair	74.25	Good
Mar-20	61.80	Fair	71.13	Fair
Jun-20	56.70	Fair	73.49	Fair
Sep-20	63.62	Fair	71.19	Fair
Dec-20	42.59	Poor	58.25	Fair
Mar-21	58.71	Fair	65.85	Fair
Jun-21	51.83	Fair	60.05	Fair
Sep-21	55.39	Fair	65.07	Fair
Dec-21	62.44	Fair	68.36	Fair

(c) Dhobi lake Modified Index Result Table for DOE Index

Dhobi Lake DOE Index				
	Modified Index Value		Original Index Value	
Month	Value	Interpretation	Value	Interpretation
Sep-18	64.72	Class III	67.56	Class III
Dec-18	79.55	Class II	77.47	Class II
Mar-19	70.93	Class III	69.70	Class III
Jun-19	75.92	Class III	72.05	Class III
Sep-19	84.69	Class II	83.46	Class II
Dec-19	86.79	Class II	84.66	Class II
Mar-20	60.47	Class III	66.00	Class III
Jun-20	74.04	Class III	71.60	Class III
Sep-20	81.50	Class II	76.52	Class II
Dec-20	66.39	Class III	64.34	Class III
Mar-21	82.01	Class II	77.46	Class II
Jun-21	81.83	Class II	77.52	Class II
Sep-21	79.07	Class II	72.80	Class III
Dec-21	76.07	Class III	75.34	Class III

(d) Dhobi lake Modified Index Result Table for Universal Index

Dhobi Lake Universal Index				
	Modified Index Value		Original Index Value	
Month	Value	Interpretation	Value	Interpretation
Sep-18	68.56	Fair	69.90	Fair
Dec-18	74.09	Good	77.42	Good
Mar-19	74.70	Good	75.59	Good
Jun-19	74.30	Good	75.88	Good
Sep-19	79.68	Good	80.81	Good
Dec-19	80.67	Good	81.87	Good
Mar-20	73.45	Fair	73.40	Fair
Jun-20	69.62	Fair	70.31	Fair
Sep-20	70.63	Fair	73.67	Fair
Dec-20	59.74	Fair	61.79	Fair
Mar-21	74.53	Good	76.56	Good
Jun-21	69.22	Fair	73.26	Fair
Sep-21	70.26	Fair	74.53	Good
Dec-21	71.76	Fair	74.17	Good

(e) Dhobi lake Modified Index Result Table for Dhamija and Jain Index

Dhobi Lake Dhamija and Jain				
	Modified Index Value		Original Index Value	
Month	Value	Interpretation	Value	Interpretation
Sep-18	37.40	Bad	40.00	Bad
Dec-18	58.00	Medium	56.00	Medium
Mar-19	41.20	Bad	36.80	Bad
Jun-19	47.20	Bad	41.60	Bad
Sep-19	90.40	Medium	88.00	Bad
Dec-19	80.10	Bad	73.60	Medium
Mar-20	57.80	Medium	56.80	Medium
Jun-20	80.70	Bad	80.80	Good
Sep-20	87.60	Bad	88.80	Good
Dec-20	69.60	Medium	65.60	Medium
Mar-21	70.10	Medium	73.60	Medium
Jun-21	81.80	Bad	79.20	Good
Sep-21	69.70	Medium	67.60	Medium
Dec-21	67.40	Medium	68.00	Medium

(f) Dhobi lake Modified Index Result Table for NSF INDEX 9 parameters

Dhobi Lake NSF INDEX 9 parameters				
	Modified Index Value		Original Index Value	
Month	Value	Interpretation	Value	Interpretation
Sep-18	54.19	Medium	64.32	Medium
Dec-18	64.87	Medium	72.57	Good
Mar-19	63.40	Medium	70.01	Good
Jun-19	59.95	Medium	57.63	Medium
Sep-19	67.19	Medium	69.50	Medium
Dec-19	70.51	Good	74.07	Good
Mar-20	51.78	Medium	56.53	Medium
Jun-20	67.84	Medium	67.36	Medium
Sep-20	63.12	Medium	66.85	Medium
Dec-20	48.33	Bad	55.25	Medium
Mar-21	67.62	Medium	69.04	Medium
Jun-21	60.99	Medium	66.72	Medium
Sep-21	57.31	Medium	65.86	Medium
Dec-21	57.69	Medium	63.73	Medium

(g) Dhobi Lake Modified Index Result Table for Bascaron Index

Dhobi Lake Bascaron Index				
	Modified Index Value		Original Index Value	
Month	Value	Interpretation	Value	Interpretation
Sep-18	29.58	Bad	26.31	Bad
Dec-18	33.06	Regular	30.26	Bad
Mar-19	29.58	Bad	25.52	Bad
Jun-19	29.86	Bad	25.39	Bad
Sep-19	33.06	Regular	35.69	Regular
Dec-19	33.82	Regular	37.19	Regular
Mar-20	29.10	Bad	28.75	Bad
Jun-20	30.28	Bad	32.08	Regular
Sep-20	33.26	Regular	35.19	Regular
Dec-20	28.54	Bad	26.38	Bad
Mar-21	31.32	Regular	33.54	Regular
Jun-21	31.53	Regular	33.61	Regular
Sep-21	30.83	Bad	31.52	Regular
Dec-21	33.19	Regular	33.02	Regular

Table 59 Bapod lake Modified Index Result Table

(a) Bapod lake Modified Index Result Table for NSF Index

Bapod Lake NSF Index				
	Modified Index Value		Original Index Value	
Month	Value	Interpretation	Value	Interpretation
Sep-18	44.51	Bad	65.40	Good to Excellent
Dec-18	42.13	Bad	61.70	Medium to Good
Mar-19	35.69	Bad to Very Bad	50.64	Medium to Good
Jun-19	37.48	Bad	52.60	Medium to Good
Sep-19	65.89	Good to Excellent	87.68	Good to Excellent
Dec-19	54.88	Medium to Good	74.13	Good to Excellent
Mar-20	59.83	Medium to Good	78.64	Good to Excellent
Jun-20	29.10	Bad to Very Bad	44.45	Bad
Sep-20	63.18	Good to Excellent	82.54	Good to Excellent
Dec-20	65.81	Good to Excellent	87.23	Good to Excellent
Mar-21	56.82	Medium to Good	70.01	Good to Excellent
Jun-21	62.15	Good to Excellent	78.09	Good to Excellent
Sep-21	63.98	Good to Excellent	82.57	Good to Excellent
Dec-21	59.53	Medium to Good	79.03	Good to Excellent

(b) Bapod lake Modified Index Result Table for Overall Water Quality Index

Bapod Lake Overall Water Quality Index				
	Modified Index Value		Original Index Value	
Month	Value	Interpretation	Value	Interpretation
Sep-18	73.27	Fair	88.60	Good
Dec-18	61.13	Fair	70.34	Fair
Mar-19	55.33	Fair	63.73	Fair
Jun-19	67.17	Fair	77.73	Good
Sep-19	78.40	Good	90.48	Good
Dec-19	72.05	Fair	74.54	Good
Mar-20	55.40	Fair	64.71	Fair
Jun-20	51.27	Fair	68.15	Fair
Sep-20	74.13	Good	86.06	Good
Dec-20	64.40	Fair	67.61	Fair
Mar-21	64.55	Fair	79.20	Good
Jun-21	50.87	Fair	60.89	Fair
Sep-21	61.73	Fair	80.56	Good
Dec-21	62.17	Fair	78.10	Good

(c) Bapod lake Modified Index Result Table for DOE Index

Bapod Lake DOE Index				
	Modified Index Value		Original Index Value	
Month	Value	Interpretation	Value	Interpretation
Sep-18	84.76	Class II	79.01	Class II
Dec-18	78.12	Class II	71.35	Class III
Mar-19	67.82	Class III	59.65	Class III
Jun-19	78.05	Class II	71.52	Class III
Sep-19	88.32	Class II	83.77	Class II
Dec-19	79.26	Class II	76.75	Class II
Mar-20	79.97	Class II	76.15	Class III
Jun-20	68.61	Class III	65.41	Class III
Sep-20	85.39	Class II	81.79	Class II
Dec-20	89.01	Class II	85.79	Class II
Mar-21	73.17	Class III	65.31	Class III
Jun-21	82.98	Class II	78.70	Class II
Sep-21	83.28	Class II	74.53	Class III
Dec-21	79.19	Class II	73.94	Class III

(d) Bapod lake Modified Index Result Table for Universal Index

Bapod Lake Universal Index				
	Modified Index Value		Original Index Value	
Month	Value	Interpretation	Value	Interpretation
Sep-18	78.58	Good	81.27	Good
Dec-18	70.90	Fair	74.10	Good
Mar-19	85.09	Good	85.71	Good
Jun-19	76.66	Good	79.42	Good
Sep-19	85.84	Good	87.10	Good
Dec-19	77.69	Good	78.55	Good
Mar-20	71.57	Fair	76.11	Good
Jun-20	59.74	Fair	61.79	Fair
Sep-20	77.16	Good	80.03	Good
Dec-20	80.76	Good	83.62	Good
Mar-21	71.77	Fair	71.28	Fair
Jun-21	68.48	Fair	72.37	Fair
Sep-21	73.65	Fair	78.63	Good
Dec-21	70.78	Fair	75.16	Good

(e) Bapod lake Modified Index Result Table for Dhamija and Jain

Bapod Lake Dhamija and Jain				
	Modified Index Value		Original Index Value	
Month	Value	Interpretation	Value	Interpretation
Sep-18	65.30	Medium	64.40	Medium
Dec-18	62.30	Medium	60.40	Medium
Mar-19	55.80	Medium	50.40	Medium
Jun-19	79.20	Good	73.60	Medium
Sep-19	70.60	Medium	64.80	Medium
Dec-19	68.00	Medium	68.80	Medium
Mar-20	85.90	Good	81.20	Medium
Jun-20	69.20	Medium	70.40	Medium
Sep-20	73.20	Medium	75.20	Good
Dec-20	55.80	Medium	50.40	Medium
Mar-21	66.10	Medium	64.40	Medium
Jun-21	67.40	Medium	68.00	Medium
Sep-21	83.10	Good	79.60	Medium
Dec-21	64.00	Medium	65.60	Medium

(f) Bapod lake Modified Index Result Table for NSF INDEX 9 parameters

Bapod Lake NSF INDEX 9 parameters				
	Modified Index Value		Original Index Value	
Month	Value	Interpretation	Value	Interpretation
Sep-18	67.69	Medium	73.38	Good
Dec-18	64.90	Medium	71.47	Good
Mar-19	66.65	Medium	68.56	Medium
Jun-19	66.40	Medium	71.59	Good
Sep-19	74.06	Good	78.81	Good
Dec-19	65.85	Medium	68.80	Medium
Mar-20	57.31	Medium	62.85	Medium
Jun-20	51.00	Medium	57.15	Medium
Sep-20	68.35	Medium	74.16	Good
Dec-20	72.58	Good	76.90	Good
Mar-21	66.45	Medium	65.74	Medium
Jun-21	59.00	Medium	64.60	Medium
Sep-21	59.65	Medium	67.22	Medium
Dec-21	56.70	Medium	63.21	Medium

(g) Bapod lake Modified Index Result Table for Bascaron Index

Bapod Lake Bascaron Index				
	Modified Index Value		Original Index Value	
Month	Value	Interpretation	Value	Interpretation
Sep-18	33.33	Regular	34.47	Regular
Dec-18	33.06	Regular	31.18	Regular
Mar-19	29.86	Bad	29.47	Bad
Jun-19	33.61	Regular	35.52	Regular
Sep-19	34.72	Regular	37.91	Regular
Dec-19	34.44	Regular	35.97	Regular
Mar-20	32.36	Regular	31.18	Regular
Jun-20	30.00	Bad	32.08	Regular
Sep-20	33.61	Regular	34.07	Regular
Dec-20	35.42	Regular	35.39	Regular
Mar-21	30.14	Bad	32.08	Regular
Jun-21	33.19	Regular	35.83	Regular
Sep-21	35.28	Regular	38.88	Regular
Dec-21	32.50	Regular	30.13	Bad

Table 60 Danteshwar lake Modified Index Result Table

(a) Danteshwar lake Modified Index Result Table for NSF Index

Danteshwar Lake NSF Index				
	Modified Index Value		Original Index Value	
Month	Value	Interpretation	Value	Interpretation
Sep-18	36.38	Bad to Very Bad	56.73	Medium to Good
Dec-18	33.47	Bad to Very Bad	53.26	Medium to Good
Mar-19	23.15	Bad to Very Bad	37.71	Bad
Jun-19	23.76	Bad to Very Bad	36.33	Bad to Very Bad
Sep-19	49.61	Medium to Good	67.96	Good to Excellent
Dec-19	62.75	Good to Excellent	82.90	Good to Excellent
Mar-20				
Jun-20				
Sep-20	46.93	Bad	58.88	Medium to Good
Dec-20	42.31	Bad	54.06	Medium to Good
Mar-21	41.92	Bad	56.36	Medium to Good
Jun-21	47.32	Bad	60.09	Medium to Good
Sep-21	69.52	Good to Excellent	86.75	Good to Excellent
Dec-21	64.34	Good to Excellent	84.70	Good to Excellent

(b) Danteshwar lake Modified Index Result Table for Overall Water Quality Index

Danteshwar Lake Overall Water Quality Index				
	Modified Index Value		Original Index Value	
Month	Value	Interpretation	Value	Interpretation
Sep-18	68.02	Fair	76.02	Good
Dec-18	67.88	Fair	84.16	Good
Mar-19	63.34	Fair	71.18	Fair
Jun-19	61.70	Fair	69.91	Fair
Sep-19	72.03	Fair	76.28	Good
Dec-19	74.65	Good	88.21	Good
Mar-20				
Jun-20				
Sep-20	62.69	Fair	70.78	Fair
Dec-20	57.66	Fair	67.47	Fair
Mar-21	56.51	Fair	64.60	Fair
Jun-21	64.59	Fair	79.74	Good
Sep-21	77.22	Good	90.38	Good
Dec-21	78.52	Good	90.87	Good

(c) Danteshwar lake Modified Index Result Table for DOE Index

Danteshwar Lake DOE Index				
	Modified Index Value		Original Index Value	
Month	Value	Interpretation	Value	Interpretation
Sep-18	80.38	Class II	76.30	Class III
Dec-18	76.30	Class III	72.78	Class III
Mar-19	61.74	Class III	58.41	Class III
Jun-19	62.16	Class III	59.64	Class III
Sep-19	76.79	Class II	72.16	Class III
Dec-19	84.79	Class II	74.73	Class III
Mar-20				
Jun-20				
Sep-20	70.20	Class III	67.40	Class III
Dec-20	55.56	Class III	56.18	Class III
Mar-21	56.29	Class III	58.15	Class III
Jun-21	65.33	Class III	62.05	Class III
Sep-21	83.04	Class II	78.49	Class II
Dec-21	87.47	Class II	82.89	Class II

(d) Danteshwar lake Modified Index Result Table for Universal Index

Danteshwar Lake Universal Index				
	Modified Index Value		Original Index Value	
Month	Value	Interpretation	Value	Interpretation
Sep-18	73.43	Fair	76.28	Good
Dec-18	71.09	Fair	74.04	Good
Mar-19	66.85	Fair	66.78	Fair
Jun-19	67.49	Fair	65.53	Fair
Sep-19	81.12	Good	79.79	Good
Dec-19	82.88	Good	85.32	Good
Mar-20				
Jun-20				
Sep-20	63.89	Fair	64.93	Fair
Dec-20	57.65	Fair	59.26	Fair
Mar-21	58.91	Fair	60.79	Fair
Jun-21	61.80	Fair	62.21	Fair
Sep-21	82.52	Good	84.68	Good
Dec-21	83.95	Good	84.71	Good

(e) Danteshwar lake Modified Index Result Table for Dhamija and Jain

Danteshwar Lake Dhamija and Jain				
	Modified Index Value		Original Index Value	
Month	Value	Interpretation	Value	Interpretation
Sep-18	82.40	Good	81.60	Good
Dec-18	76.40	Good	76.80	Good
Mar-19	69.00	Medium	72.80	Medium
Jun-19	79.20	Good	78.40	Good
Sep-19	76.40	Good	76.80	Good
Dec-19	73.00	Medium	68.00	Medium
Mar-20				
Jun-20				
Sep-20	83.00	Good	85.60	Good
Dec-20	73.10	Medium	71.60	Medium
Mar-21	64.10	Medium	68.80	Medium
Jun-21	80.10	Good	81.60	Good
Sep-21	83.10	Good	79.60	Good
Dec-21	90.10	Excellent	89.60	Good

(f) Danteshwar lake Modified Index Result Table for NSF INDEX 9 parameters.

Danteshwar Lake NSF INDEX 9 parameters				
	Modified Index Value		Original Index Value	
Month	Value	Interpretation	Value	Interpretation
Sep-18	63.69	Medium	72.60	Good
Dec-18	61.16	Medium	69.88	Medium
Mar-19	57.91	Medium	63.90	Medium
Jun-19	61.43	Medium	64.75	Medium
Sep-19	69.62	Medium	76.17	Good
Dec-19	68.92	Medium	69.25	Medium
Mar-20				
Jun-20				
Sep-20	53.43	Medium	56.35	Medium
Dec-20	52.64	Medium	58.13	Medium
Mar-21	49.52	Bad	57.84	Medium
Jun-21	52.47	Medium	56.92	Medium
Sep-21	75.65	Good	77.92	Good
Dec-21	78.89	Good	77.34	Good

(g) Danteshwar lake Modified Index Result Table for Bascaron Index

Danteshwar Lake Bascaron Index				
	Modified Index Value		Original Index Value	
Month	Value	Interpretation	Value	Interpretation
Sep-18	32.78	Regular	33.68	Regular
Dec-18	35.14	Regular	34.73	Regular
Mar-19	31.94	Regular	32.50	Regular
Jun-19	32.08	Regular	33.62	Regular
Sep-19	34.86	Regular	39.02	Regular
Dec-19	33.47	Regular	36.80	Regular
Mar-20				
Jun-20				
Sep-20	32.08	Regular	33.28	Regular
Dec-20	30.97	Bad	32.10	Regular
Mar-21	32.08	Regular	34.86	Regular
Jun-21	32.08	Regular	35.13	Regular
Sep-21	35.42	Regular	37.22	Regular
Dec-21	39.44	Regular	40.39	Regular

Table 61 Gorwa lake Modified Index Result Table

(a) Gorwa lake Modified Index Result Table for NSF Index

Gorwa Lake NSF Index				
	Modified Index Value		Original Index Value	
Month	Value	Interpretation	Value	Interpretation
Sep-18	27.81	Bad to Very Bad	46.35	Bad
Dec-18	25.20	Bad to Very Bad	39.18	Bad
Mar-19	26.22	Bad to Very Bad	37.64	Bad
Jun-19	30.75	Bad to Very Bad	40.35	Bad
Sep-19	42.75	Bad	52.33	Medium to Good
Dec-19	48.37	Bad	60.79	Medium to Good
Mar-20				
Jun-20				
Sep-20	48.97	Bad	61.05	Medium to Good
Dec-20	58.42	Medium to Good	76.49	Good to Excellent
Mar-21	63.27	Good to Excellent	81.82	Good to Excellent
Jun-21	61.29	Medium to Good	76.90	Good to Excellent
Sep-21	51.08	Medium to Good	68.11	Good to Excellent
Dec-21	46.89	Bad	61.17	Medium to Good

(b) Gorwa lake Modified Index Result Table for Overall Water Quality Index

Gorwa Lake Overall Water Quality Index				
	Modified Index Value		Original Index Value	
Month	Value	Interpretation	Value	Interpretation
Sep-18	81.46	Good	85.27	Good
Dec-18	73.84	Fair	66.18	Fair
Mar-19	67.61	Fair	73.53	Fair
Jun-19	59.03	Fair	65.70	Fair
Sep-19	66.15	Fair	70.89	Fair
Dec-19	66.99	Fair	69.81	Fair
Mar-20				
Jun-20				
Sep-20	77.48	Good	69.25	Fair
Dec-20	83.99	Good	77.94	Good
Mar-21	84.21	Good	78.76	Good
Jun-21	82.65	Good	77.27	Good
Sep-21	83.57	Good	77.67	Good
Dec-21	77.90	Good	71.73	Fair

(c) Gorwa lake Modified Index Result Table for DOE Index

Gorwa Lake DOE Index				
	Modified Index Value		Original Index Value	
Month	Value	Interpretation	Value	Interpretation
Sep-18	70.40	Class III	68.44	Class III
Dec-18	60.99	Class III	59.93	Class III
Mar-19	66.91	Class III	61.89	Class III
Jun-19	64.89	Class III	56.52	Class III
Sep-19	64.66	Class III	61.62	Class III
Dec-19	70.60	Class III	65.87	Class III
Mar-20				
Jun-20				
Sep-20	65.76	Class III	64.52	Class III
Dec-20	85.46	Class II	81.18	Class II
Mar-21	84.18	Class II	72.43	Class III
Jun-21	86.14	Class II	82.75	Class II
Sep-21	74.44	Class III	73.64	Class III
Dec-21	68.73	Class III	67.65	Class III

(d) Gorwa lake Modified Index Result Table for Universal Index

Gorwa Lake Universal Index				
	Modified Index Value		Original Index Value	
Month	Value	Interpretation	Value	Interpretation
Sep-18	77.98	Good	76.69	Good
Dec-18	73.95	Fair	69.44	Fair
Mar-19	60.26	Fair	62.42	Fair
Jun-19	56.12	Fair	58.45	Fair
Sep-19	56.50	Fair	58.11	Fair
Dec-19	61.87	Fair	64.37	Fair
Mar-20				
Jun-20				
Sep-20	62.90	Fair	63.55	Fair
Dec-20	74.07	Good	77.94	Good
Mar-21	77.83	Good	80.85	Good
Jun-21	74.18	Good	77.00	Good
Sep-21	74.39	Good	75.13	Good
Dec-21	65.83	Fair	65.54	Fair

(e) Gorwa lake Modified Index Result Table for Dhamija and Jain Index

Gorwa Lake Dhamija and Jain				
	Modified Index Value		Original Index Value	
Month	Value	Interpretation	Value	Interpretation
Sep-18	75.40	Good	76.00	Good
Dec-18	56.40	Medium	59.20	Medium
Mar-19	75.20	Good	75.20	Good
Jun-19	68.00	Medium	68.80	Medium
Sep-19	65.20	Medium	67.20	Medium
Dec-19	64.00	Medium	65.60	Medium
Mar-20				
Jun-20				
Sep-20	82.50	Good	84.80	Good
Dec-20	86.40	Good	84.80	Good
Mar-21	87.80	Good	87.20	Good
Jun-21	89.90	Good	88.80	Good
Sep-21	74.30	Medium	73.20	Medium
Dec-21	80.40	Good	80.00	Good

(f) Gorwa lake Modified Index Result Table for NSF INDEX 9 parameters.

Gorwa Lake NSF INDEX 9 parameters				
	Modified Index Value		Original Index Value	
Month	Value	Interpretation	Value	Interpretation
Sep-18	61.83	Medium	68.24	Medium
Dec-18	62.25	Medium	65.03	Medium
Mar-19	51.86	Medium	58.52	Medium
Jun-19	54.17	Medium	59.46	Medium
Sep-19	47.09	Bad	51.29	Medium
Dec-19	48.70	Bad	52.25	Medium
Mar-20				
Jun-20				
Sep-20	60.79	Medium	64.80	Medium
Dec-20	66.75	Medium	73.65	Good
Mar-21	70.30	Good	75.10	Good
Jun-21	64.43	Medium	67.96	Medium
Sep-21	64.18	Medium	68.57	Medium
Dec-21	59.03	Medium	62.30	Medium

(g) Gorwa lake Modified Index Result Table for Bascaron Index

Gorwa Lake Bascaron Index				
	Modified Index Value		Original Index Value	
Month	Value	Interpretation	Value	Interpretation
Sep-18	35.83	Regular	35.73	Regular
Dec-18	31.11	Regular	31.05	Regular
Mar-19	31.81	Regular	30.92	Bad
Jun-19	28.61	Bad	28.15	Bad
Sep-19	31.39	Regular	33.75	Regular
Dec-19	31.81	Regular	33.33	Regular
Mar-20				
Jun-20				
Sep-20	30.97	Bad	31.05	Regular
Dec-20	36.25	Regular	37.32	Regular
Mar-21	37.92	Regular	41.88	Regular
Jun-21	35.42	Regular	38.75	Regular
Sep-21	35.83	Regular	39.58	Regular
Dec-21	34.03	Regular	35.39	Regular

Table 62 Gotri lake Modified Index Result Table

(a) Gotri lake Modified Index Result Table for NSF Index

Gotri Lake NSF Index				
	Modified Index Value		Original Index Value	
Month	Value	Interpretation	Value	Interpretation
Sep-18	22.23	Bad to Very Bad	40.68	Bad
Dec-18	32.17	Bad to Very Bad	51.62	Medium to Good
Mar-19	39.55	Bad	56.10	Medium to Good
Jun-19	41.46	Bad	59.47	Medium to Good
Sep-19	59.69	Medium to Good	76.90	Good to Excellent
Dec-19	64.05	Good to Excellent	81.58	Good to Excellent
Mar-20	53.58	Medium to Good	70.17	Good to Excellent
Jun-20	54.06	Medium to Good	66.13	Good to Excellent
Sep-20	48.25	Bad	68.35	Good to Excellent
Dec-20	47.92	Bad	66.49	Good to Excellent
Mar-21	62.81	Good to Excellent	76.40	Good to Excellent
Jun-21	61.07	Medium to Good	76.10	Good to Excellent
Sep-21	48.06	Bad	65.23	Good to Excellent
Dec-21	54.99	Medium to Good	71.87	Good to Excellent

(b) Gotri lake Modified Index Result Table for Overall Water Quality Index

Gotri Lake Overall Water Quality Index				
	Modified Index Value		Original Index Value	
Month	Value	Interpretation	Value	Interpretation
Sep-18	65.36	Fair	71.48	Fair
Dec-18	61.27	Fair	76.63	Good
Mar-19	59.27	Fair	77.34	Good
Jun-19	52.76	Fair	67.18	Fair
Sep-19	44.74	Poor	61.45	Fair
Dec-19	66.55	Fair	76.01	Good
Mar-20	68.70	Fair	75.86	Good
Jun-20	36.50	Poor	57.09	Fair
Sep-20	58.50	Fair	66.81	Fair
Dec-20	47.31	Poor	59.45	Fair
Mar-21	45.17	Poor	61.87	Fair
Jun-21	40.58	Poor	57.69	Fair
Sep-21	49.68	Fair	68.85	Fair
Dec-21	52.87	Fair	65.70	Fair

(c) Gotri lake Modified Index Result Table for DOE Index

Gotri Lake DOE Index				
	Modified Index Value		Original Index Value	
Month	Value	Interpretation	Value	Interpretation
Sep-18	62.28	Class III	63.16	Class III
Dec-18	73.25	Class III	70.84	Class III
Mar-19	80.68	Class II	72.88	Class III
Jun-19	81.94	Class II	73.55	Class III
Sep-19	84.50	Class II	75.68	Class III
Dec-19	84.46	Class II	78.12	Class II
Mar-20	78.83	Class II	72.42	Class III
Jun-20	80.63	Class II	76.87	Class II
Sep-20	67.12	Class III	67.90	Class III
Dec-20	67.35	Class III	67.51	Class III
Mar-21	74.10	Class III	66.71	Class III
Jun-21	77.81	Class II	70.93	Class III
Sep-21	65.64	Class III	63.56	Class III
Dec-21	77.88	Class II	74.71	Class III

(d) Gotri lake Modified Index Result Table for Universal Index

Gotri Lake Universal Index				
	Modified Index Value		Original Index Value	
Month	Value	Interpretation	Value	Interpretation
Sep-18	68.37	Fair	70.33	Fair
Dec-18	68.05	Fair	71.85	Fair
Mar-19	76.75	Good	82.38	Good
Jun-19	76.95	Good	82.62	Good
Sep-19	73.88	Fair	78.91	Good
Dec-19	80.10	Good	81.05	Good
Mar-20	77.88	Good	79.72	Good
Jun-20	63.13	Fair	65.89	Fair
Sep-20	65.22	Fair	68.42	Fair
Dec-20	65.22	Fair	68.42	Fair
Mar-21	67.83	Fair	71.58	Fair
Jun-21	72.50	Fair	77.24	Good
Sep-21	63.41	Fair	66.78	Fair
Dec-21	69.91	Fair	74.11	Good

(e) Gotri lake Modified Index Result Table for Dhamija and Jain Index

Gotri Lake Dhamija and Jain				
	Modified Index Value		Original Index Value	
Month	Value	Interpretation	Value	Interpretation
Sep-18	60.40	Medium	64.00	Medium
Dec-18	56.40	Medium	59.20	Medium
Mar-19	67.50	Medium	69.60	Medium
Jun-19	69.20	Medium	70.40	Medium
Sep-19	80.40	Good	80.00	Good
Dec-19	86.40	Good	84.80	Good
Mar-20	75.90	Medium	73.20	Medium
Jun-20	80.40	Good	80.00	Good
Sep-20	65.30	Medium	70.40	Medium
Dec-20	56.60	Medium	53.60	Medium
Mar-21	69.40	Medium	71.20	Medium
Jun-21	78.00	Good	76.80	Good
Sep-21	61.90	Medium	62.00	Medium
Dec-21	81.90	Good	78.00	Good

(f) Gotri lake Modified Index Result Table for NSF INDEX 9 parameters.

GotriLake NSF INDEX 9 parameters				
	Modified Index Value		Original Index Value	
Month	Value	Interpretation	Value	Interpretation
Sep-18	53.19	Medium	64.06	Medium
Dec-18	55.98	Medium	65.06	Medium
Mar-19	56.44	Medium	65.27	Medium
Jun-19	58.18	Medium	67.68	Medium
Sep-19	53.60	Medium	60.41	Medium
Dec-19	65.03	Medium	69.20	Medium
Mar-20	63.91	Medium	65.72	Medium
Jun-20	53.12	Medium	60.02	Medium
Sep-20	49.69	Bad	61.68	Medium
Dec-20	47.19	Bad	57.96	Medium
Mar-21	57.13	Medium	63.27	Medium
Jun-21	54.68	Medium	61.55	Medium
Sep-21	43.78	Bad	53.90	Medium
Dec-21	53.54	Medium	60.02	Medium

(g) Gotri lake Modified Index Result Table for Bascaron Index

Gotri Lake Bascaron Index				
	Modified Index Value		Original Index Value	
Month	Value	Interpretation	Value	Interpretation
Sep-18	32.50	Regular	33.22	Regular
Dec-18	32.50	Regular	32.50	Regular
Mar-19	32.57	Regular	33.95	Regular
Jun-19	32.50	Regular	32.12	Regular
Sep-19	31.81	Regular	32.01	Regular
Dec-19	34.10	Regular	36.25	Regular
Mar-20	34.17	Regular	36.38	Regular
Jun-20	32.36	Regular	36.25	Regular
Sep-20	32.71	Regular	33.88	Regular
Dec-20	31.67	Regular	32.91	Regular
Mar-21	30.00	Bad	30.69	Bad
Jun-21	30.69	Bad	32.01	Regular
Sep-21	30.28	Bad	32.63	Regular
Dec-21	33.26	Regular	35.34	Regular

Table 63 Harni Lake Modified Index Result Table

(a) Harni Lake Modified Index Result Table for NSF Index

Harni Lake NSF Index				
	Modified Index Value		Original Index Value	
Month	Value	Interpretation	Value	Interpretation
Sep-18	25.33	Bad to Very Bad	45.48	Bad
Dec-18	33.14	Bad to Very Bad	53.53	Medium to Good
Mar-19	34.25	Bad to Very Bad	52.11	Medium to Good
Jun-19	27.23	Bad to Very Bad	45.56	Bad
Sep-19	55.55	Medium to Good	74.05	Good to Excellent
Dec-19	59.51	Medium to Good	75.99	Good to Excellent
Mar-20	60.67	Medium to Good	75.89	Good to Excellent
Jun-20	54.44	Medium to Good	67.49	Good to Excellent
Sep-20	57.46	Medium to Good	77.90	Good to Excellent
Dec-20	50.94	Medium to Good	70.94	Good to Excellent
Mar-21	41.43	Bad	54.88	Medium to Good
Jun-21	55.21	Medium to Good	74.53	Good to Excellent
Sep-21	66.51	Good to Excellent	83.64	Good to Excellent
Dec-21	46.27	Bad	60.54	Medium to Good

(b) Harni Lake Modified Index Result Table for Overall Water Quality Index

Harni Lake Overall Water Quality Index				
	Modified Index Value		Original Index Value	
Month	Value	Interpretation	Value	Interpretation
Sep-18	61.08	Fair	69.87	Fair
Dec-18	73.92	Fair	79.35	Good
Mar-19	64.92	Fair	72.80	Fair
Jun-19	63.09	Fair	78.79	Good
Sep-19	60.32	Fair	67.56	Fair
Dec-19	68.69	Fair	78.30	Good
Mar-20	62.63	Fair	71.29	Fair
Jun-20	52.29	Fair	72.46	Fair
Sep-20	75.33	Good	78.72	Good
Dec-20	73.04	Fair	76.82	Good
Mar-21	52.66	Fair	61.10	Fair
Jun-21	65.09	Fair	73.55	Fair
Sep-21	62.56	Fair	71.25	Fair
Dec-21	60.82	Fair	78.66	Good

(c) Harni Lake Modified Index Result Table for DOE Index

Harni Lake DOE Index				
	Modified Index Value		Original Index Value	
Month	Value	Interpretation	Value	Interpretation
Sep-18	60.60	Class III	61.19	Class III
Dec-18	72.67	Class III	70.22	Class III
Mar-19	74.23	Class III	72.00	Class III
Jun-19	61.98	Class III	62.10	Class III
Sep-19	67.21	Class III	65.26	Class III
Dec-19	75.32	Class III	69.09	Class III
Mar-20	84.85	Class II	78.71	Class II
Jun-20	75.59	Class III	73.61	Class III
Sep-20	83.32	Class II	81.56	Class II
Dec-20	70.39	Class III	70.96	Class III
Mar-21	53.58	Class III	50.05	Class IV
Jun-21	69.43	Class III	69.56	Class III
Sep-21	73.81	Class III	73.69	Class III
Dec-21	57.12	Class III	60.04	Class III

(d) Harni Lake Modified Index Result Table for Universal Index

Harni Lake Universal Index				
	Modified Index Value		Original Index Value	
Month	Value	Interpretation	Value	Interpretation
Sep-18	65.22	Fair	68.42	Fair
Dec-18	76.00	Good	76.70	Good
Mar-19	75.84	Good	77.86	Good
Jun-19	65.22	Fair	68.42	Fair
Sep-19	79.58	Good	80.21	Good
Dec-19	86.08	Good	87.02	Good
Mar-20	81.28	Good	81.94	Good
Jun-20	63.39	Fair	66.21	Fair
Sep-20	78.84	Good	80.03	Good
Dec-20	71.36	Fair	72.14	Fair
Mar-21	58.91	Fair	60.79	Fair
Jun-21	69.22	Fair	73.26	Fair
Sep-21	73.65	Fair	78.63	Good
Dec-21	64.57	Fair	65.37	Fair

(e) Harni Lake Modified Index Result Table for Dhamija and Jain Index

Harni Lake Dhamija and Jain				
	Modified Index Value		Original Index Value	
Month	Value	Interpretation	Value	Interpretation
Sep-18	66.20	Medium	66.40	Medium
Dec-18	75.20	Good	75.20	Good
Mar-19	76.60	Good	74.40	Medium
Jun-19	52.50	Medium	53.20	Medium
Sep-19	75.20	Good	72.00	Medium
Dec-19	87.40	Good	84.00	Good
Mar-20	92.70	Excellent	90.40	Good
Jun-20	84.10	Good	84.80	Good
Sep-20	83.80	Good	84.00	Good
Dec-20	65.90	Medium	65.20	Medium
Mar-21	59.40	Medium	63.20	Medium
Jun-21	69.20	Medium	67.20	Good
Sep-21	77.10	Medium	71.60	Medium
Dec-21	69.20	Medium	67.20	Medium

(f) Harni Lake Modified Index Result Table for NSF INDEX 9 parameters

Harni Lake NSF INDEX 9 parameters				
	Modified Index Value		Original Index Value	
Month	Value	Interpretation	Value	Interpretation
Sep-18	49.36	Bad	61.72	Medium
Dec-18	69.28	Medium	75.98	Good
Mar-19	64.60	Medium	70.76	Good
Jun-19	51.47	Medium	61.61	Medium
Sep-19	64.97	Medium	66.75	Medium
Dec-19	68.92	Medium	69.48	Medium
Mar-20	67.49	Medium	67.80	Medium
Jun-20	55.79	Medium	59.87	Medium
Sep-20	70.29	Good	73.60	Good
Dec-20	60.93	Medium	67.43	Medium
Mar-21	47.44	Bad	55.74	Medium
Jun-21	57.91	Medium	65.34	Medium
Sep-21	62.20	Medium	69.82	Medium
Dec-21	51.35	Medium	55.88	Medium

(g) Harni Lake Modified Index Result Table for Bascaron Index

Harni Lake Bascaron Index				
	Modified Index Value		Original Index Value	
Month	Value	Interpretation	Value	Interpretation
Sep-18	32.78	Regular	33.55	Regular
Dec-18	35.90	Regular	38.95	Regular
Mar-19	34.03	Regular	34.44	Regular
Jun-19	30.97	Bad	33.47	Regular
Sep-19	33.47	Regular	35.69	Regular
Dec-19	35.83	Regular	37.77	Regular
Mar-20	33.75	Regular	33.68	Regular
Jun-20	33.06	Regular	37.61	Regular
Sep-20	35.97	Regular	39.44	Regular
Dec-20	34.72	Regular	37.91	Regular
Mar-21	29.58	Bad	33.33	Regular
Jun-21	33.19	Regular	35.97	Regular
Sep-21	35.28	Regular	37.91	Regular
Dec-21	31.39	Regular	31.11	Regular

Table 64 Kamala Lake Modified Index Result Table

(a) Kamala Lake Modified Index Result Table for NSF Index

Kamala Lake NSF Index				
	Modified Index Value		Original Index Value	
Month	Value	Interpretation	Value	Interpretation
Sep-18	42.41	Bad	63.98	Good to Excellent
Dec-18	43.68	Bad	65.65	Good to Excellent
Mar-19	41.15	Bad	60.17	Medium to Good
Jun-19	45.37	Bad	66.80	Good to Excellent
Sep-19	66.56	Good to Excellent	86.17	Good to Excellent
Dec-19	63.70	Good to Excellent	79.63	Good to Excellent
Mar-20	56.71	Medium to Good	68.94	Good to Excellent
Jun-20	52.23	Medium to Good	65.10	Good to Excellent
Sep-20	55.56	Medium to Good	71.68	Good to Excellent
Dec-20	63.72	Good to Excellent	84.59	Good to Excellent
Mar-21	66.98	Good to Excellent	86.69	Good to Excellent
Jun-21	66.72	Good to Excellent	82.81	Good to Excellent
Sep-21	63.10	Good to Excellent	78.27	Good to Excellent
Dec-21	68.18	Good to Excellent	85.57	Good to Excellent

(b) Kamala Lake Modified Index Result Table for Overall Water QualityIndex

Kamala Lake Overall Water Quality Index				
	Modified Index Value		Original Index Value	
Month	Value	Interpretation	Value	Interpretation
Sep-18	74.34	Good	79.33	Good
Dec-18	75.29	Good	79.97	Good
Mar-19	74.49	Good	78.41	Good
Jun-19	81.93	Good	85.49	Good
Sep-19	75.83	Good	80.72	Good
Dec-19	73.46	Fair	87.91	Good
Mar-20	67.16	Fair	82.98	Good
Jun-20	68.09	Fair	82.88	Good
Sep-20	67.85	Fair	73.66	Fair
Dec-20	72.72	Fair	76.84	Good
Mar-21	81.55	Good	92.75	Good
Jun-21	74.65	Good	80.94	Good
Sep-21	73.92	Fair	80.29	Good
Dec-21	76.04	Good	81.53	Good

(c) Kamala Lake Modified Index Result Table for DOE Index

Kamala Lake DOE Index				
	Modified Index Value		Original Index Value	
Month	Value	Interpretation	Value	Interpretation
43344.00	87.09	Class II	82.23	Class II
43435.00	86.06	Class II	79.98	Class II
43525.00	85.66	Class II	80.82	Class II
43617.00	89.60	Class II	84.43	Class II
43709.00	87.88	Class II	83.38	Class II
43800.00	79.73	Class II	72.69	Class III
43891.00	76.48	Class III	72.68	Class III
43983.00	70.61	Class III	71.28	Class III
44075.00	79.68	Class II	77.94	Class II
44166.00	84.10	Class II	82.05	Class II
44256.00	87.54	Class II	83.63	Class II
44348.00	84.79	Class II	80.98	Class II
44440.00	84.76	Class II	81.34	Class II
44531.00	90.70	Class II	87.07	Class II

(d) Kamala Lake Modified Index Result Table for Universal Index

Kamala Lake Universal Index				
	Modified Index Value		Original Index Value	
Month	Value	Interpretation	Value	Interpretation
Sep-18	85.19	Good	85.08	Good
Dec-18	81.35	Good	83.07	Good
Mar-19	93.26	Good	93.72	Good
Jun-19	94.59	Excellent	93.45	Good
Sep-19	90.01	Good	90.54	Good
Dec-19	79.77	Good	78.52	Good
Mar-20	71.71	Fair	71.40	Fair
Jun-20	77.93	Good	74.12	Good
Sep-20	73.48	Fair	73.45	Fair
Dec-20	77.02	Good	79.09	Good
Mar-21	83.07	Good	84.01	Good
Jun-21	86.33	Good	86.47	Good
Sep-21	84.29	Good	82.86	Good
Dec-21	81.56	Good	84.10	Good

(e) Kamala Lake Modified Index Result Table for Dhamija and Jain Index

Kamala Lake Dhamija and Jain				
	Modified Index Value		Original Index Value	
Month	Value	Interpretation	Value	Interpretation
Sep-18	67.40	Medium	68.00	Medium
Dec-18	69.20	Medium	70.40	Medium
Mar-19	68.40	Medium	62.40	Medium
Jun-19	82.70	Good	79.60	Good
Sep-19	88.30	Good	84.40	Good
Dec-19	83.10	Good	79.60	Good
Mar-20	78.80	Good	78.40	Good
Jun-20	84.00	Good	81.60	Good
Sep-20	95.30	Excellent	94.40	Good
Dec-20	81.90	Good	78.00	Good
Mar-21	91.00	Excellent	90.40	Good
Jun-21	87.80	Good	87.20	Good
Sep-21	84.30	Good	81.20	Good
Dec-21	87.80	Good	87.20	Good

(f) Kamala Lake Modified Index Result Table for Dhamija and Jain Index

Kamala Lake NSF INDEX 9 parameters				
	Modified Index Value		Original Index Value	
Month	Value	Interpretation	Value	Interpretation
Sep-18	72.83	Good	77.62	Good
Dec-18	73.83	Good	78.34	Good
Mar-19	73.42	Good	76.86	Good
Jun-19	77.09	Good	81.53	Good
Sep-19	74.26	Good	76.10	Good
Dec-19	71.89	Good	72.61	Good
Mar-20	67.61	Medium	67.78	Medium
Jun-20	65.97	Medium	64.82	Medium
Sep-20	67.95	Medium	68.66	Medium
Dec-20	69.26	Medium	74.23	Good
Mar-21	75.37	Good	79.79	Good
Jun-21	72.32	Good	73.17	Good
Sep-21	72.96	Good	73.41	Good
Dec-21	73.09	Good	76.14	Good

(g) Kamala Lake Modified Index Result Table for Bascaron Index

Kamala Lake Bascaron Index				
	Modified Index Value		Original Index Value	
Month	Value	Interpretation	Value	Interpretation
Sep-18	34.17	Regular	35.52	Regular
Dec-18	36.25	Regular	36.57	Regular
Mar-19	35.28	Regular	36.47	Regular
Jun-19	38.06	Regular	40.65	Regular
Sep-19	37.78	Regular	42.50	Regular
Dec-19	33.06	Regular	70.83	Acceptable
Mar-20	31.53	Regular	32.50	Regular
Jun-20	32.78	Regular	35.83	Regular
Sep-20	33.61	Regular	35.26	Regular
Dec-20	36.25	Regular	36.57	Regular
Mar-21	37.36	Regular	39.05	Regular
Jun-21	36.94	Regular	40.13	Regular
Sep-21	34.44	Regular	36.38	Regular
Dec-21	39.72	Regular	41.84	Regular

4.4 Eco Heart Index Results

Eco-Heart Index was computed for four urban lake bodies from the Study area from 2019 to 2021 covering all three seasons for water assessment for three lakes i.e. Harni, Dhobi, Gotri and Sama Lake.

Six parameters, namely, pH, turbidity, dissolved oxygen (DO), phosphate, nitrate, and fecal coliforms (FC) were determined, and their levels were labelled using a categorization table.

The six water performance indicators were chosen to capture both overall water quality and substantial pollution loads, such as eutrophication load by phosphate and nitrate, aesthetic visibility and suspended solids load by turbidity, bacterial contamination by Fecal coliform, and important lake parameters (pH and DO).

For Harni Lake, in 2019, a small heart figure was formed with some parameter edges, namely, fecal coliform, dissolved oxygen, pH, turbidity, and phosphate, bending under the class 2 range. The figure demonstrates water as having good quality. In 2020, a deshaped heart was formed due to a single parameter value fluctuation, i.e., phosphate, while all the other parameters were in the same range as found in 2019 However, the turbidity value decreased compared to that of 2019. From a deshaped heart in 2020 to a full-fledged heart puff edges for four parameters were formed. Compared to 2020, phosphate and pH value came under class 3 from class 4 and class 1 to class 2 for pH. Nitrate, fecal coliform, and dissolved oxygen values remained the same throughout, while turbidity values increased compared to that of 2020. For three consecutive years, a nearly full heart to deshaped heart was observed, indicating the water quality to be under clean to moderate class as shown in Figure 42. The phosphate and turbidity values happened to be the limiting parameters here, which changed the dynamics of water quality.

For Dhobi Lake, in 2019, the half-formed heart was obtained, shrunk only from one side due to a variation in the pH value. All other parameters were found to be in the desirable range. In 2020, a shrunken heart was formed due to the high value of phosphate. Other parameters, such as DO, fecal coliform, and turbidity, were in an acceptable range. The pH value was found to be in the acceptable range when compared to the 2019 value. In 2021, again one-sided shrunken heart was formed due to a high level of phosphate. All other parameters, such as nitrate, turbidity, and DO, were in the desirable range; however, the pH value slipped down to class 3 when compared to the

2020 value. Fecal coliform remained constant, and the turbidity value decreased compared to that in 2020. For 3 years, different shapes of the heart were seen from a half-formed heart to shrunk heart due to the high level of phosphate and pH fluctuations, indicating that the water quality varied from clean to moderate to slightly polluted class as shown in Figure 43.

For Gotri Lake, in 2019, a broken heart is formed because of a high level of phosphate, due to which the value falls under the V range, making it heavily polluted under eutrophication pressure and some high values of pH, turbidity, and fecal coliform. In 2020 the same broken heart was formed; however, more pointed curves were present than in 2019, indicating it was a polluted water body due to the high values of pH and phosphate and small changes in resultant values of fecal coliform and turbidity. By 2021, water quality considerably deteriorated, and a shrunk broken heart was formed due to an increase in turbidity value over the year. The values of phosphate, pH and fecal coliform remained in the same class as in 2020. For all the 3 years, a broken heart was formed mainly due to high values of phosphate and turbidity, making the water body fall under the polluted class as shown in Figure 44.

For Sama Lake, in 2019, the heart was formed with a pointed curve for 5 out of 6 parameters, making it halfway to produce a full heart. All the other parameters fell under the acceptable range, other than phosphate, which fell under class 3, changing the entire shape of the heart. For 2020 and 2021, a deshaped heart was formed, where all the parameters were in the same class range, except phosphate, which fell under class 4. Water quality deteriorated in 2020–2021, compared to that of 2019, making it moderately to slightly polluted water as shown in Figure 45.

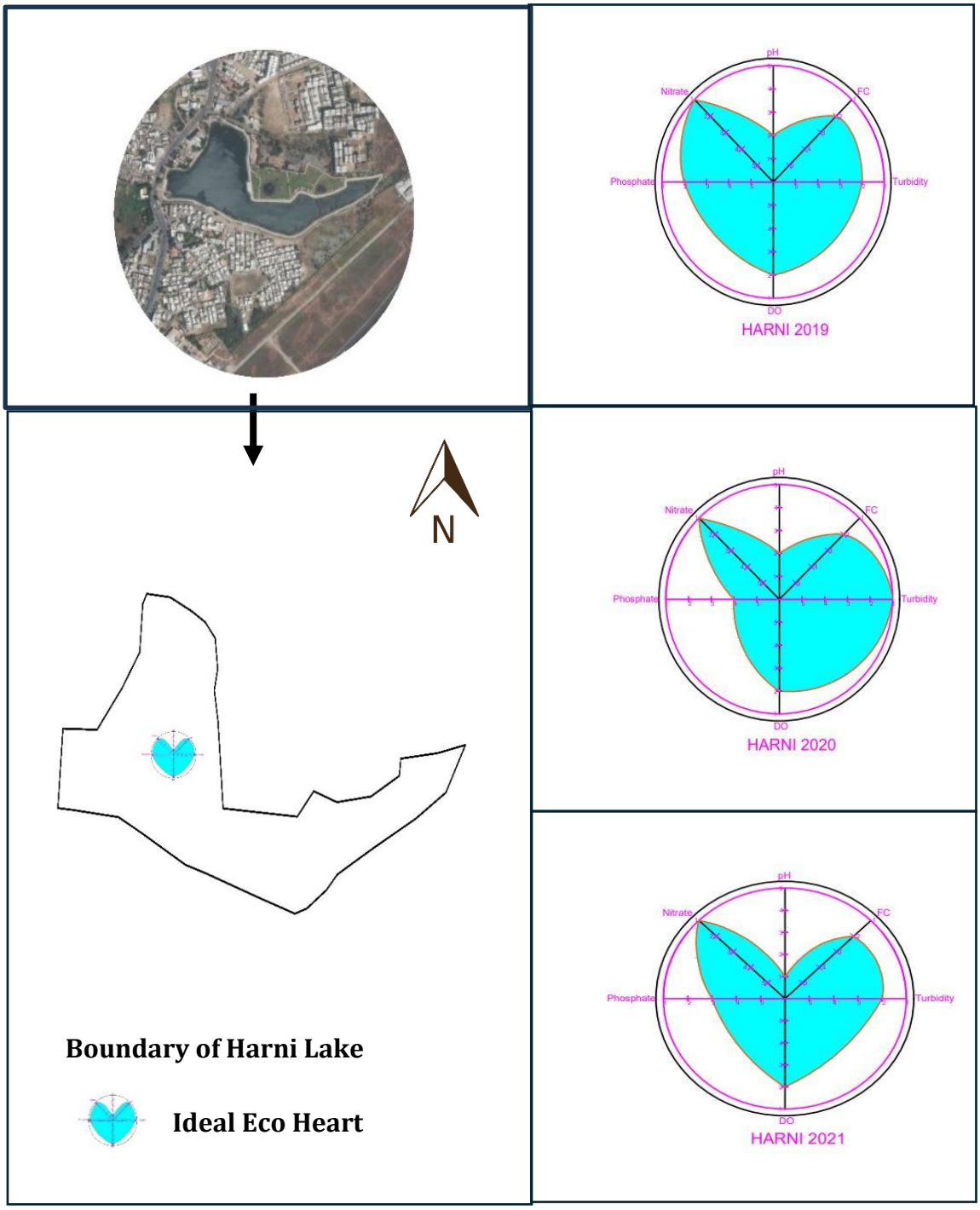


Figure 42 Eco-Heart Index of Harni Lake for 3 years 2019-2020-2021.

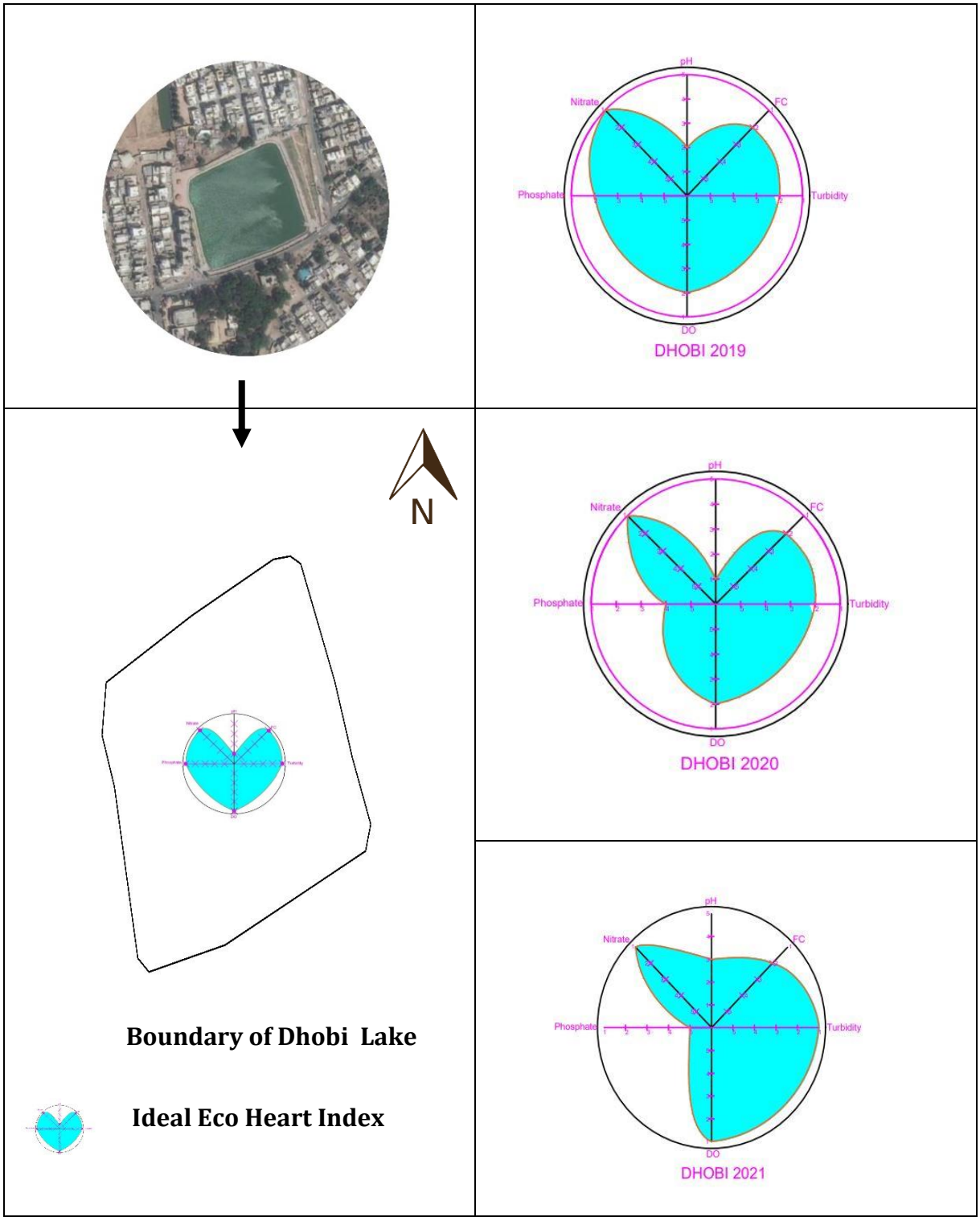


Figure 43 Eco-Heart Index of Dhobi Lake for 3 years 2019-2020-2021

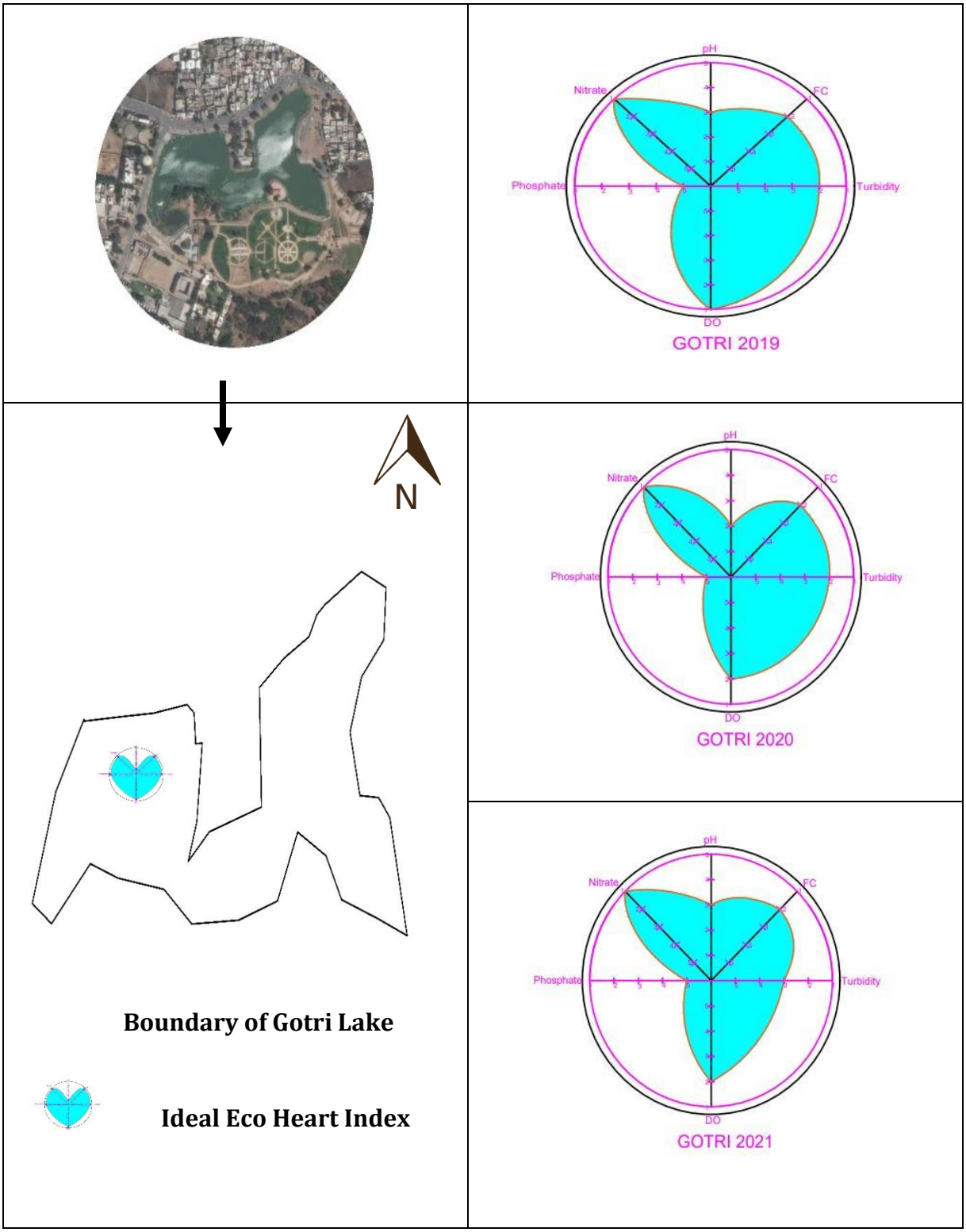


Figure 44 Eco-Heart Index of Gotri Lake for 3 years 2019-2020-2021

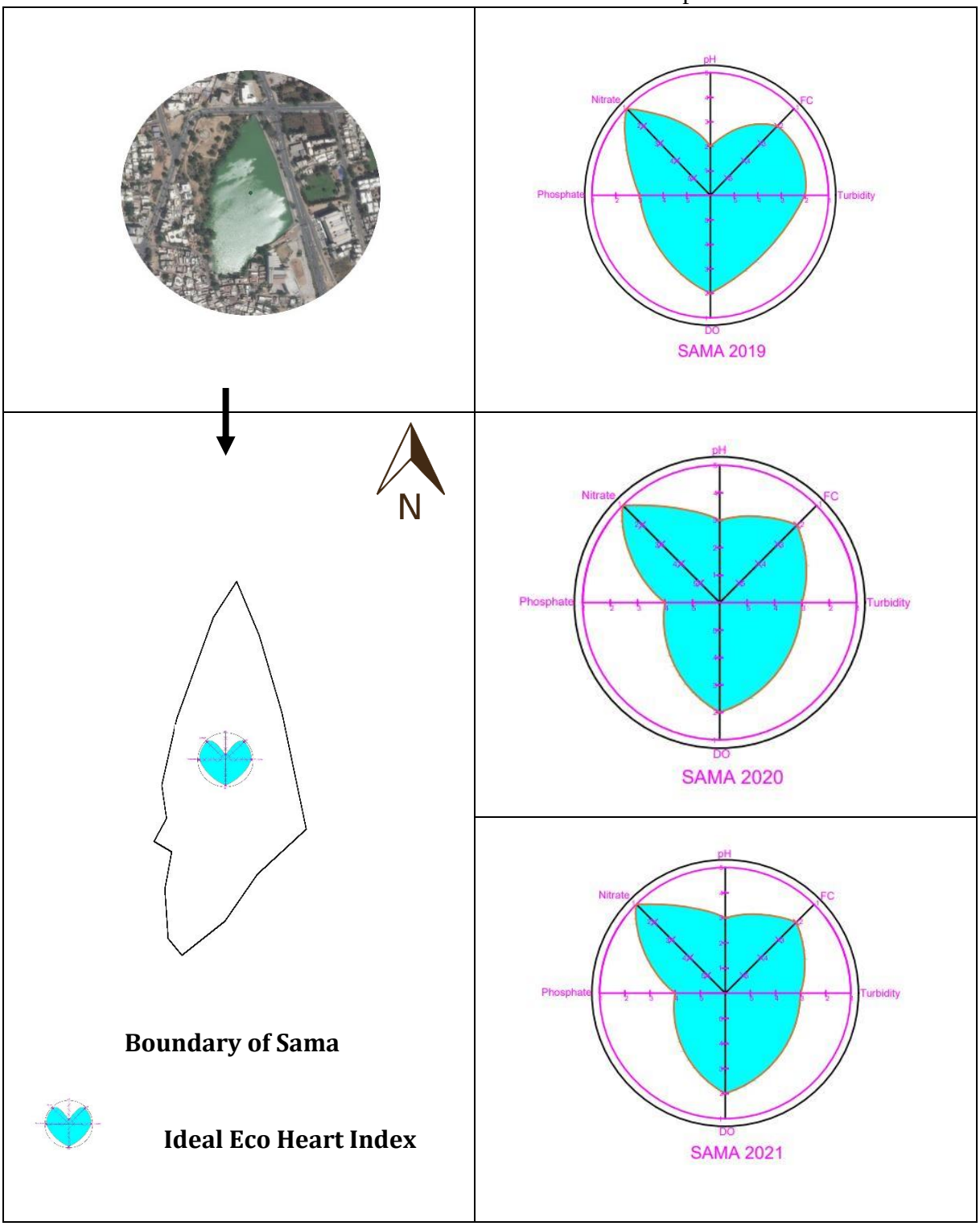


Figure 45 Eco-Heart Index of Sama Lake for 3 years 2019-2020-2021

To understand the fate of the Eco-Heart index in sustainably evaluating the status of the water body, its correlation has been established with the NSFWQI. Both indices showed a moderate positive correlation of **0.4951**. A moderate relationship was observed due to the parameter selection, as both were compared using six parameters. However, in NSFWQI, nine parameters are generally considered, the parameter weightage system, which is not seen in EHI, the range classification concept used in EHI, and the weightage graph, which has been used in NSFWQI and not in EHI as it is independently derived to gain basic quality knowledge of water bodies. Despite all these variations, a positive correlation indicated that EHI could be used in assessing the status of water bodies to give the common people a basic idea about water quality. Subsequently, the scientifically developed index can also be interlinked for better and more detailed assessment.

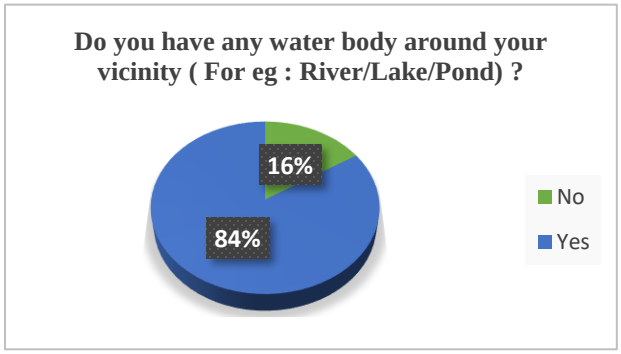
From the results, it was observed that for 2019, all the water bodies could be classified under the clean to moderate class but for 2020 and 2021, the water quality deteriorated for all four lakes. The main parameters, which influence this, were phosphate, turbidity, and pH. A high level of phosphate was mainly due to the sewage discharge and solid waste disposal into the lake bodies, which increased the eutrophication level and lead to the contaminant layer formation by increasing the turbidity level. Thus, the turbidity level increased due to pollutant dispersion from the surrounding areas and improper disposal of solid wastes, such as paper, plastics, and flowers, because of proximity to commercial and residential areas. pH fluctuations were observed due to varying anthropogenic activities observed at the water body (Parmar & Samnani, 2022).

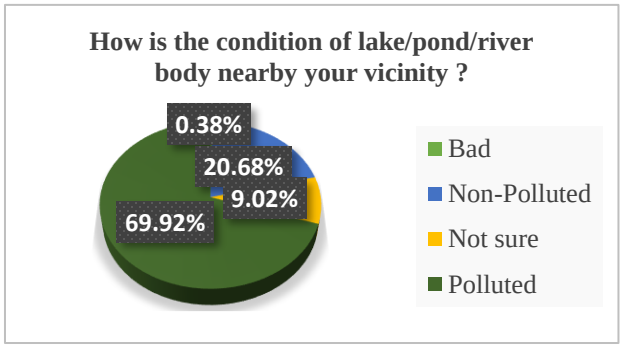
All water bodies studied exhibited a deshaped heart and a full heart was not seen for a single water body, indicating that none of the water bodies fell under pristine quality. Since the contributing parameters were only one or two, the water can probably be used for better purposes using simple treatment methods.

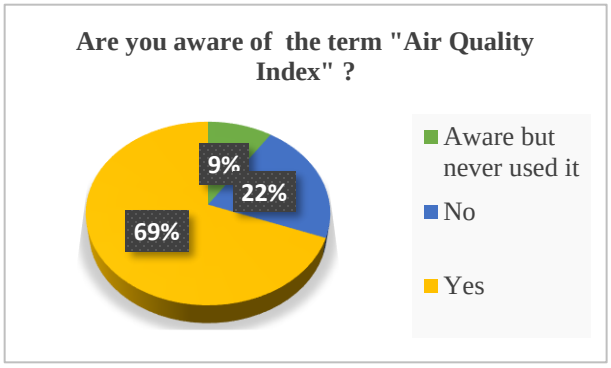
To know the effectiveness of the Eco-Heart Index at ground level, a survey was carried out. A google form and personal interaction with people living near water bodies were used in the survey. The total sample size for the study area was 385, out of which 300 data were recorded with all responses making it 78% responses in total. 10 questions were asked with a pictorial representation of the Eco-Heart Index for people to understand the concept and how such a tool can be used for future sustainable practices. The effectiveness and connectivity of the questions asked were assessed using the Cronbach Alpha method. The Cronbach Alpha test evaluates the reliability of

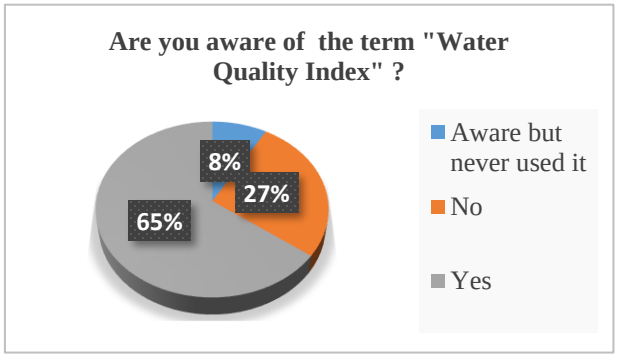
the questions in the questionnaire, and the results showed that they had a reliability rating of 0.97 indicating excellent reliability.

Results from the survey are presented in Figure 46 (i) and (ii), 67% of the people were able to understand the idea of the Eco-Heart Index with 60% in favour of the Eco-Heart Index being the next sustainable tool. However, from the management point of view, mixed responses were gathered, some people opted for using both indices (Numerical and Pictorial) for representation, but some showed disagreement over the new index helping in the conservation of water bodies just by the use of a picture. People living around the periphery of water bodies showed a 50 -50 response in use of the Eco-Heart index as many use that water on a day-to-day purpose, so according to them such activity would affect their daily chores while some opted for placing such an image on the periphery so that nearby people would stop polluting the water by throwing garbage to the water body. Such practices would prevent water from being contaminated.









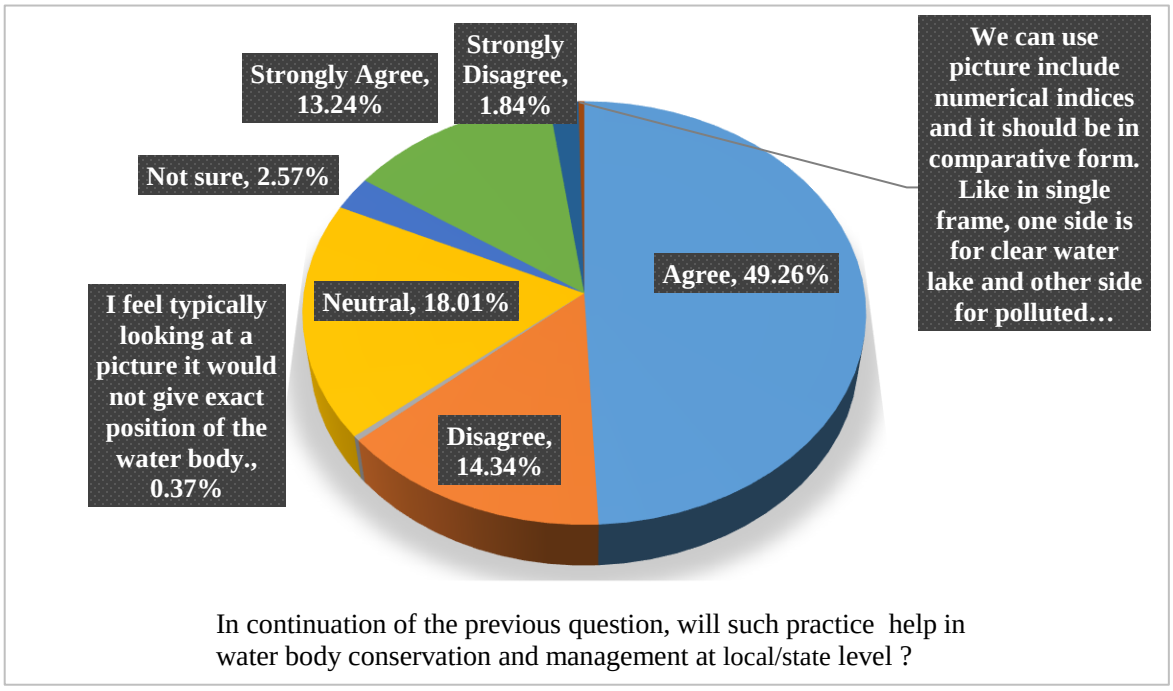
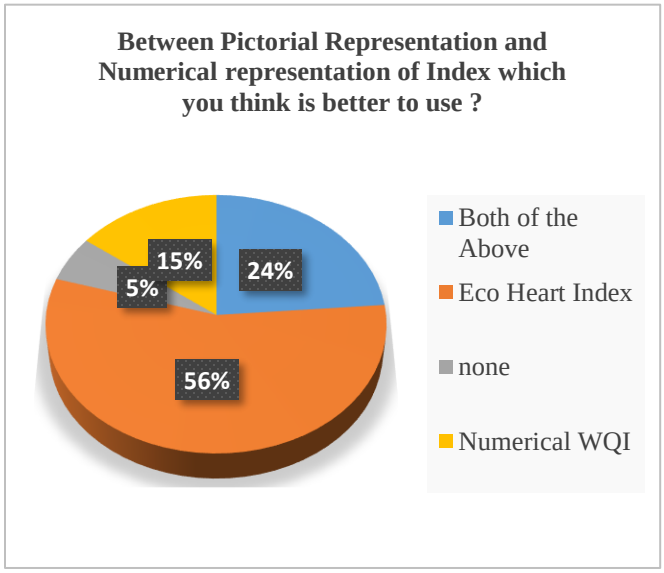
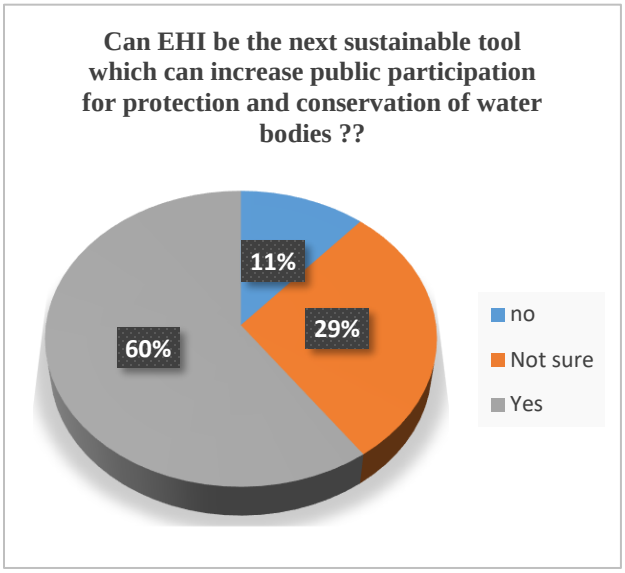
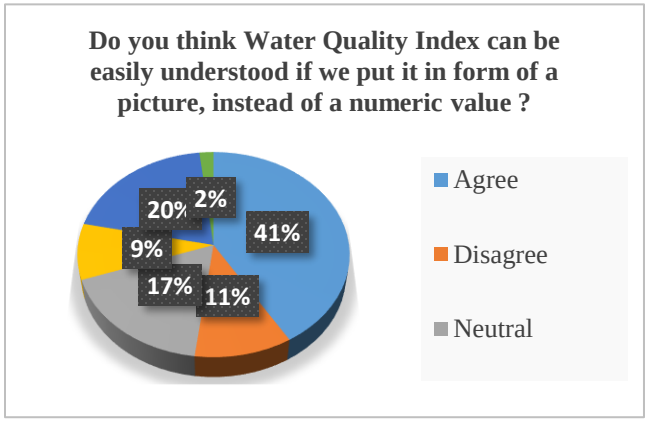
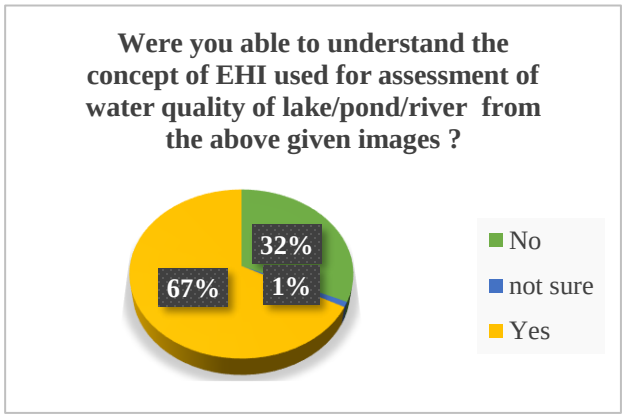


Figure 46 (i) Survey results









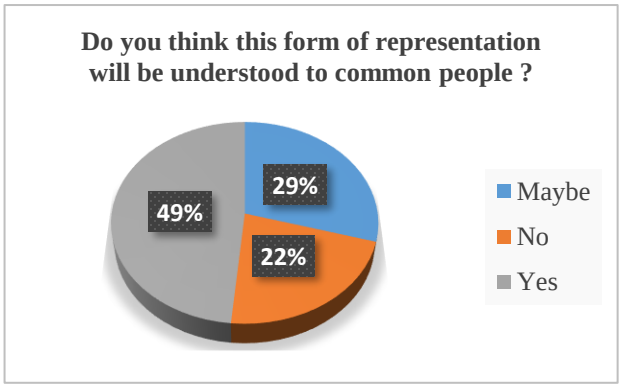


Figure 46(ii) Survey results

4.5 Statistical Analysis Results

Water bodies are one of the important ecological components in the urban area. As per the report of the governing body, 20 water bodies are scattered in and around the city of culture. In this study to understand the dynamics of the water quality. 9 water bodies were selected based on inclusion and exclusion criteria. Further for monitoring purposes monthly water samples from year 2018 to 2021 were collected and analyzed in the laboratory. In total 24 biochemical parameters were recorded namely pH, TDS, TSS, conductivity, temperature, turbidity, colour, fluoride, acidity, alkalinity, total hardness, Ca-hardness, Mg-hardness, COD, DO, BOD, chloride, Ammonical nitrogen, total kjeldahl nitrogen, nitrate, phosphate, sulphate, total coliform, fecal coliforms.

Data Analysis:

Coefficient of Variation (C.V.) was computed based on the mean and the standard deviation which eventually helps in doing comparison between water bodies in context to biochemical parameters as presented in Table 66. While Principal component analysis was carried out in the R-studio version 2021.09.1. PCA was carried out to reduce the dimension of the data and to identify the potential parameter that significantly influence Water Quality Index. It was also used to explain the total percentage variation among variables of interest.

Correlation matrix for all lakes are shown in Table 66 to 74.

Result and discussion

Table 65 Descriptive Statistics of the biochemical parameters

Biochemical Parameters	Water bodies								
	Sama Lake	Motnath Lake	Dhobi Lake	Bapod Lake	Dantesh war Lake	Gorwa Lake	Gotri Lake	Hami Lake	Kamala Lake
pH	5.58	6.36	5.39	4.88	26.19	27.00	4.50	4.49	5.32
TDS	44.28	43.86	50.25	29.51	42.65	59.85	25.11	22.90	43.63
TSS	32.68	55.33	46.72	47.16	58.61	43.50	41.80	76.73	29.36
Conductivity	54.97	45.08	47.77	28.62	49.64	58.09	27.85	25.18	36.31
Temperature	9.31	8.36	10.37	11.61	27.09	24.05	8.81	9.96	11.29
Turbidity	91.42	70.96	61.94	63.70	93.82	76.45	36.33	69.48	53.25
Colour	37.91	55.98	188.76	52.28	45.05	41.28	52.61	45.48	57.91

Biochemical Parameters	Water bodies								
	Sama Lake	Motnath Lake	Dhobi Lake	Bapod Lake	Dantesh war Lake	Gorwa Lake	Gotri Lake	Harni Lake	Kamala Lake
Fluoride	55.93	54.00	55.22	31.82	192.66	168.85	48.00	65.12	50.98
Acidity	130.83	49.83	57.96	55.32	62.94	102.78	52.95	92.79	58.37
Alkalinity	68.09	61.83	77.83	65.94	67.32	63.35	34.18	46.30	58.87
Total Hardness	43.39	57.63	60.69	43.81	51.81	43.68	20.83	30.66	57.17
Ca-Hardness	51.97	84.25	70.13	47.48	62.27	53.27	44.76	44.42	74.53
Mg-Hardness	87.49	41.97	88.28	69.76	65.38	63.93	48.33	55.80	71.64
COD	43.26	46.40	54.06	70.81	52.42	76.64	57.10	90.52	51.64
DO	40.13	28.50	38.96	20.27	66.67	61.64	38.24	35.83	13.47
BOD	98.41	76.89	118.49	99.14	82.72	79.55	82.58	120.11	88.41
Chloride	53.45	55.69	48.82	38.61	43.59	68.81	42.66	32.15	48.03
Ammonical Nitrogen	61.84	52.50	66.13	53.15	199.58	214.86	80.70	52.14	56.96
Total Kjeldahl Nitrogen	46.94	59.38	53.62	73.91	286.19	155.48	61.17	60.00	91.43
Nitrate	65.79	51.20	78.51	68.24	178.42	193.07	71.29	68.54	89.41
Phosphate	59.74	56.06	77.55	80.65	291.84	266.67	53.52	64.00	64.29
Sulphate	40.28	76.52	62.85	32.98	64.96	41.63	35.92	54.51	30.74
Total Coliform	35.82	31.79	39.13	32.46	49.75	38.89	31.16	44.29	56.41
Fecal Coliform	41.02	35.97	43.76	32.97	51.37	41.55	48.540	35.59	57.60

CV is an important relative measure of scatteredness that gives freedom to compare and discuss consistency and risk. The coefficient of Variation corresponding to each variable and water body were computed for compression purposes. Biochemical parameters having the highest CV values among all water bodies are highlighted in yellow colour. In Dhantewshar 8 parameters had the highest CV values namely temperature, turbidity, fluoride, DO, total kjeldahl, phosphate, total coliform, and fecal coliform, while Gorwa Lake reported 6 parameters whose CV value was highest among all. Followed by Dhobi Lake had 5 biochemical parameters whose CV value was high. This shows that disturbance in the Dhantshwar Lake was high followed by Gorwa and Dhobi Lake. Thus, variability in WQI of these Lake were high as compared to other water bodies under study.

Table 66 Correlation coefficient for Kamala Lake

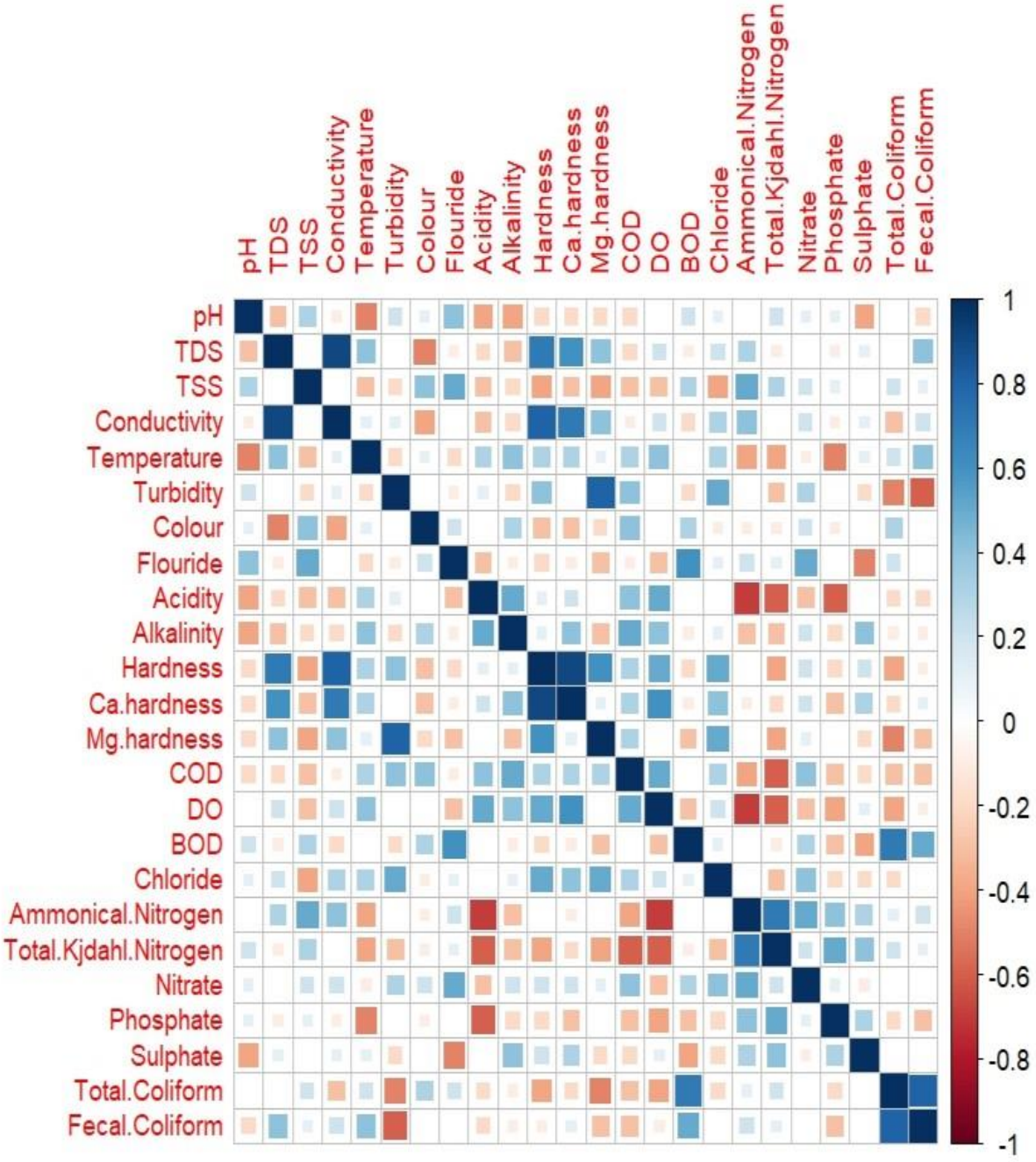


Table 67 Correlation coefficient for Harni Lake

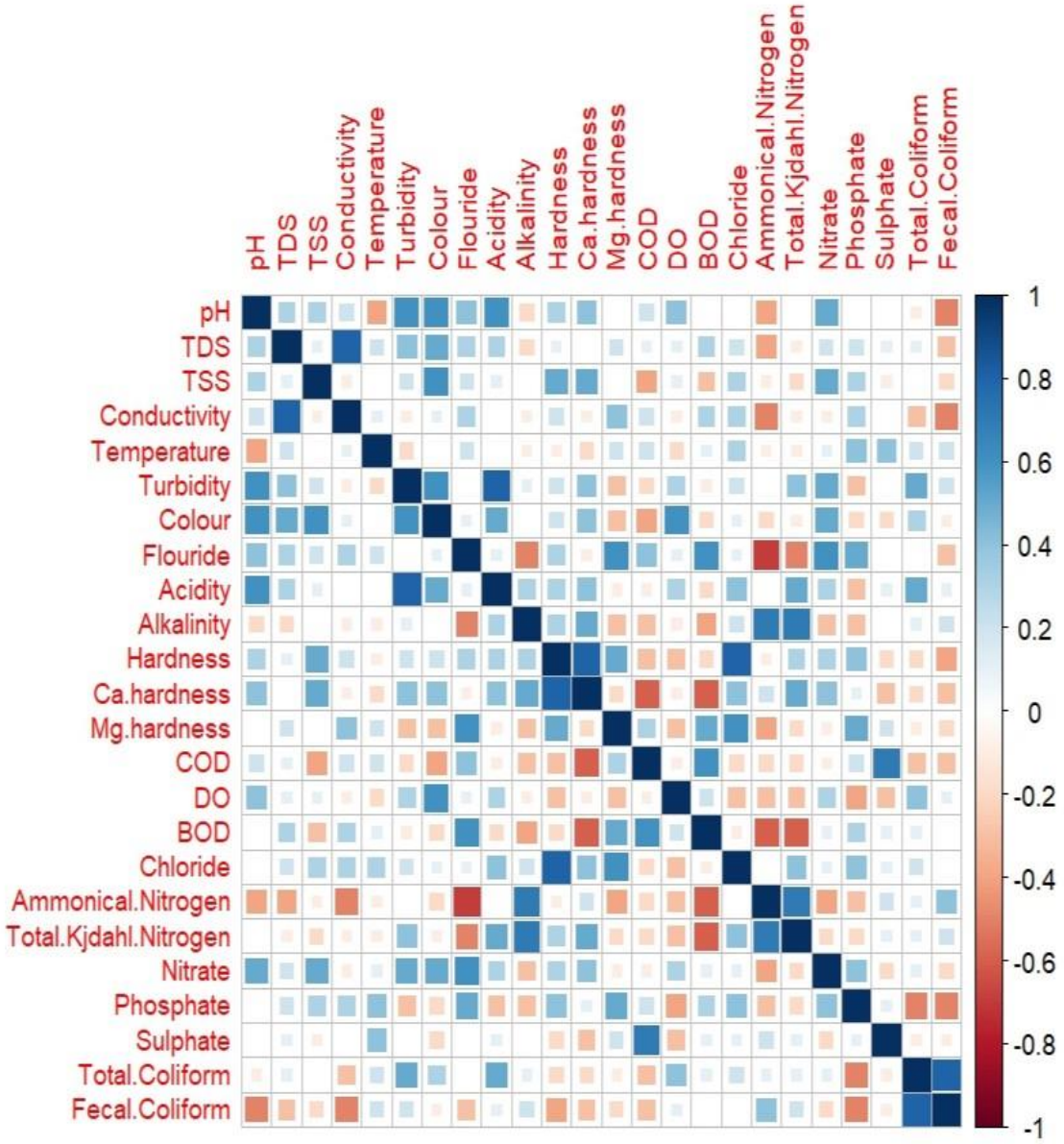


Table 68 Correlation coefficient for Gotri Lake

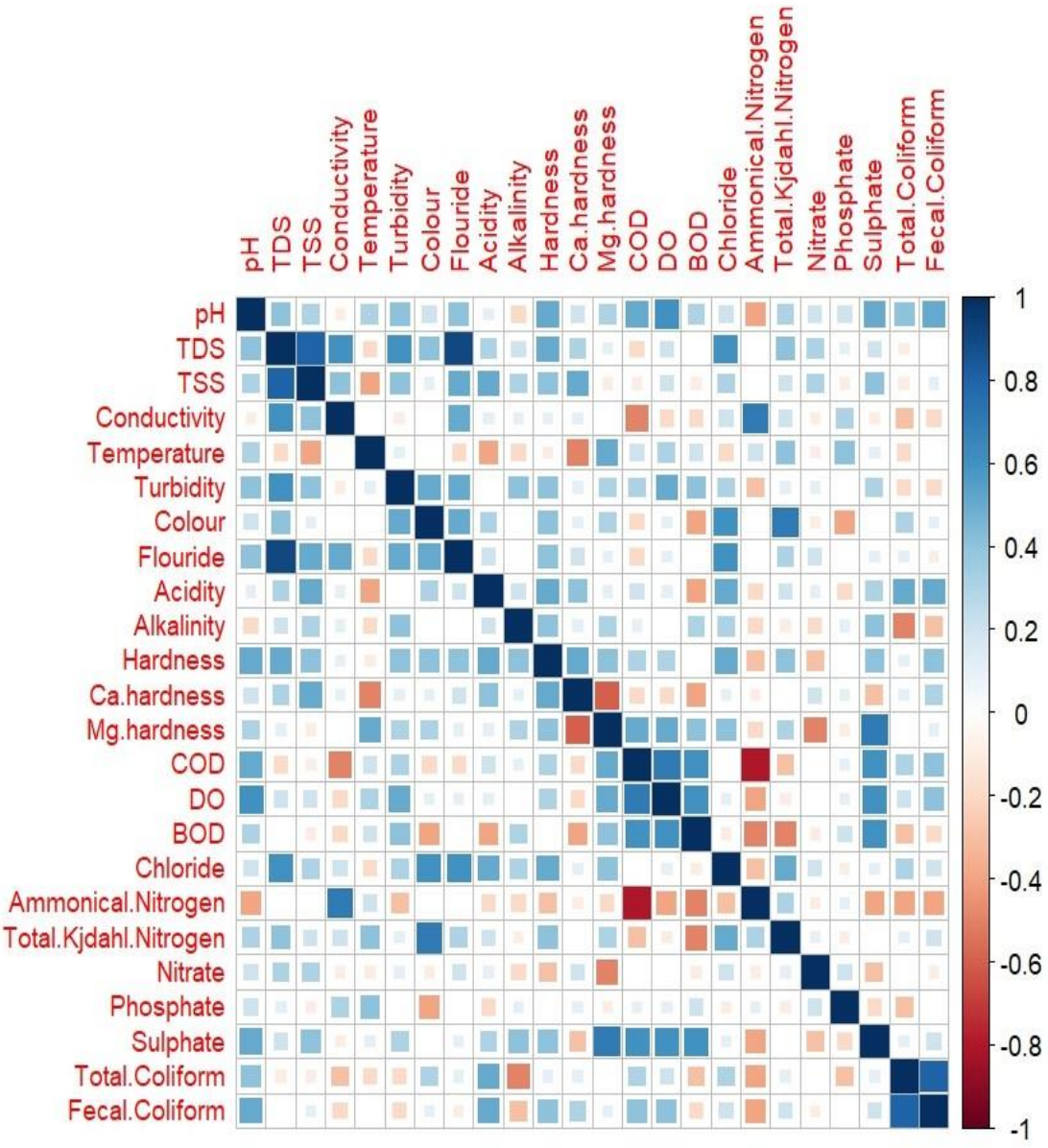


Table 69 Correlation coefficient for Gorwa Lake

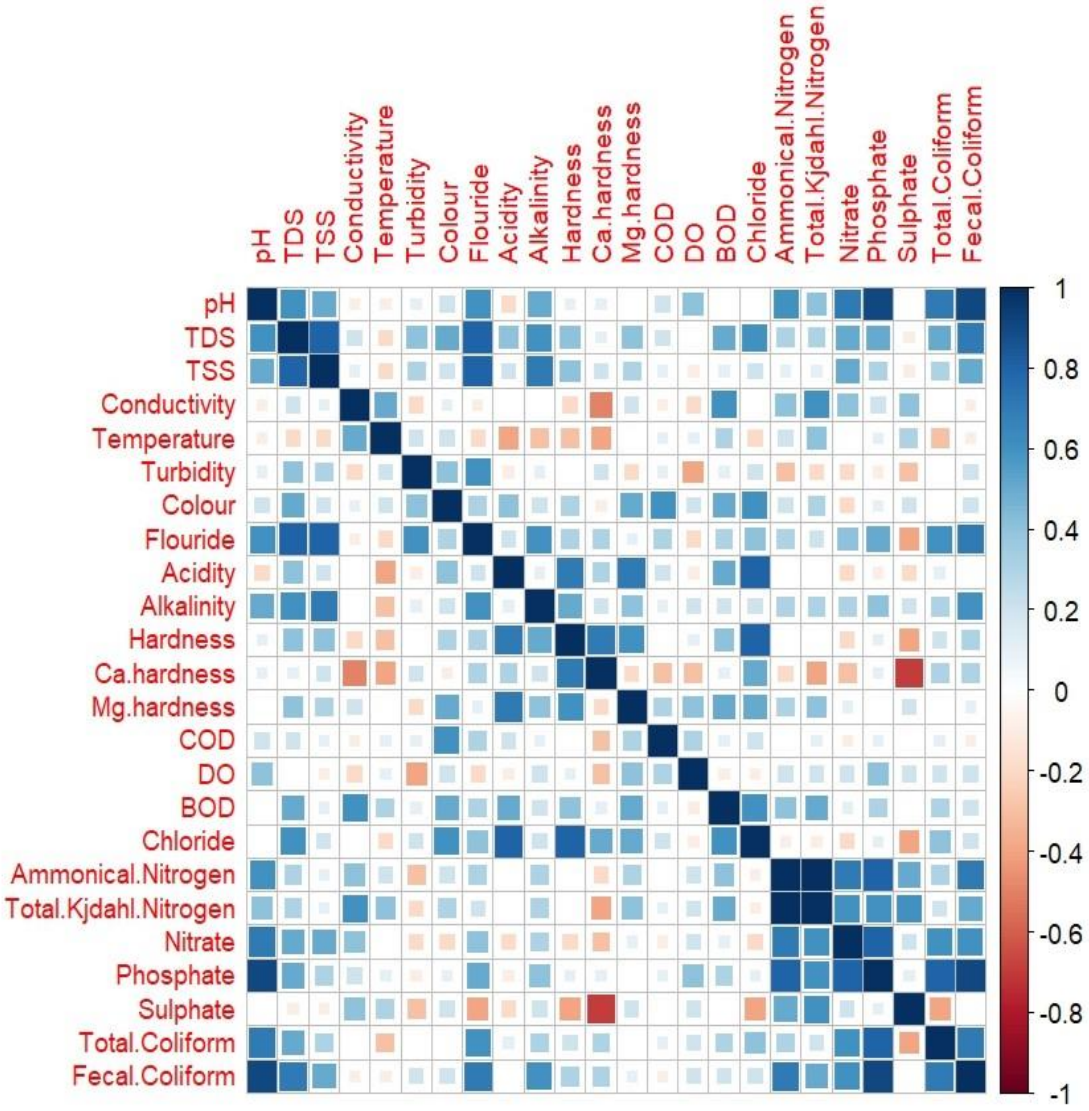


Table 70 Correlation coefficient for Danteshwar Lake

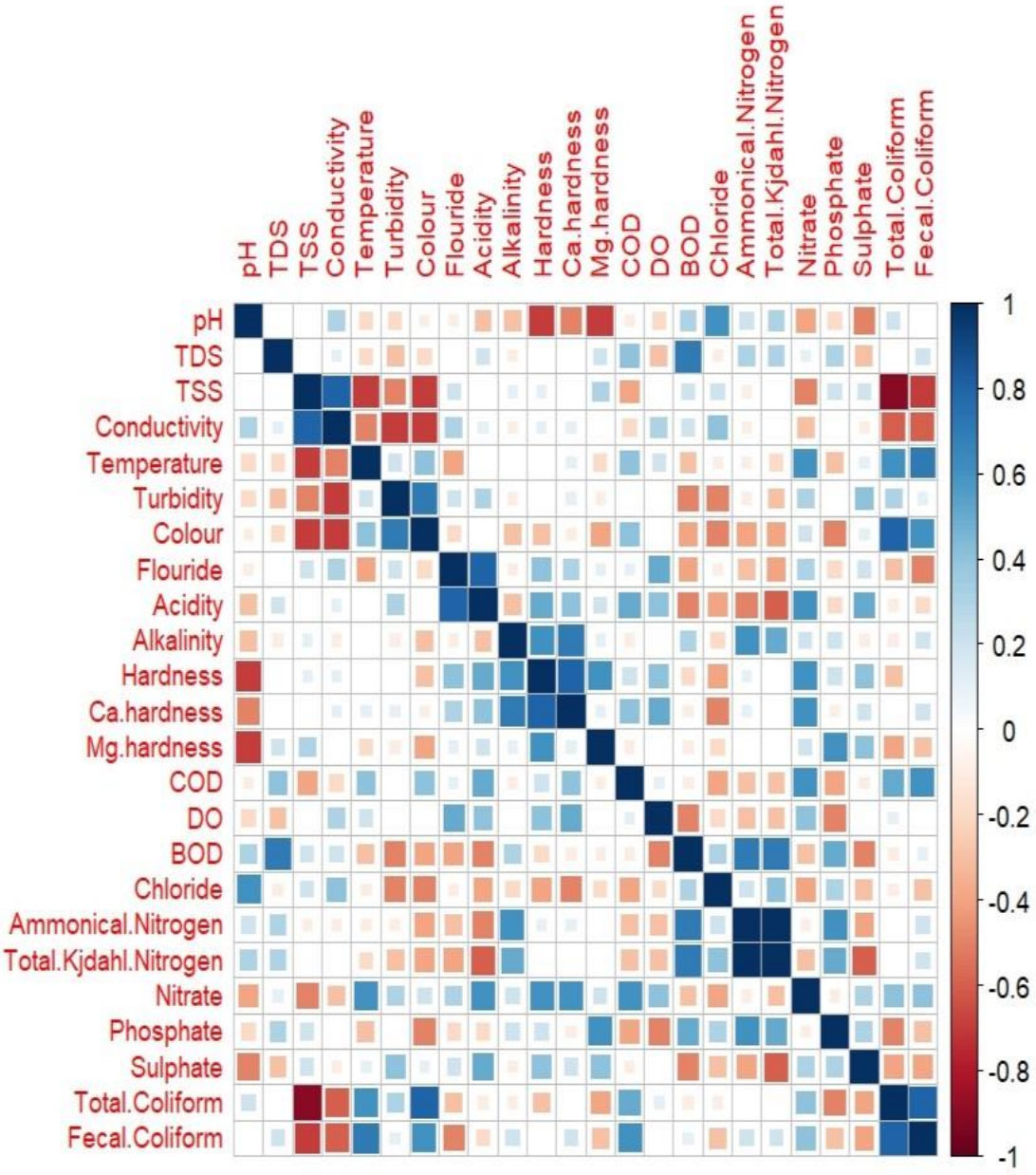


Table 71 Correlation coefficient for Bapod Lake

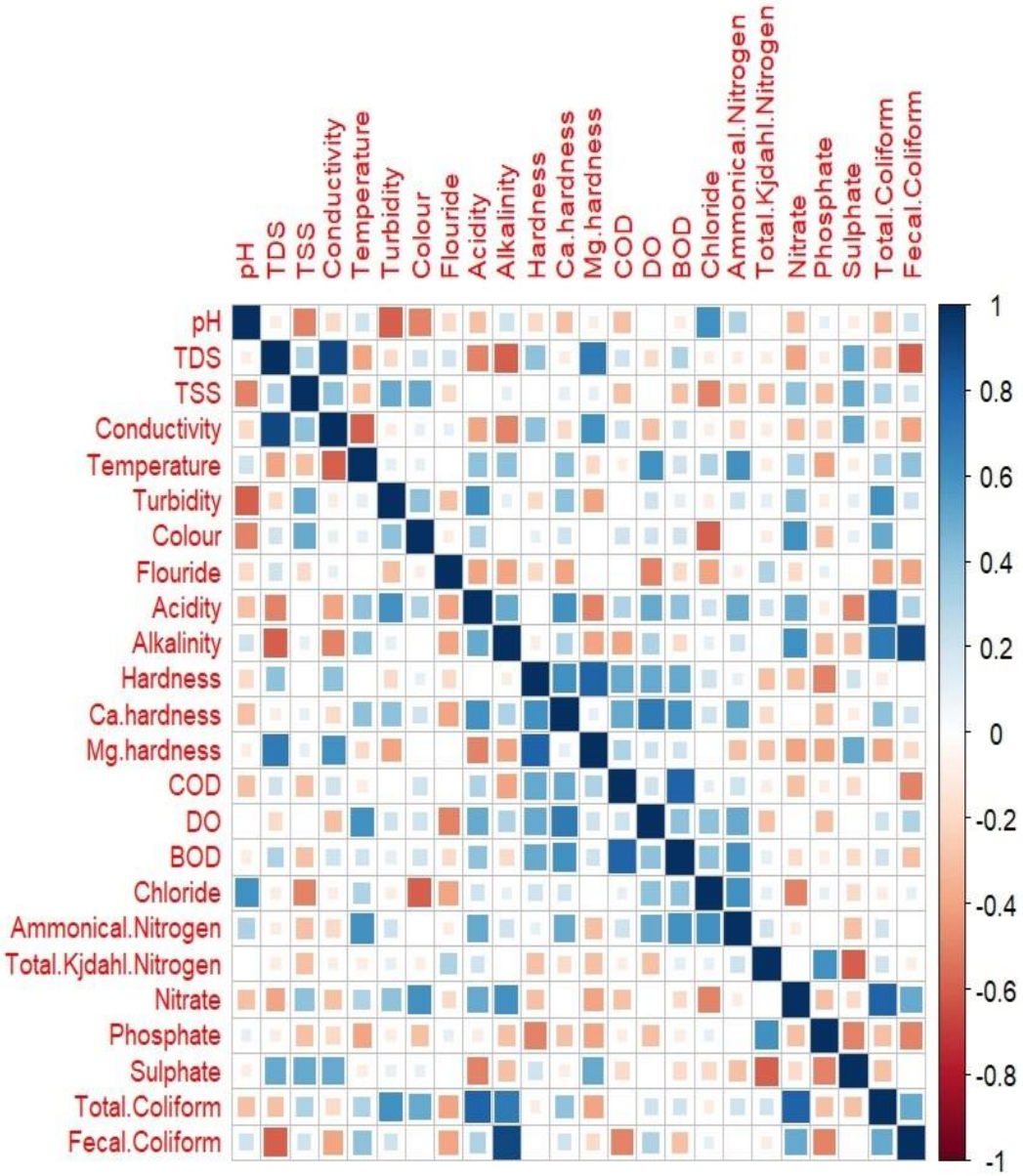


Table 72 Correlation coefficient for Dhobi Lake

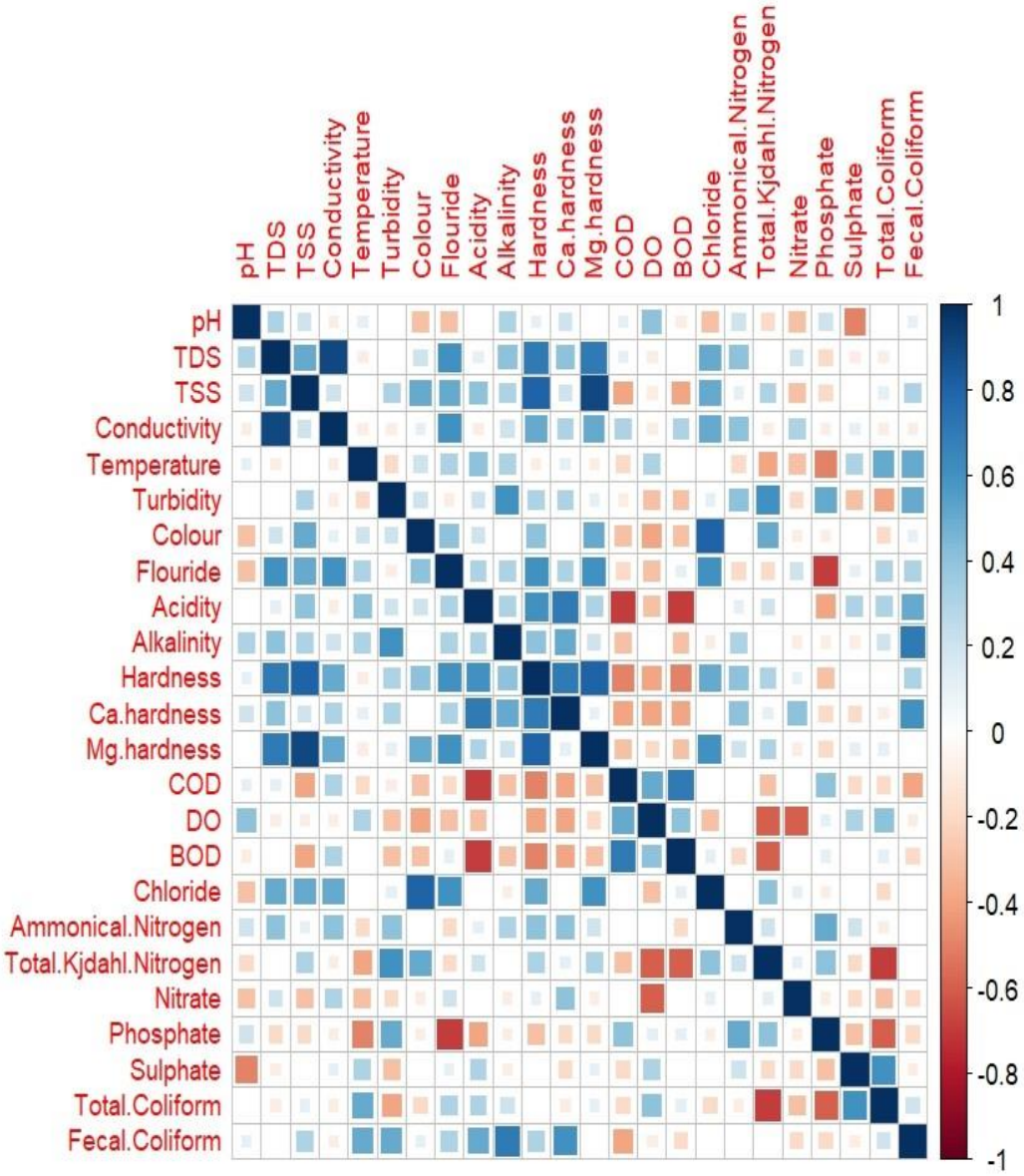


Table 73 Correlation coefficient for Motnath Lake

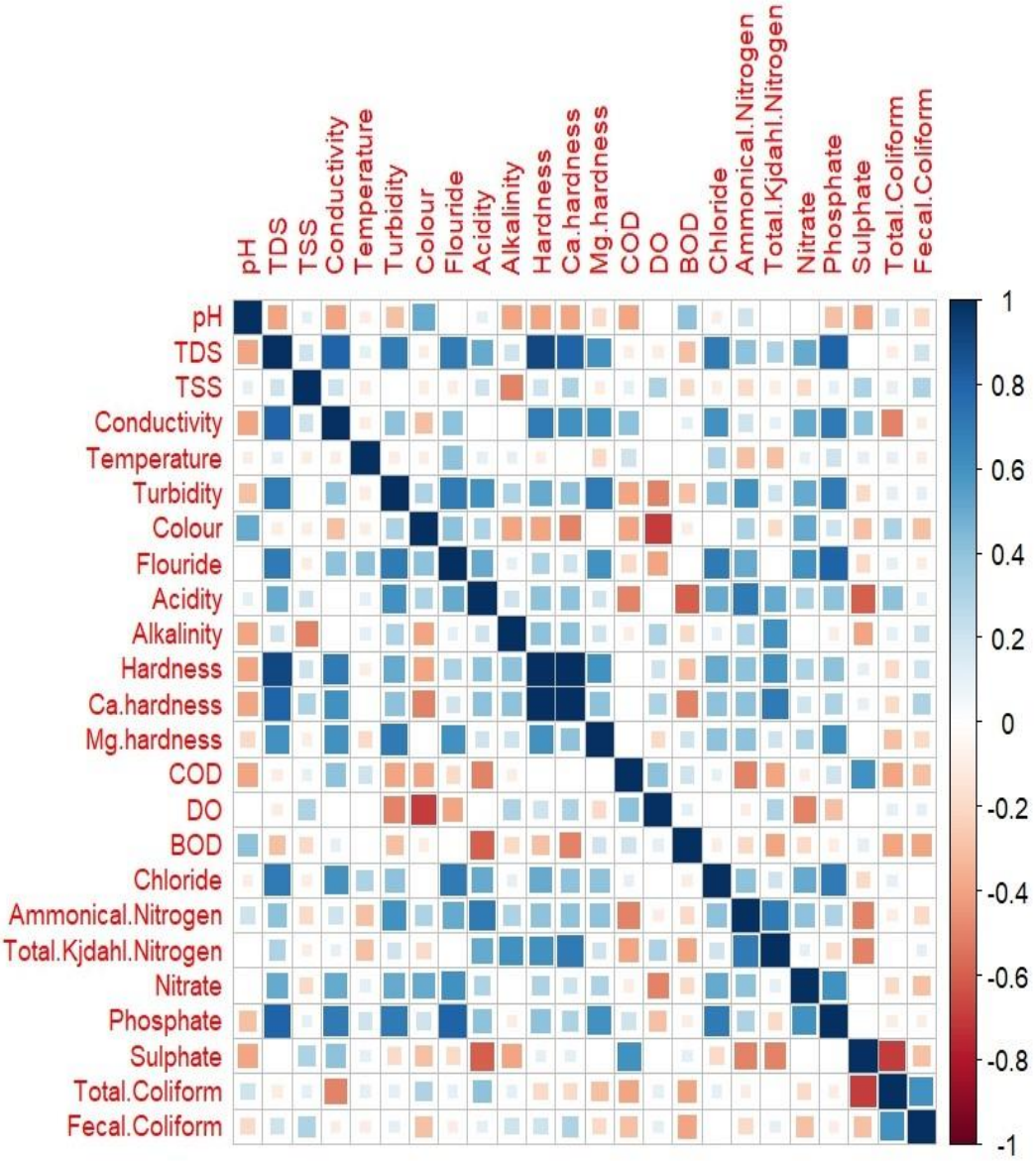
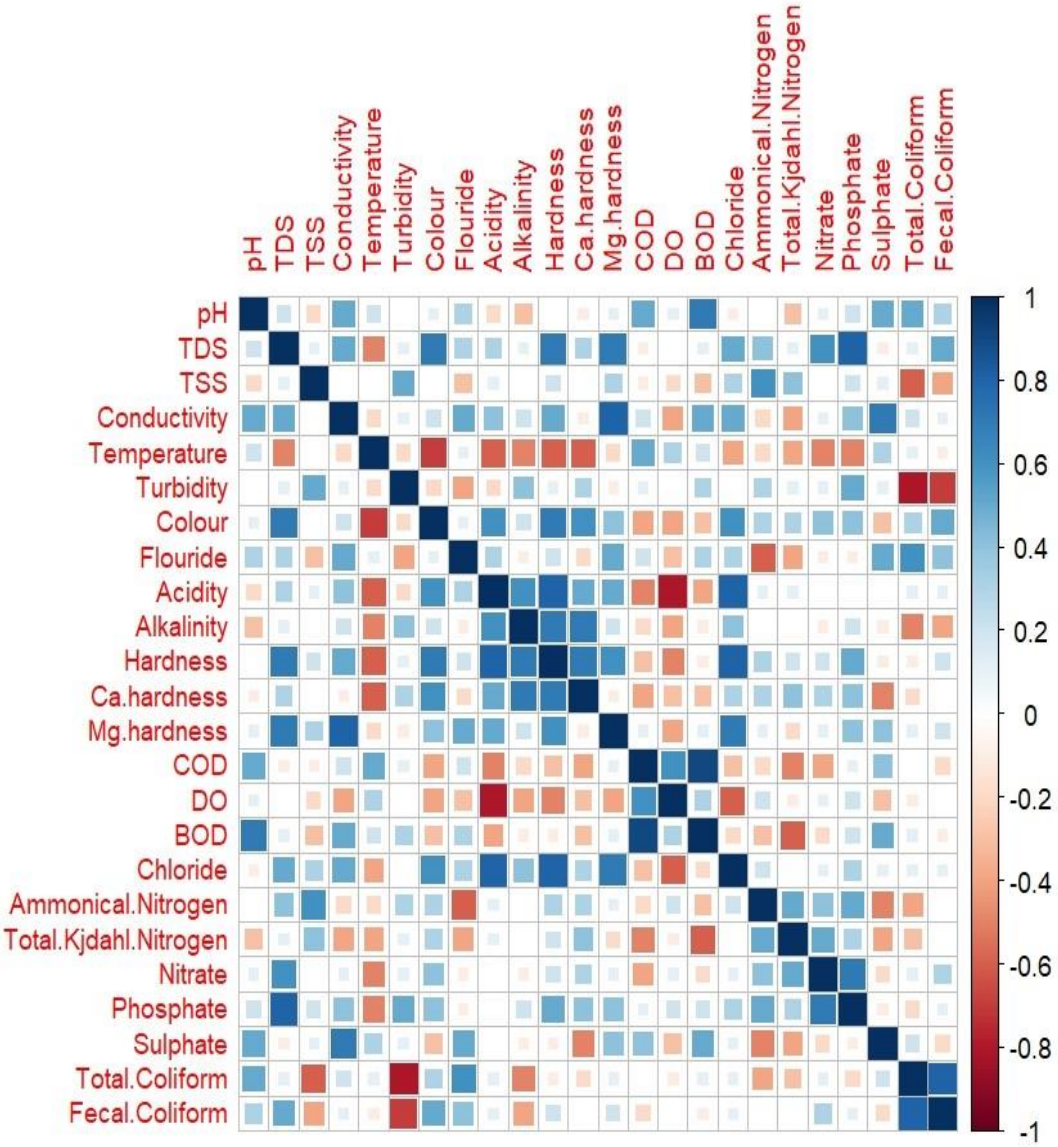
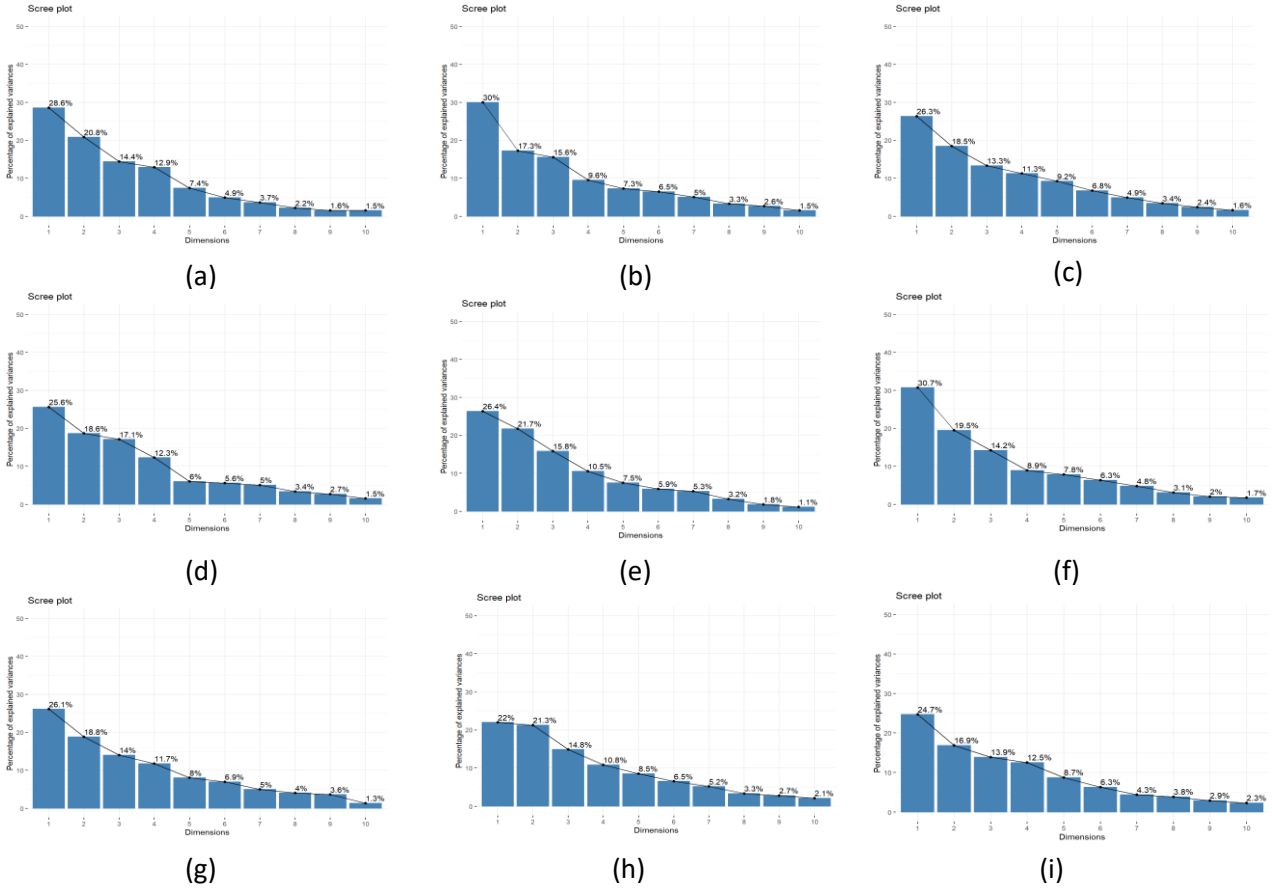


Table 74 Correlation coefficient for Sama Lake



PCA Result

Scree plot helps in identifying the number of components needs to be selected to understand the significant variability. Plot for individual 9 lakes are summarized in Figure 47 and Biplot plot of the water quality parameters as shown in Figure 48. Table 76 display eigen values and variance explained by individual component and cumulative variance. Except Sama, all other lakes had seven components that were significant whose eigen values were one or more than one. Observing the cumulative it was found that in all case together they were able to example more than 85% of variation present within the data. Lakes are labelled as (a) Sama Lake,(b) Motnath,(c) Dhobi lake, (d) Bapod Lake, (e) Danteshwar Lake,(f) Gorwa Lake,(g) Gotri Lake,(h)-Harni lake,(i) Kamala lake for tables and figures used in this section ahead.



Note: (a) Sama, (b) Motnath, (c) Dhobi, (d) Bapod, (e) Danteshwar, (f) Gorwa, (g) Gotri, (h) Harni, (i) Kamala.

Figure 47 Scree Plots of all 9 water bodies

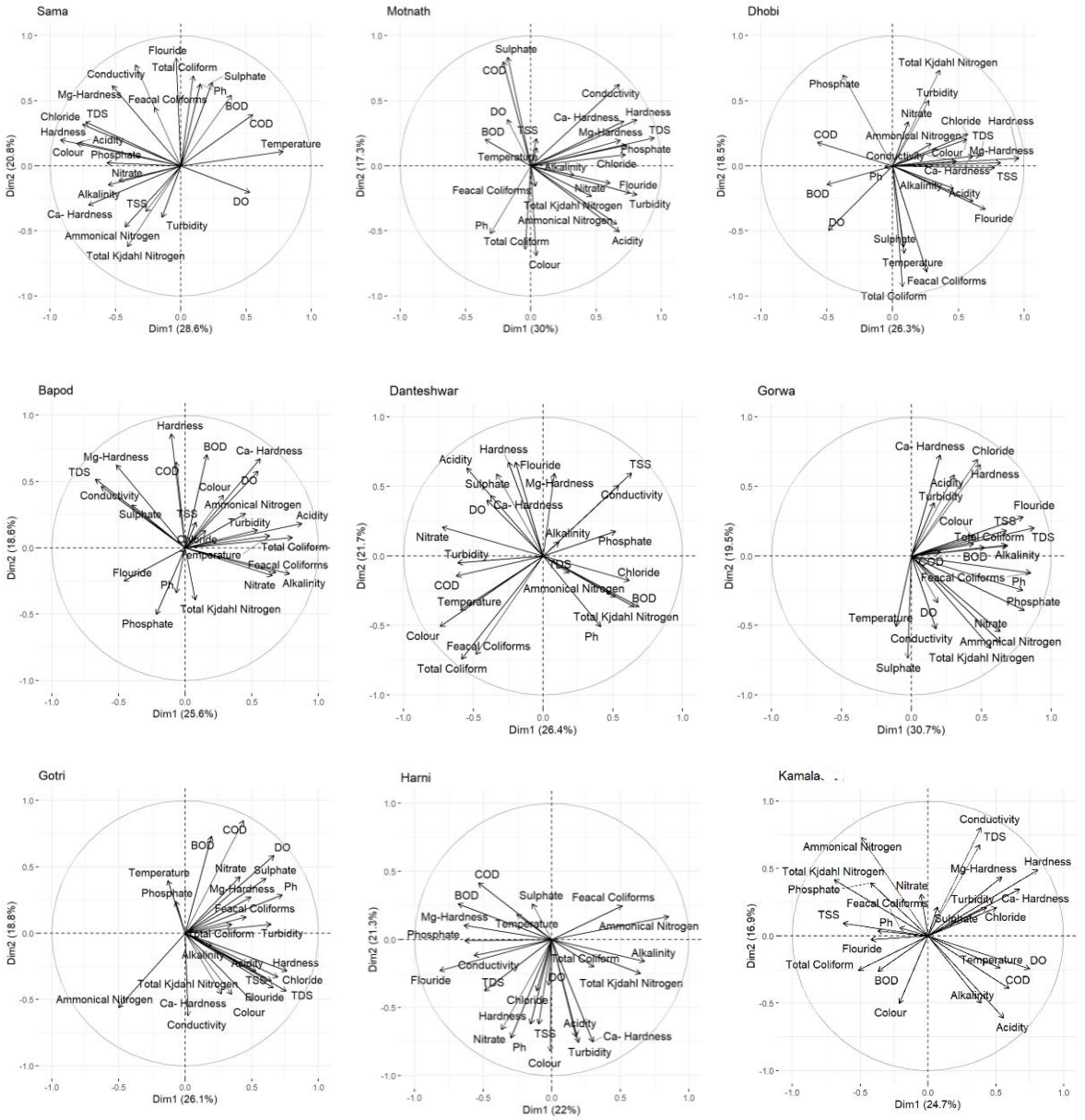


Figure 48 Biplot plots of the water quality parameters

Biplot is a plot that makes use of the loading values of variables corresponding to first two components as a coordinate and are plotted in the suitable quadrant. Variables having similar behaviour are placed in the same quadrant with minimum distance from each other. While variables that depict different characteristic to that of variable placed in the opposite quadrant in

the diagonal. Considering the first two principal components biplot of all urban water bodies are constructed and are displayed in figure 48.

Parameters of Sama were scatted in first three quadrants, six parameters were in the first quadrant indicating having positive relation with both components followed by eight in the second quadrant and then in third quadrant. Only DO was placed in the fourth quadrant this showed that this parameter was having distinct behaviour in comparison to that of other parameters. Further in Motnath parameters were more placed in the first and fourth and DO, BOD, COD, Sulphate were placed in the second and pH and total coliform were in third. Here parameters in the respective quadrants were placed very close to each other, concentrated to very specific angle of the plot. which says that all parameters placed close to each-other were sharing similar behaviour in terms of the variability within the data points. A similar behaviour was observed in the Dhobi lake where majority of the biochemical parameters were falling the first and fourth quadrant while few selected were in the second and third quadrant. However, parameters displayed in quadrants in this lake was partially different from that of Motnath lake. In Bapod lake excluding seven parameters all had positive relation with second component while with first component some had positive, and few had negative relation as a result more than half of the parameters were placed in the first and second quadrant of the plot. had majority of the variables. In Harni the scenario was completely opposite of that of Bapod, seven parameters were placed in the first and second while rest all parameters were placed in the third and fourth quadrants on the biplot. Danteshwar and Kamala are two such water bodies where parameters were placed in the clusters but were scattered all around 360 degrees in the plot. Further observing the graph of Gorwa and Gotri shared similar pattern in context of distribution of the parameters in the plot. Temperature and sulphate were in the fourth quadrant in plot of Gorwa while three parameters namely temperature, phosphate in third and Ammonical Nitrogen alone in fourth quadrant of plot of Gotri.

Lakes under study were located in the different directions of the urban area with significant distance between them to which even thou they shared similar patterns in context of density of the parameters placed in the biplot. Although the placement of the individual parameters was not completely carbon copy as observed in the case of Gotri and Gorwa

Table 75 Eigne value, variance, and cumulative variance of water bodies

Water bodies	Component	PC1	PC2	PC3	PC4	PC5	PC6	PC7
Sama Lake	Eigenvalue	6.86	4.99	3.46	3.09	1.79	1.17	-
	Variance Percent	28.59	20.81	14.40	12.89	7.45	4.89	-
	Cumulative Variance Percent	28.59	49.39	63.80	76.69	84.14	89.03	-
Motnath Lake	Eigenvalue	7.20	4.14	3.74	2.29	1.76	1.56	1.21
	Variance Percent	30.01	17.26	15.58	9.55	7.31	6.49	5.02
	Cumulative Variance Percent	30.01	47.28	62.86	72.41	79.72	86.21	91.23
Dhobi Lake	Eigenvalue	6.32	4.43	3.19	2.70	2.21	1.62	1.18
	Variance Percent	26.32	18.47	13.30	11.26	9.23	6.76	4.93
	Cumulative Variance Percent	26.32	44.79	58.09	69.36	78.58	85.34	90.27
Bapod Lake	Eigenvalue	6.14	4.47	4.10	2.94	1.44	1.34	1.21
	Variance Percent	25.58	18.64	17.08	12.27	6.02	5.56	5.04
	Cumulative Variance Percent	25.58	44.22	61.30	73.58	79.60	85.16	90.20
Danteshwar Lake	Eigenvalue	6.32	5.21	3.80	2.53	1.80	1.41	1.26
	Variance Percent	26.35	21.72	15.83	10.54	7.51	5.88	5.27
	Cumulative Variance Percent	26.35	48.07	63.90	74.44	81.94	87.82	93.09
Gorwa Lake	Eigenvalue	7.37	4.68	3.40	2.15	1.88	1.52	1.15
	Variance Percent	30.70	19.48	14.18	8.95	7.81	6.34	4.77
	Cumulative Variance Percent	30.70	50.19	64.37	73.31	81.13	87.46	92.23
Gotri Lake	Eigenvalue	6.26	4.52	3.36	2.82	1.92	1.67	1.19
	Variance Percent	26.10	18.81	14.01	11.74	8.00	6.94	4.96
	Cumulative Variance Percent	26.10	44.92	58.93	70.67	78.67	85.61	90.57
Harni Lake	Eigenvalue	5.27	5.11	3.56	2.59	2.05	1.56	1.24
	Variance Percent	21.96	21.27	14.84	10.79	8.52	6.51	5.17
	Cumulative Variance Percent	21.96	43.23	58.08	68.87	77.39	83.90	89.07
Kamala Lake	Eigenvalue	5.92	4.04	3.33	3.00	2.08	1.50	1.04
	Variance Percent	24.68	16.85	13.89	12.50	8.69	6.27	4.34
	Cumulative Variance Percent	24.68	41.53	55.42	67.92	76.61	82.88	87.22

Component loading tells us about the association between components and the variables which is shown in Table 76. It was observed that in Gotri pH, TSS, Fluoride, COD, BOD and Chloride had high positive loadings with component 1 while Acidity had moderate negative loading with PC1. In PC2 Total Hardness and Sulphate had high positive loadings similarly Ca- Hardness had positive loading with PC3, Alkalinity and positive loading while that of DO had high negative loading of -0.9 with PC4. Turbidity, conductivity, and TDS had positive loading with PC5 and lastly Ammonical Nitrogen which is known as the one of the most important elements for the survival of the life in aquatic (M.P.& J.J,2015) had positive loading with PC6 and Nitrate and Phosphate and high negative loading. Looking loading for the Harni lake-pH, TDS, Conductivity, Fluoride, DO and Chloride had positive loading with PC1 while Turbidity had contract loading with PC1. With PC2 TSS, Nitrate and Phosphate had positive loading and COD had negative loading. Ca-Hardness, Sulphate had positive loading with PC3 while Hardness had positive loading with PC4. With PC5 two variable had high loading in which Alkalinity had high negative loading and Ammonical Nitrogen had high positive loading. With PC6 Acidity had positive loading.

Table 76 Component loadings

Component	Water bodies	pH	TDS	TSS	Conductivity	Temperature	Turbidity	Colour	Fluoride	Acidity	Alkalinity	Total Hardness	Fecal Coliform
PC1	a	0.15	-0.73	-0.27	-0.35	0.78	-0.14	-0.80	-0.04	-0.78	-0.56	-0.92	-0.20
	b	-0.31	0.94	0.04	0.68	0.05	0.81	0.04	0.76	0.68	0.33	0.81	0.04
	c	-0.06	0.67	0.77	0.48	0.09	0.27	0.56	0.70	0.61	0.46	0.96	0.26
	d	-0.07	-0.68	0.08	-0.63	0.63	0.54	0.29	-0.46	0.87	0.78	-0.10	0.68
	e	0.41	0.19	0.63	0.54	-0.59	-0.61	-0.74	-0.20	-0.55	0.11	-0.25	-0.48
	f	0.80	0.88	0.68	0.17	-0.11	0.16	0.44	0.80	0.31	0.69	0.49	0.85
	g	0.73	0.76	0.65	0.02	-0.13	0.64	0.50	0.66	0.53	0.20	0.76	0.457
	h	-0.30	-0.49	-0.09	-0.57	-0.26	0.20	-0.01	-0.82	0.18	0.68	-0.15	0.51
	i	-0.37	0.38	-0.63	0.39	0.53	0.43	-0.21	-0.42	0.56	0.39	0.81	-0.21
PC2	a	0.63	0.34	-0.35	0.78	0.11	-0.40	0.17	0.83	0.18	-0.15	0.20	0.45
	b	-0.52	0.22	0.21	0.63	0.14	-0.22	-0.69	-0.21	-0.51	-0.07	0.35	-0.16

Component	Water bodies	pH	TDS	TSS	Conductivity	Temperature	Turbidity	Colour	Fluoride	Acidity	Alkalinity	Total Hardness	Fecal Coliform
	c	-0.01	0.08	-0.01	0.03	-0.67	0.50	0.21	-0.34	-0.27	-0.17	0.06	-0.82
	d	-0.34	0.52	0.19	0.46	0.09	0.14	0.40	-0.25	0.18	-0.20	0.86	-0.19
	e	-0.51	-0.12	0.60	0.51	-0.39	-0.05	-0.51	0.68	0.63	0.10	0.67	-0.71
	f	-0.25	0.20	0.18	-0.53	-0.51	0.38	0.14	0.28	0.58	0.08	0.66	-0.12
	g	0.29	-0.44	-0.36	-0.62	0.40	0.07	-0.51	-0.41	-0.29	-0.09	-0.28	0.125
	h	-0.72	-0.38	-0.62	-0.12	0.18	-0.76	-0.82	-0.23	-0.72	-0.16	-0.62	0.25
	i	0.04	0.68	0.09	0.80	-0.24	0.21	-0.50	-0.03	-0.61	-0.50	0.49	0.06
PC3	a	0.19	0.12	0.46	0.41	0.05	0.83	-0.31	-0.12	-0.16	0.35	0.15	-0.71
	b	0.22	-0.03	-0.17	0.20	0.17	0.17	0.62	0.45	-0.22	-0.56	-0.38	-0.60
	c	-0.25	0.47	-0.03	0.71	-0.15	-0.43	0.14	0.47	-0.54	-0.34	0.03	-0.11
	d	-0.58	0.19	0.86	0.30	-0.29	0.42	0.61	-0.01	-0.07	0.07	-0.14	0.16
	e	0.41	-0.39	0.24	0.20	-0.17	-0.05	-0.25	0.18	0.08	-0.76	-0.67	-0.42
	f	0.44	-0.08	0.16	-0.45	-0.35	0.11	-0.61	0.26	-0.55	0.07	-0.27	0.36
	g	0.07	-0.43	-0.26	-0.50	-0.21	-0.42	0.25	-0.33	0.51	-0.49	0.06	0.716
	h	-0.23	-0.11	0.16	0.20	0.17	-0.34	-0.37	-0.09	-0.13	0.34	0.71	-0.36
	i	-0.33	0.51	0.13	0.32	0.58	-0.68	-0.03	0.06	0.02	0.19	0.13	0.88

Component	Water bodies	Ca-Hardness	Mg-Hardness	COD	DO	BOD	Chloride	Ammonical Nitrogen	Total Kjdahl Nitrogen	Nitrate	Phosphate	Sulphate	Total Coliform
PC1	a	-0.71	-0.52	0.55	0.53	0.39	-0.75	-0.43	-0.41	-0.47	-0.57	0.24	0.09
	b	0.71	0.68	-0.21	-0.18	-0.35	0.72	0.66	0.46	0.61	0.73	-0.18	-0.04
	c	0.61	0.82	-0.57	-0.49	-0.50	0.57	0.29	0.36	0.12	-0.38	0.08	0.08
	d	0.56	-0.52	-0.07	0.55	0.16	0.15	0.45	0.07	0.65	-0.22	-0.40	0.80
	e	-0.38	0.08	-0.62	-0.40	0.69	0.62	0.52	0.65	-0.72	0.52	-0.33	-0.58
	f	0.20	0.44	0.21	0.19	0.52	0.47	0.64	0.57	0.63	0.81	-0.03	0.68
	g	0.27	0.49	0.44	0.67	0.20	0.70	-0.50	0.35	0.41	-0.07	0.61	0.35

Component	Water bodies	Ca-Hardness	Mg-Hardness	COD	DO	BOD	Chloride	Ammonical Nitrogen	Total Kjdahl Nitrogen	Nitrate	Phosphate	Sulphate	Total Coliform
	h	0.30	-0.64	-0.53	-0.02	-0.68	-0.11	0.85	0.65	-0.37	-0.63	-0.14	0.31
	i	0.68	0.54	0.60	0.75	-0.37	0.51	-0.49	-0.69	-0.05	-0.42	0.07	-0.51
PC2	a	-0.30	0.62	0.39	-0.20	0.54	0.32	-0.47	-0.62	-0.12	0.02	0.64	0.69
	b	0.34	0.20	0.80	0.36	0.20	0.08	-0.45	-0.23	-0.13	0.16	0.84	-0.64
	c	0.07	0.02	0.18	-0.50	-0.15	0.24	0.17	0.73	0.34	0.70	-0.62	-0.93
	d	0.67	0.62	0.65	0.58	0.70	0.13	0.26	-0.39	-0.21	-0.50	0.32	0.08
	e	0.44	0.59	-0.14	0.40	-0.37	-0.18	-0.30	-0.37	0.21	0.18	0.59	-0.74
	f	0.73	0.09	0.03	-0.34	0.06	0.70	-0.62	-0.66	-0.55	-0.39	-0.74	0.08
	g	-0.46	0.27	0.85	0.59	0.73	-0.33	-0.56	-0.46	0.43	0.24	0.41	0.07
	h	-0.75	0.10	0.42	-0.34	0.26	-0.38	0.17	-0.25	-0.66	-0.01	0.26	-0.20
	i	0.35	0.44	-0.39	-0.24	-0.26	0.21	0.73	0.42	0.31	0.39	0.22	-0.26
PC3	a	0.00	0.21	0.53	0.09	0.57	0.08	0.18	-0.19	-0.12	0.46	0.40	-0.65
	b	-0.53	0.23	0.13	-0.66	0.42	0.17	-0.07	-0.66	0.51	0.48	0.30	-0.29
	c	-0.28	0.24	0.60	0.11	0.70	0.58	-0.10	-0.30	0.29	-0.16	-0.01	-0.05
	d	-0.16	-0.07	-0.28	-0.25	-0.43	-0.82	-0.57	-0.27	0.59	-0.34	0.48	0.32
	e	-0.61	-0.34	-0.20	0.02	-0.43	0.26	-0.69	-0.58	-0.48	-0.45	-0.12	-0.06
	f	0.33	-0.72	-0.34	-0.06	-0.59	-0.41	-0.11	-0.33	0.31	0.31	-0.38	0.41
	g	0.25	-0.24	0.18	-0.09	-0.55	0.01	-0.26	0.09	0.05	-0.38	-0.21	0.84
	h	0.46	0.43	-0.07	-0.79	-0.34	0.63	0.28	0.41	-0.16	0.53	0.15	-0.52
	i	0.40	-0.43	-0.20	0.12	0.41	-0.05	0.09	0.03	-0.05	-0.41	0.20	0.66

Considering the first two rotated components biplot is constructed as shown in Figure 48. This help us to visualize which all variables are coming together with respect to PC1 and PC2. Observing all plots in figure we can see that majority of parameters of Gorwa, Gotri, Mothnath, Dhobi Lake were in 1st and 4th quadrant. While for Danteshware, Kamala Lake all parameters are scatted in all quadrants. On the other hand, for Harni parameters were concentrated in 3rd and 4th quadrant.

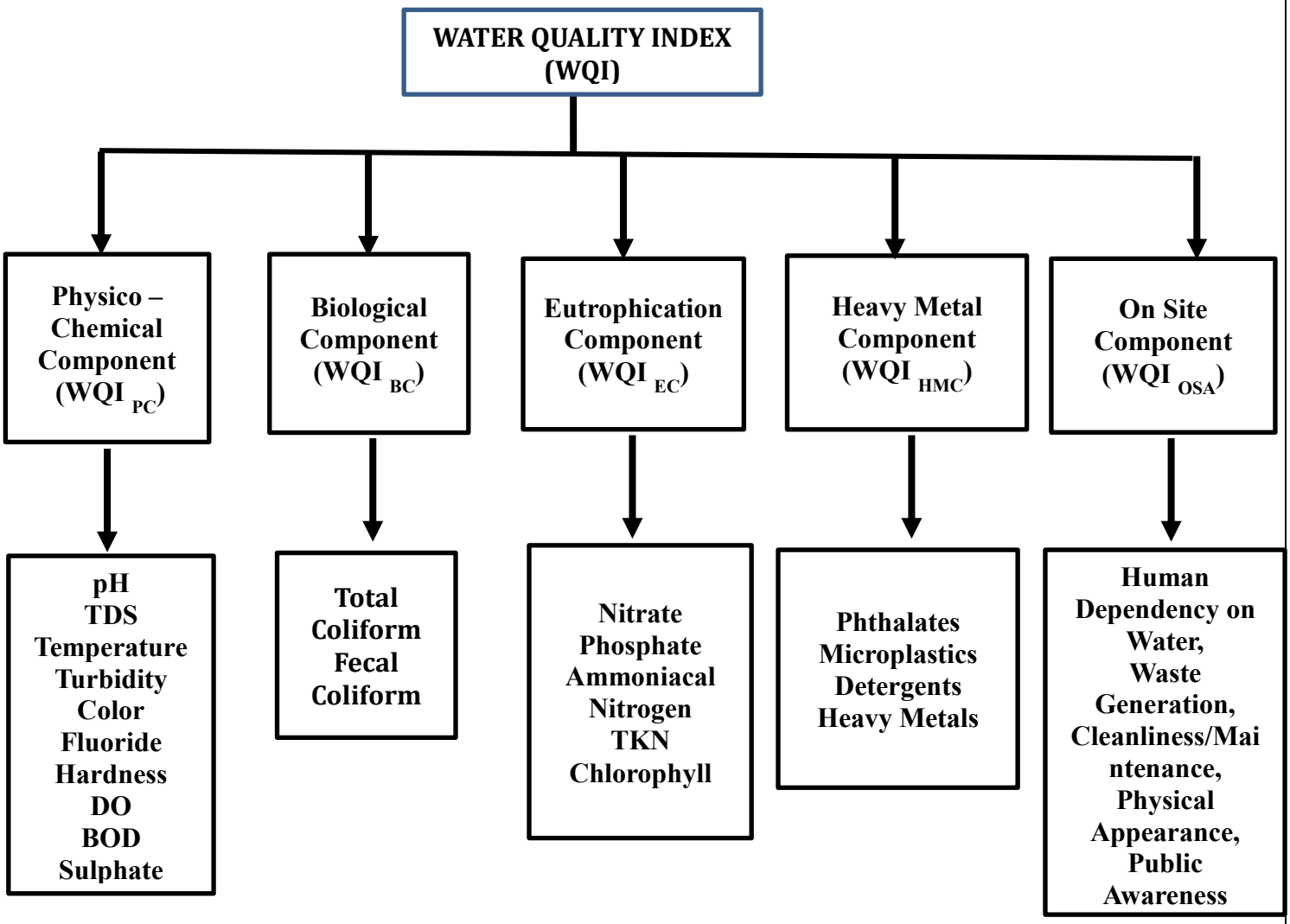
From the statistical study, using descriptive analysis and Principal component analysis, parameters dominating the water bodies can be identified. The concept of modified index suggested above can be applied after running statistical analysis for better and accurate index interpretation.

4.6 Development of New Water Quality Index

In the suggested index, we have divided parameters taken into calculation into 5 factors i.e., physico-chemical, biological, eutrophication, heavy metals and on-site activities based on study carried out during 4 year of study period 2018-2021.Weightage method seen commonly for many indices is also taken here to justify the dominance of a particular parameters based on scale of 1 to 4.Range selection is also included in calculation process of WQI here and output value is concluded in form of percentage weightage from 0 to 100%. The resultant index value is rationalised at end to avoid to greater value of WQI. Parameters taken into consideration for all factors are given in table. Selection of all these parameters is purely based on results obtained during the study. Weightage and range selection example are suggested on table 77.

Advantages of suggested index:

1. Inclusion and deletion of any parameters based on parameters which are dominating for any particular water body.
2. Weightage method is free from fixed weightage system assigned to other indices.
3. Range selection is free from fixed assigned range method.
4. Inclusion of heavy metals and other important parameters like phthalates, detergents and microplastics for the index calculation based on their quantitative anaylsis during study period. These particular factors can be skipped based on results of the water body studied.
5. Inclusion of one of the most important factors in the suggested index is addition of human intervention, anthropogenic stress received by the water body which is mostly seen the main cause of pollution in urban water bodies. Human dependency on water, waste generation cleanliness / maintenance, physical appearance, public awareness around water bodies for maintenance are included for calculation of WQI.
6. In the suggested index, one can delete any of the factors based on the results obtained on from the study. i.e., if traces of heavy metals and eutrophication are nil, both factors can be deleted and addition of other parameters which are important for the study can be included and their range selection must be done for weightage percentage calculation.
7. WQI range is decided on the scale of 1 to 5, for common people and people living around the water bodies to easily interpret the resultant WQI value and its interpretation as large WQI values many a times confuses people.



$$WQI = WQI_{PC} + WQI_{BC} + WQI_{EC} + WQI_{HMC} + WQI_{OSA}$$

Table 77(i) Calculation tables for Suggested Index

Weightage	Classification
1	Least Important
2	Moderately Important
3	Important
4	Highly Important

Table 77 (ii) Calculation tables for Suggested Index

Parameter	100	75	50	25	0
pH	6.50–7.50	6.00–6.49/ 7.51–8.00	5.50–5.99/ 8.01–8.50	5.0–5.49/ 8.51–9.00	<5.00 >9.00
Dissolved oxygen	5.50–6.50	4.50–5.50	3.50–4.50	2.00–3.50	<2
Fecal coliform	0–10	$10–10^2$	$10^2–10^3$	$10^3–10^5$	$>10^5$
Phosphate	0–0.002	0.16–0.02	0.40–0.16	0.40–1.00	>1
Nitrate	0–10	10–20	20–50	50–100	>100
Turbidity	0–5	5–15	15–50	50–100	>100

Table 77 (iii) Calculation tables for Suggested Index

Factors	Weightage	Rationalized Weight
Physico Chemical	100	1
Biological	100	1
Eutrophication	100	1
Heavy metals	100	1
On site Activities	100	1
Sum	**500**	**5**

Table 77 (iv) Calculation tables for Suggested Index

WQI Range	Classification of Quality of water
0- 1	Heavily Polluted
1-2	Polluted
2-3	Acceptable
3-4	Good
4-5	Excellent