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Physicochemical assessment of two freshwater dams from Jawhar, Palghar (M.S.) India

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Abstract

The present study aims to investigate the water quality status and seasonal variation of two prominent freshwater reservoirs, Jaysagar Dam and Jamsar Dam situated in Jawhar Tehsil of Palghar District, Maharashtra. The physicochemical analysis was conducted over a period of two years from June 2021 to May 2023. The samples were collected twice a month from designated stations and analyzed for key parameters including Atmospheric Temperature (AT), Water Temperature (WT), Rainfall (RF), pH, Turbidity (NTU), Dissolved Oxygen (DO), Salinity (Cl^-), Alkalinity (CO_3^{2-} and HCO_3^-), Calcium (Ca^{2+}), Silicates (SiO_2), Phosphate (PO_4^{3-}–P), Nitrate (NO_3^-–N), Nitrite (NO_2^-–N), Ammonia (NH_3–N), and Optical Density of Chlorophyll Pigment (OD Chl.). The findings from both the stations revealed variations between the water parameters, AT ranged between 15.0 to 27.2^{0}C, WT 18.3 to 29.1^{0}C, highest RF with 1452.4 mm precipitation recorded in July 2022, pH 6.22 to 8.46, turbidity 4.00 to 15.12 NTU, DO 4.52 to 8.60 mg/l, Cl^- 2.34 to 11.65 mg/l, CO_3^{2-} 1.90 to 15.60 mg/l, HCO_3^- 30.90 to 200.10 mg/l, Ca^{2+} 8.89, to 42.30 mg/l, SiO_2 4.98 to 23.72 mg/l, PO_4^{3-}–P 0.018 to 0.061 mg/l, NO_3^-–N 0.20 to 9.10 mg/l, NO_2^-–N 0.01 to 0.09 mg/l, NH_3–N 0.019 to 0.097 mg/l, and OD of Chlorophyll pigment ranged between 0.080 to 0.520. All the parameters were found to be within permissible limits. These results provide baseline data for Jawhar's freshwater ecosystem, which helps to assess and manage regional water quality.

Introduction:

The Western Ghats is well-known global biodiversity hotspot in India. They are the birthplace of numerous rivers, and provides waters for drinking, irrigation, and hydropower to countless people [Chandrakanth et al., 2004]. Maharashtra, including the Palghar region, significantly contributes to the diverse flora and fauna in

the eastern area, such as Jawhar. Lotic, lentic water and wetlands compose a freshwater ecosystem. A lentic freshwater ecosystem is any standing water body, including lakes and reservoirs, that has a strong bond with the surrounding drainage basin through the influx of chemical components transported via groundwater and free-flowing surface waters of streams and rivers as a lotic ecosystem [Wetzel, 2013]. Studies from Palghar and wider Maharashtra demonstrate that pH, hardness, nitrate, phosphorus, and oxygen-demand metrics shift across monsoon, winter, and summer, sometimes enough to change the assessed trophic state of a lake or pond [Gadhi et al., 2025]. Recent studies suggest that seasonal variations were observed in the lakes of Palghar, which maintained better water quality despite influx from local agriculture runoff [Macchi et al., 2025 & Mule et al., 2019]. Similarly, in India freshwater bodies are unprotected and vulnerable to environmental degradations, increasing population, industrial growth, and urbanization. T aquatic atmosphere of water bodies getting influenced resulted in mishandling and ignorance by the public [Mahananda et al., 2010]. Earlier investigations on freshwater bodies in Maharashtra, such as studies on Visapur dam and Kaneri lake, have consistently highlighted the dynamic nature of aquatic ecosystems and the importance of consistent monitoring to find out variations in aquatic quality [Bhalsingh & Pokale, 2026]. The winter, summer, and monsoon seasons show seasonal fluctuations in various physicochemical parameters [Jadhav et al., 2013]. To date, hydrobiological studies on these reservoirs have not been carried out, underscoring the significance of the present work.

The present study aims to assess key water quality parameters and seasonal variations in samples drawn from two lentic freshwater dams. It further contributes to regional freshwater ecosystems research by investigating physicochemical parameters, complementing studies on other reservoirs across Maharashtra.

Material and Methods:

The present investigation was conducted on two freshwater dams located in Jawhar tehsil of Palghar District, Maharashtra, India. Physio graphics of the Jaysagar Dam as station 1 show a coordinate of latitude $19^0$55’41” N and longitude $73^0$13’24” E and Jamsar Dam as station 2 show a coordinate of latitude $19^0$58’7” N and longitude $73^0$14’15”. These two stations are 10 km apart and represent lentic ecosystems of regional importance.

Water sampling was carried out fortnightly between 6.00 am and 7.00 am, twice a month from each station for two-years, from June 2021 to May 2023.

Water samples were collected in pre-cleaned, 2-liter high-density polyethylene bottles from a depth of 30 cm below the surface water. Samples were transported to the laboratory after collection. AT and WT [ºC] were recorded in situ using a calibrated centigrade thermometer, and annual rainfall (mm) data was obtained from the Maharain website. Fixation of oxygen was done at the site for the estimation of DO in water. Samples were analyzed using protocols suggested by the American Public Health Association [APHA, 2017]. Classical variants like Harvey's titration for salinity, Nesslerization for ammonia [Goel et al., 1984], and alkalinity [Theroux et al., 1943] were employed to ensure continuity with prior Indian limnological studies. pH was measured using a digital pH meter, and turbidity was measured by a turbidimeter. DO was determined by modified Winkler's method. Estimation of calcium was done by the EDTA titrimetric method, silicate by the calorimetric molybdosilicate method, phosphate by the colorimetric stannous chloride method, nitrate-nitrogen by calorimetric cadmium reduction method, and nitrite-nitrogen by the diazotization coupling method, and the optical density of chlorophyll pigment was measured colorimetrically. Chemical parameters are expressed in mg/l except for pH, turbidity, and OD of chlorophyll pigment. Recorded values from both the sites were tabulated in tables 1 and 2. Seasonal variations were assessed across monsoon, winter, and summer periods.

RESULTS AND DISCUSSION

Results of fortnightly variations of different physicochemical parameters are represented in table 1 for Jaysagar dam station 1 and table 2 for Jamsar dam station 2. Seasonal variations were observed across physical and chemical parameters, with notable differences between the two sites.

Physicochemical Analysis:

Atmospheric temperature (AT): AT fluctuated seasonally, peaking during rainy and summer months. At stations 1 and 2, AT ranged between 15.0 to 26.2ºC and 16.1 to 27.2ºC, respectively.

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Table No. 1
Station 1- Jaysagar Dam- Fortnightly variations of various physicochemical parameters

Date	Atm. Temp. (°C)	Water Temp. (°C)	pH	Turbidity (NTU)	DO (mg/L)	Salinity (Cl^-) (mg/L)	Rainfall (mm)	Alkalinity (CO_3^{2-}) (mg/L)	Alkalinity (HCO_3^-) (mg/L)	Calcium (Ca^{2+}) (mg/L)	Silicate (SiO_2) (mg/L)	Phosphate Phosphorous (PO_4^{3-}–P) (mg/L)	Nitrate Nitrogen (NO_3^-–N) (mg/L)	Nitrite Nitrogen (NO_2^-–N) (mg/L)	Ammonia Nitrogen (NH_3–N) (mg/L)	OD Chl Pig.
6/6/2021	25.6	24.6	7.29	4.63	5.34	3.91	34.9	11.50	105.10	42.30	18.23	0.021	3.13	0.05	0.061	0.355
21/6/2021	25.7	24.9	7.11	6.32	6.52	3.56	337.4	9.60	78.85	40.16	18.88	0.022	1.22	0.04	0.057	0.210
6/7/2021	26.2	23.4	7.05	7.98	7.10	3.34	249.7	8.40	71.70	38.00	19.14	0.035	0.65	0.03	0.044	0.180
21/7/2021	26.1	23.5	6.91	8.31	7.30	2.98	547.5	6.20	60.10	36.30	20.36	0.061	0.43	0.03	0.039	0.135
5/8/2021	25.1	23.1	6.85	9.23	7.66	2.85	744	4.40	56.50	34.60	21.67	0.058	0.39	0.02	0.035	0.143
20/8/2021	25.1	23.1	6.8	9.18	7.78	2.65	100.6	4.10	49.70	33.20	22.09	0.050	0.34	0.02	0.032	0.151
4/9/2021	24.7	23.9	6.95	8.57	7.17	3.20	220.8	3.55	45.36	31.90	23.68	0.059	0.25	0.01	0.027	0.170
19/9/2021	24.2	23.9	6.96	8.69	7.10	3.40	476.6	2.86	42.22	31.10	23.72	0.057	0.20	0.01	0.022	0.183
4/10/2021	23.7	24.1	6.98	7.96	7.02	3.71	496.8	2.60	40.80	30.82	22.98	0.051	0.98	0.02	0.023	0.180
19/10/2021	23.6	24.7	7.1	7.91	6.74	3.60	128.2	3.00	41.20	30.75	22.80	0.049	1.02	0.02	0.025	0.210
3/11/2021	23.9	25.1	7.14	7.27	6.38	3.62	0	2.90	50.20	31.10	21.41	0.047	1.17	0.02	0.031	0.235
18/11/2021	24.2	25.6	7.2	7.17	6.36	4.10	1	3.10	58.30	31.00	21.38	0.046	1.30	0.03	0.032	0.240
3/12/2021	20.1	25.1	7.19	6.80	6.16	4.00	100	4.20	85.50	30.03	20.55	0.041	1.89	0.03	0.041	0.274
18/12/2021	19.5	24.8	7.25	6.30	6.10	4.49	0.3	4.90	88.81	29.97	19.22	0.041	2.02	0.03	0.042	0.279
2/1/2022	19.1	23.9	7.19	5.88	5.72	4.83	0	5.70	90.55	28.40	18.90	0.038	2.36	0.04	0.039	0.280
17/1/2022	18.9	23.8	7.28	5.82	5.68	4.92	0	6.10	100.40	28.36	18.53	0.039	2.39	0.04	0.038	0.291
1/2/2022	19.6	23.7	7.29	5.50	5.50	5.31	0	7.00	109.00	29.63	17.00	0.043	2.51	0.04	0.039	0.314
16/2/2022	19.7	23.3	7.25	5.48	5.42	6.12	0	8.76	115.00	30.29	17.07	0.042	2.54	0.04	0.045	0.300
3/3/2022	21.0	24.1	7.3	5.36	5.36	6.85	0	9.10	118.10	31.90	16.48	0.044	2.45	0.05	0.053	0.339
18/3/2022	21.1	24.9	7.35	5.30	5.20	7.55	0.9	10.80	117.20	33.20	16.14	0.041	2.49	0.05	0.068	0.345
2/4/2022	22.3	27.8	7.81	5.11	4.88	8.38	0	12.10	120.60	34.58	15.60	0.039	2.72	0.05	0.071	0.392
17/4/2022	22.3	28.6	7.79	5.09	4.56	9.25	0	12.50	125.30	36.30	15.34	0.039	2.84	0.04	0.081	0.410
2/5/2022	23.6	28.5	7.81	4.91	4.70	10.00	0	12.90	115.80	38.00	14.09	0.035	2.98	0.05	0.079	0.433
17/5/2022	24.2	29.1	7.83	4.88	4.88	10.15	0	13.20	108.30	41.08	14.06	0.034	3.11	0.05	0.083	0.439
1/6/2022	24.8	28.9	7.85	4.69	4.94	11.05	0	14.50	103.20	40.68	14.91	0.029	3.55	0.05	0.076	0.405
16/6/2022	24.9	28.2	7.77	4.25	6.06	11.20	13.5	13.40	105.50	39.11	14.20	0.033	3.16	0.05	0.065	0.331
1/7/2022	24.1	26.2	7.16	8.32	7.76	9.62	91.3	11.70	99.30	37.55	15.76	0.042	2.87	0.04	0.051	0.221
16/7/2022	24.1	25.8	7.02	9.10	7.92	4.52	1095.6	8.20	82.10	37.03	16.92	0.044	9.10	0.03	0.042	0.190
31/7/2022	24.6	25.6	6.9	9.27	8.60	3.85	356.5	7.30	70.10	35.60	17.00	0.047	0.79	0.02	0.038	0.188
15/8/2022	24.9	27.3	6.87	9.23	8.32	3.26	439.6	6.00	52.30	34.22	18.57	0.029	0.47	0.01	0.039	0.157
30/8/2022	24.5	27.1	6.95	9.18	8.30	2.90	288	5.40	43.10	32.90	18.81	0.026	0.41	0.02	0.029	0.123
14/9/2022	24.9	26.5	6.96	8.57	8.10	2.79	209	4.30	38.20	31.06	19.63	0.022	0.29	0.01	0.026	0.098
29/9/2022	24.8	26.5	6.92	8.69	7.92	2.55	236.4	3.60	36.80	30.90	20.11	0.020	0.36	0.01	0.025	0.115
14/10/2022	23.1	28.7	7.03	7.96	7.70	2.37	78.2	1.90	30.90	31.82	21.30	0.024	0.56	0.01	0.019	0.185
29/10/2022	20.0	27.2	7.1	7.91	7.58	2.90	45.2	2.10	35.70	31.74	22.00	0.027	0.83	0.02	0.020	0.179
13/11/2022	19.1	26.9	7.2	7.27	7.36	3.22	0	2.90	39.40	31.26	22.19	0.033	1.02	0.02	0.023	0.230
28/11/2022	19.5	26.1	7.1	7.17	7.32	3.62	0	4.80	44.20	31.06	21.78	0.038	0.99	0.02	0.025	0.210
13/12/2022	21.2	26.0	7.33	6.80	6.98	3.80	0	6.10	58.40	29.98	21.16	0.048	1.13	0.03	0.029	0.242
28/12/2022	21.3	26.2	7.3	6.30	7.04	4.11	0	7.40	61.10	29.94	20.99	0.051	1.37	0.03	0.034	0.291
12/1/2023	18.9	26.1	7.28	5.88	6.92	4.32	0	9.50	75.30	28.30	20.51	0.052	1.41	0.03	0.035	0.360
27/1/2023	20.9	24.4	7.35	5.82	6.68	4.86	0	10.10	81.20	28.25	20.14	0.049	1.92	0.04	0.038	0.384
11/2/2023	15.0	18.3	7.41	5.50	6.34	5.00	0	12.20	100.10	28.09	19.67	0.046	2.23	0.04	0.040	0.400
26/2/2023	20.0	24.0	7.45	5.48	5.02	5.59	0	12.40	110.20	29.01	19.40	0.045	2.45	0.04	0.043	0.418
13/3/2023	21.5	27.21	7.38	5.36	5.18	5.89	12.7	12.80	119.70	29.39	18.23	0.043	2.54	0.04	0.052	0.450
28/3/2023	21.1	27.63	7.35	5.30	5.10	6.45	8.3	13.10	120.60	30.38	17.67	0.044	2.68	0.05	0.057	0.465
12/4/2023	24.7	28.52	7.42	5.11	5.68	6.94	0	13.20	119.10	30.90	16.80	0.041	2.93	0.05	0.063	0.442
27/4/2023	22.2	28.34	7.49	5.09	5.84	7.40	0	14.10	111.60	31.22	16.10	0.042	3.11	0.05	0.070	0.460
12/5/2023	23.6	28.55	7.56	4.91	5.94	8.15	0	14.30	102.80	33.66	15.11	0.040	3.22	0.05	0.074	0.471
27/5/2023	23.0	27.91	7.65	4.88	5.28	9.61	0	13.90	105.40	35.11	14.71	0.039	3.28	0.05	0.080	0.479

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Table No. 2
Station 2- Jamsar Dam- Fortnightly variations of various physicochemical parameters

Date	Atm. Temp. (0C)	Water Temp. (0C)	pH	Turbidity (NTU)	DO (mg/l)	Salinity (Cl^-) (mg/L)	Rainfall (mm)	Alkalinity (CO_3^{2-}) (mg/L)	Alkalinity (HCO_3^-) (mg/L)	Calcium (Ca^{2+}) (mg/L)	Silicate (SiO_2) (mg/L)	Phosphate Phosphorous (PO_4^{3-}–P) (mg/L)	Nitrate Nitrogen (NO_3^-–N) (mg/L)	Nitrite Nitrogen (NO_2^-–N) (mg/L)	Ammonia Nitrogen (NH_3–N) (mg/L)	OD Chl Pig.
13/6/2021	26.2	23.5	7.47	7.69	6.82	5.28	223.2	10.10	135.00	11.83	8.12	0.028	0.58	0.02	0.087	0.382
28/6/2021	25.6	24.1	7.32	8.21	7.25	4.90	262.8	9.20	115.20	10.14	7.68	0.022	0.29	0.01	0.065	0.260
13/7/2021	24.1	23.9	7.11	8.87	7.56	4.20	154.7	6.90	110.00	11.62	8.21	0.026	0.22	0.01	0.051	0.215
28/7/2021	25.0	24.2	6.90	9.21	7.92	2.95	1154.2	5.00	100.80	10.10	6.00	0.018	0.25	0.01	0.042	0.158
12/8/2021	26.2	25.1	6.58	10.19	8.16	3.09	150.9	4.00	95.50	14.42	8.55	0.020	0.26	0.01	0.039	0.166
27/8/2021	25.8	24.8	6.62	11.41	8.14	3.15	130.8	3.60	90.20	15.79	8.30	0.023	0.30	0.01	0.037	0.183
11/9/2021	24.2	25.5	6.60	13.05	7.84	2.84	318.8	3.20	88.60	13.06	8.42	0.029	0.36	0.09	0.032	0.156
26/9/2021	24.9	24.1	6.77	13.45	7.38	2.50	551.6	2.60	85.40	14.38	6.94	0.033	0.41	0.01	0.026	0.160
11/10/2021	24.2	23.3	6.84	14.00	6.88	2.34	358.5	2.10	88.20	14.22	7.29	0.039	0.44	0.01	0.021	0.180
26/10/2021	23.8	23.4	7.05	15.01	6.00	3.24	26.9	2.00	85.70	18.03	9.36	0.042	0.49	0.02	0.027	0.211
10/11/2021	21.0	24.0	7.21	15.12	5.68	4.52	1.0	2.00	83.30	19.80	11.15	0.044	0.51	0.02	0.030	0.265
25/11/2021	22.9	24.8	7.33	13.86	5.50	5.22	17.8	2.60	84.30	21.40	15.84	0.046	0.55	0.03	0.034	0.252
10/12/2021	23.8	25.2	7.35	12.64	5.96	6.11	82.5	3.00	95.40	20.76	16.37	0.049	0.59	0.03	0.039	0.260
25/12/2021	21.0	25.6	7.41	12.57	6.60	6.90	0	3.60	105.10	21.88	17.27	0.042	0.63	0.03	0.043	0.283
9/1/2022	19.5	23.7	7.25	11.63	6.10	7.20	0	4.10	140.40	22.48	19.22	0.035	0.70	0.02	0.041	0.301
24/1/2022	18.3	22.8	7.21	10.24	5.90	7.55	0	4.70	145.40	20.10	17.90	0.033	0.87	0.02	0.044	0.285
8/2/2022	16.5	19.4	7.26	9.87	5.50	7.99	0	5.30	150.20	19.81	17.26	0.038	1.02	0.02	0.048	0.302
23/2/2022	16.1	19.2	7.30	8.96	5.20	8.29	0	6.30	160.70	21.32	14.21	0.040	1.31	0.01	0.055	0.330
10/3/2022	17.2	22.3	7.32	8.49	4.90	8.44	0.8	7.20	172.20	23.64	13.59	0.042	1.23	0.04	0.062	0.322
25/3/2022	18.0	23.2	7.39	8.10	4.70	9.05	0	9.20	178.30	25.53	15.20	0.040	1.27	0.04	0.070	0.350
9/4/2022	20.5	23.9	7.99	7.78	5.10	9.40	0	10.90	181.40	26.22	16.02	0.039	1.32	0.04	0.085	0.403
24/4/2022	21.3	24.0	8.09	7.19	5.40	9.90	0	11.50	186.10	28.17	16.82	0.037	1.51	0.04	0.090	0.454
9/5/2022	22.1	25.8	8.46	6.92	4.90	11.09	0	12.00	190.20	29.21	17.71	0.032	1.68	0.05	0.095	0.471
24/5/2022	23.0	27.6	8.25	6.41	4.52	11.65	0	12.10	195.20	30.01	18.00	0.028	1.80	0.04	0.086	0.460
8/6/2022	23.2	28.1	8.31	6.32	5.00	10.40	0	12.90	200.10	31.26	18.57	0.024	2.07	0.04	0.079	0.492
23/6/2022	24.1	28.9	8.35	5.98	5.34	10.90	45.0	13.10	196.10	30.18	17.68	0.027	2.36	0.04	0.073	0.481
8/7/2022	24.8	28.2	6.81	7.68	5.96	8.76	303.9	12.20	175.10	24.00	14.36	0.036	2.09	0.02	0.065	0.320
23/7/2022	26.6	25.3	6.56	8.05	6.56	6.27	1028.4	9.70	161.60	16.43	9.72	0.029	1.20	0.01	0.057	0.200
7/8/2022	24.6	26.0	6.50	10.58	7.10	5.80	240.7	8.90	156.00	14.71	8.55	0.024	0.90	0.01	0.049	0.162
22/8/2022	24.2	25.3	6.22	11.17	7.44	4.14	583.7	7.00	153.50	11.22	6.47	0.026	0.57	0.01	0.041	0.155
6/9/2022	24.2	27.5	6.87	11.40	8.06	3.90	142.2	6.20	119.00	10.10	6.11	0.024	0.39	0.08	0.036	0.131
21/9/2022	24.5	26.1	6.95	12.09	8.40	3.47	356.2	5.50	106.40	8.89	4.98	0.022	0.34	0.01	0.029	0.110
6/10/2022	25.1	27.6	6.96	12.60	7.22	3.58	29.8	3.90	92.20	9.33	9.25	0.020	0.41	0.01	0.025	0.080
21/10/2022	25.8	28.1	6.92	13.18	7.42	3.25	113.8	2.80	85.30	9.09	9.12	0.024	0.48	0.01	0.020	0.127
5/11/2022	23.1	26.3	7.03	11.24	6.88	3.69	3.2	2.60	79.20	10.82	11.96	0.029	0.58	0.02	0.029	0.152
20/11/2022	22.8	27.0	7.10	10.92	6.22	4.10	0	3.10	84.30	12.34	10.64	0.036	0.89	0.03	0.036	0.210
5/12/2022	20.5	26.9	7.20	9.96	5.88	5.22	0	4.00	91.30	14.70	12.85	0.039	0.94	0.03	0.032	0.253
20/12/2022	20.2	26.1	7.10	9.87	5.28	6.00	0	5.50	100.00	18.31	14.71	0.042	1.13	0.03	0.030	0.280
4/1/2023	20.8	23.4	7.33	9.05	5.12	6.36	0	6.80	110.40	19.15	13.77	0.048	1.26	0.03	0.038	0.300
19/1/2023	19.9	22.3	7.30	8.89	6.10	6.88	0	8.10	124.70	20.00	13.21	0.047	1.20	0.02	0.042	0.340
3/2/2023	18.9	21.4	7.18	8.40	6.66	7.03	0	9.40	133.10	21.48	14.15	0.049	1.46	0.02	0.047	0.401
18/2/2023	20.3	22.9	7.75	8.78	7.14	7.46	0	11.00	167.90	22.64	14.93	0.045	1.75	0.02	0.050	0.448
5/3/2023	22.9	24.4	7.72	7.95	7.80	8.00	0	12.60	180.20	24.32	15.23	0.043	1.88	0.03	0.054	0.475
20/3/2023	23.5	26.9	7.69	7.20	7.00	7.90	18.0	13.10	189.60	26.10	16.45	0.041	2.00	0.04	0.063	0.490
4/4/2023	23.8	28.1	7.80	6.91	6.86	8.51	3.0	13.90	160.50	28.41	17.12	0.042	2.11	0.04	0.069	0.453
19/4/2023	24.1	28.6	7.98	6.70	6.36	9.33	0	14.50	152.20	28.89	17.34	0.039	2.19	0.05	0.077	0.466
4/5/2023	24.5	26.5	8.03	6.38	5.94	10.19	0	15.10	144.10	29.62	18.60	0.040	2.22	0.05	0.082	0.494
19/5/2023	25.4	27.2	8.13	5.86	5.62	10.68	0.0	15.30	130.30	30.01	17.37	0.038	2.31	0.05	0.091	0.502
3/6/2023	27.2	28.7	8.21	4.00	5.18	11.05	0.3	15.60	119.30	32.50	15.02	0.035	2.52	0.05	0.097	0.527

Water Temperature (WT): The WT was consistently higher than AT, peaking during the summer. Values for stations 1 and 2 ranged from 18.3 to 29.1ºC and 19.2 to 28.9ºC, respectively. The water bodies in the Indian subcontinent exhibit a temperature range between 7.8 ºC to 38.5 ºC [Singhal et al., 1986].

pH: Both the stations reflected slightly acidic to more alkaline conditions. pH ranged between 6.8 to 7.85 and 6.22 to 8.46 at station 1and 2, respectively.

Turbidity: The values for turbidity ranged between 4.25 to 9.27 NTU, and 4.00 to 15.12 NTU at stations 1 and 2, respectively. Station 2 exhibited a higher turbidity value than station 1. Maximum values were recorded during the monsoon, while minimum were recorded during the summer.

Dissolved Oxygen (DO): DO values for stations 1 and 2 ranged from 4.56 to 8.60 mg/l and 4.52 to 8.40 mg/l, respectively. Average DO values were maximum in the monsoon and minimum during summer, as recorded.

Salinity (Cl^-): Both the stations revealed lower Cl^- values during the monsoon compared to the post-monsoon season. The stations 1 and 2 showed Cl^- between 2.37 to 11.20 mg/l and 2.34 to 11.65 mg/l, respectively. Maximum Cl^- values during summer and minimum during winter due to high temperature and evaporation of water [Shinde et al., 2011].

Rainfall: The rainfall plays a significant role in regulating the various seasonal biological rhythms. In 2021, total rainfall was 3572.3 mm across 110 rainy days. While in 2022, it decreased to 2854.4 mm with 93 rainy days. The highest monthly rainfall occurred in July [1265.8 mm] and in September [1091.5 mm] of 2021 and in July [1452.4 mm] and August [727.9 mm] of 2022. July 2022 recorded the single highest precipitation. These findings highlight rainfall as a key driver of hydrochemical variability in the reservoir ecosystem. Rainfall data source: https://maharain.maharashtra.gov.in

Alkalinity: Alkalinity acts as buffer system in freshwater to neutralize strong acids. Carbonate (CO_3^{2-}) values ranged between 1.90 to 14.50 mg/l and 2.00 to 15.60 mg/l at stations 1 and 2, respectively. Bicarbonate (HCO_3^-) values ranged from 30.90 to 125.30 mg/l and 79.20 to 200.10 mg/l at stations 1 and 2, respectively. Lower values were recorded during the monsoon, followed by an increase in the post-monsoon period [Jain et al., 2021].

Calcium (Ca^{2+}): Stations 1 and 2 exhibited values between 28.09 to 42.30 mg/l and 8.89 to 32.5 mg/l, respectively. Seasonal changes were apparent, with decreased values recorded in the monsoon and increased values in the post-monsoon

period. Comparative studies indicate that calcium concentrations in lakes and ponds generally range between 7.21 and 41.68 mg/l [Surana et al., 2010].

Silicate (SiO_2): The values ranged from 14.06 to 23.72 mg/l, and 4.98 to 19.22 mg/l at stations 1 and 2, respectively. The SiO_2 values were low during the monsoon due to dilution from precipitation influx, but surged in the post-monsoon period.

Phosphate (PO_4^{3-}–P): The value was recorded between 0.020 to 0.061mg/l and 0.018 to 0.049 mg/l at stations 1 and 2, respectively. The PO_4^{3-} level was lower during the monsoon due to dilution from rainwater inflow but increased after the post-monsoon period. Station 1 showed a higher PO_4^{3-} than station 2.

Nitrate (NO_3^-): The values recorded between 0.20 to 9.10 mg/l, and 0.22 to 2.52 mg/l at stations 1 and 2, respectively. Station 1exhibited a higher nitrate than station 2. Higher nitrate concentrations being found during monsoon months may be due to surface runoff compared to summer and winter months.

Nitrite (NO_2^-): The values ranged between 0.01 to 0.05 mg/l, and 0.01 to 0.09 mg/l at stations 1 and 2, respectively.

Ammonia (NH_3^--N): The values fluctuated between 0.019 to 0.083 mg/l and 0.020 to 0.097 mg/l at stations 1 and 2, respectively. Higher values were recorded during pre-monsoon.

Optical Density of Chlorophyll Pigment: Stations 1 and 2, exhibited values between 0.098 to 0.479 and 0.080 to 0.520. An increasing trend for OD values was observed during post-monsoon.

Conclusion

The investigation revealed prominent seasonal variations in parameters with site-specific differences reflecting localized catchment influences. In general, station 1 exhibited relatively higher WT, DO, Ca^{2+}, SiO_2, PO_4^{3-}–P, and NO_3^-–N levels than station 2, suggesting healthier ecological conditions and indicating an ecosystem closer to mesotrophic balance for sustaining aquatic biodiversity. In contrast, station 2 showed elevated levels of AT, NTU, Cl^-, CO_3^{2-}, and HCO_3^-, NO_2^-–N, NH_3–N, chlorophyll pigment and a broad range of pH, pointing that system at environmental stress, greater risk of algal blooms due to nutrient enrichment, and susceptibility to eutrophication. These findings contribute valuable baseline data for regional water quality monitoring and management. The water from station 1 is perfect for drinking purposes according to WHO and ISI standards, and the water from station 2 is ideal for agriculture and fish culture. The seasonal fluctuations in summer, monsoon, and winter seasons indicate variation among the physicochemical parameters.

Parameters beyond the permissible limit in monsoon season due to runoff from the catchment area of rainwater into reservoirs.

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