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PHYSICO-CHEMICAL ANALYSIS OF UPPER MORNA RESERVOIR, MEDSHI DISTRICT- WASHIM, MAHARASHTRA



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ABSTRACT

The study of various Physico-chemical parameters of Upper Morna Reservoir situated in Medshi, Washim district, Maharashtra was carried out for the period of two years i. e. From January 2012 to December 2013. Water samples were collected from four different sites named S1, S2, S3, and S4. Physico-chemical parameters such as Color, Water temperature, Turbidity, PH, DO, Carbon Dioxide, Alkalinity, Hardness, Chloride, Phosphate, Nitrates were analyzed monthly. By comparing four different sites, significant seasonal variation was observed during the study of various parameters. The results indicated that all the parameters were within the permissible limit hence the reservoir water can be used for irrigation, domestic and also for culturing fishes.

KEYWORDS :Physico-chemical parameters, Upper Morna Reservoir, Medshi, Water analysis.

INTRODUCTION

The physico-chemical parameters are very important in study of any environment, especially aquatic environment. Temperature, pH and dissolved oxygen are important factors, which control the exchange of nutrients between the sediment and water (Bais and Agrawal, 1990). The maintenance of a healthy aquatic ecosystem is dependent on the physical-chemical properties of water and the biological diversity. A large number of streams and rivers in India have been impounded to store the water for multipurpose beneficial uses like irrigation, fisheries, power generation and drinking water supply.

Tilkar et al.,(2013) reported different physico-chemical parameters like atmospheric and water temperature, pH, electrical conductivity, (TDS), acidity, alkalinity, carbon dioxide and dissolved oxygen in Mohari dam. Pulugandi (2014) analysed the water quality parameters in Vembakottai water reservoir, Virudhunagar district, Tamil Nadu. Lawson (2011) studied Physico-chemical parameters and heavy metal contents of water from the Mangrove Swamps of Lagos lagoon, Lagos, Nigeria. Machowski and Ruman (2004) studied changes in the chosen physico chemical parameters of the Srebrne lake and Kacze Doly lake waters (the Opolska Plain). Kumbhar et al., (2009) studied seasonal variation in physico-chemical parameters of Ujani Reservoir of Madha tehsil, district, Solapur.

The Water quality is also affected by its pollutant, which act an element existing in water such as dissolved oxygen or ammonia, nitrates. The Physico- chemical means are useful in detecting effects of pollution on the water quality but changes in trophic conditions of water are reflected in the biotic community-structure including species pattern, distribution and diversity.

MATERIAL AND METHODS

Site Description: The Upper Morna reservoir is located (18°36'44"N and 76°56'33.61'E) at Medshi, Malegaon Taluka in Washim district of Maharashtra. It is constructed on the Upper stretch of the Morna River, one of the minor river of Vidarbha region of Maharashtra and one of the tributary of the Purna River.

SAMPLING

Sampling period: Water samples were collected during season for a period of two successive years as under: 1. First year i.e. January 2012 to December 2013.

Topographic map of the site:

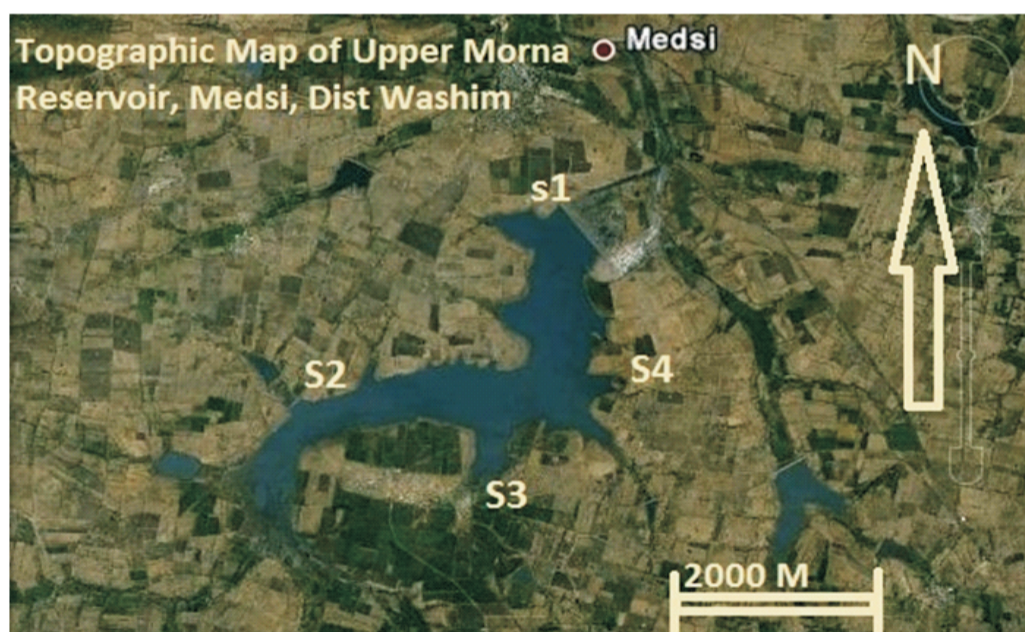


Fig: Topographic map Google Earth, the Upper Morna Reservoir showing four different sampling sites S1, S2, S3 and S4 located at North, West, South and East respectively.

Water samples collected monthly from four sites S1, S2, S3, S4 in morning 8 -12 a.m. which are preserved in a 1L polyethylene bottles which is properly labeled site, date, time of sampling. For the analysis of oxygen and free CO₂ the ground Stoppard glass bottles preferably BOD bottles is used. Samples were collected strictly as per the instruction given in "Standard Methods for the Examination of Water and Waste Water. 20th Edition Edited by Lenore S. Clesceri, Arnold E. Greenberg, Andrew D. Eaton, (1998) and brought to the laboratory for analysis.

RESULT AND DISCUSSION

Physico-chemical parameters analyzed during the period of two years of present study are discussed as under.

PHYSICAL PARAMETERS

Temperature:

The mean value of annual water temperatures were ranged between 18.25 ± 1.7078 to 29.75 ± 0.5000 °C during first year of study period while 19.50 ± 2.682 to 29.75 ± 0.9574 °C in second year. Water temperature in four sites S1, S2, S3, S4 were compared, the variation shown by calculated 'F' value, which was found 0.12 in 2012 and 0.15 in 2013 i.e. it did not show much variation in temperature in all four sites. In the present investigation water temperature found higher in the month of May and June and lower in November and December, This trend supported by the observation of (Kamble et al., 2009; Pandey et al., 2012 and Tayade 2012).

pH: pH in aquatic ecosystem indicates the alkalinity and acidity of water. During the study period pH value ranged from 7.23 ± 0.170 to 8.10 ± 0.121 in January to December 2012 and 7.13 ± 0.2500 to 8.63 ± 0.1708 in 2013. The pH value are found more in April, June in 2012 during the study period and less in the November, December in both the year 2012 to 2013 The analysis of variance 'F' value of pH found 0.63 in 2012 and 0.18 in 2013. The result found during the study period it indicate the pH was alkaline.

In present investigation pH value increases in summer and pre monsoon and decreases in winter, there were found somewhat fluctuation in all results, which in some reservoir the pH found to be maximum in summer ad minimum in winter reported by (Shinde et al., 2011 and Manjare et al., 2010). The highest pH in summer is might be due to removal of sufficient amount of CO₂ in the process of photosynthesis done by aquatic ecosystem given by Solanki and et al., (2005).

Conductivity:

Conductivity is an important parameter to know the quality of water. The mean values of conductivity ranged between 215 ± 7.746 µmhos/cm to 377.50 ± 22.883 µmhos/cm in year 2012 and 264.25 ± 41.89 µmhos/cm to 401.25 ± 13.149 µmhos/cm. in 2013. The conductivity shows lower value in December in both year and shows higher in February 2012 and July 2013. 'F' value of conductivity comparing four sides of water was found 0.04 to 3.96 in 2012 and 0.02 to 1.56 in 2013, which shows significant variation with magnesium and total hardness in 2012.

Conductivity was lower in winter season was reported by (Pandey et al., 2012). All water body of Upper Morna reservoir is maximum covered with the field area therefore organic matter influence the water conductivity, in rainy season organic soil are artificially drained, it increases the cation concentration of ponds.

Turbidity:

Turbidity of water was found 5.20 ± 0.5142 to 9.14 ± 0.153 NTU in the first year period January to December 2012 and 5.68 ± 0.4538 to 9.40 ± 0.7283 NTU in January 2013 to December 2013. Maximum turbidity observed in the month of June and all over the monsoon and minimum in December in both the year. As compared four sides analysis of variance shows 'F' value that is 0.12 in the year 2012 and 0.28 in the year 2013. In Monsoon season turbidity is increases due to rain water flow in the reservoir from all sides, similar result obtained by Agarwal and Rajwar (2010).

Total Dissolved Solids (TDS):

TDS in year 2012 ranged from 228.83 ± 28.798 to 375.36 ± 36.155 mg/L while it was found 210.01 ± 27.4095 to 391.07 ± 32.933 mg/L in 2013. Total dissolved solids were found to be maximum in the month of June, July and minimum in April. Due to agricultural land near the reservoir, runoff is rich and it increases the fertilizers, organic matter and salts in aquatic water, therefore the 391 mg/L TDS is found in June, similar result obtained by Makode (2012) of Charghad dam Amravati, Maharashtra. As comparing the four sides that was S1,S2,S3,S4 during study period 'F' value of TDS were found to be 0.42 in 2012 and 0.02 in 2013 which do not shows differ significantly.

CHEMICAL PARAMETERS

Dissolved Oxygen:

During the first year of investigation, mean values was found 3.90 ± 0.3559 to 7.70 ± 2.2494 mg/L and in the second year 2013 it was found 4.25 ± 0.5066 to 7.28 ± 0.4573 mg/L. Comparative accounts in all four sites S1, S2, S3, S4 shows the 'F' value of dissolved oxygen 0.66 in 2012 and 0.21 in 2013 during study period. Oxygen diffused in water is depends on temperature, total dissolved solids, Salinity and water movements. Dissolved oxygen was found maximum in the month of December and January and minimum in September, October. Similar results were recorded by Khan et al., (2012).

Carbon dioxide:

CO₂ is found in three forms i.e. freeCO₂, CO₃, or HCO₃ depends upon the pH and biological condition. The Carbon dioxide found 0.98 ± 0.7500 to 8.80 ± 0.8287 mg/L in 2012 and 0.95 ± 0.4435 mg/L to 9.23 ± 0.9394 mg/L in the year 2013. It found maximum in monsoon and minimum in March month in both the study year but presence of free CO₂ is also depends upon the time of sampling and seasonal fluctuations in water body. 'F' value of carbon dioxide found 0.66 in the year 2012 and 0.14 in 2013 when compared all four sides during study period. The total CO₂ concentration in water depends upon pH which is governed by the buffering effect of carbonic acid, carbonate and bicarbonate. Free CO₂ was recorded negligible at Kagal tank, high at Kanerwadi and moderate at kandalgaon tank by (Pailwan et al., 2008; Sharma et al., 1978) also pointed that, absence of free carbon dioxide in unpolluted water bodies.

Alkalinity

The alkalinity to natural waters is mainly imparted by three prominent bases; Carbonate (CO₃), bicarbonates (HCO₃) and hydroxide (OH), therefore alkalinity estimated as individual base.

CO₃ (Carbonate Phenolphthalein alkalinity): During the study period Carbonate was found 22 ± 2.8284 mg/L to 56 ± 23.44 mg/L in first year of study period and 23 ± 4.546 mg/L to 57.75 ± 14.338 mg/L in 2013. For the four sites annual result found was in 2012 'F' value of carbonate was 2.08 and 0.35 in the

year 2013, which was not show any significant difference during study period. Carbonate value increases in summer and minimized in monsoon season.

HCO₃ (Bicarbonate or Methyl Orange alkalinity): Annual changes found in bicarbonate value are ranged from 98.13 ± 1.652 mg/L to 163 ± 46.88 mg/L in 2012 and 94.02 ± 8.900 to 186.25 ± 36.73 mg/L in the year 2013. Bicarbonate value found to be minimum in June month and maximum bicarbonate alkalinity found in March of both the year. Bicarbonate value of all four sides when compared annually the 'F' value was 0.64 in first year and 0.20 in second year of study period which were also not shows much more fluctuations in values of four sides.

The total value of carbonate and bicarbonate increases in summer and decreases in the month of monsoon it may due to dilution water in rainy season and in summer less water increases the percentage of alkalinity in water body. The controversial results obtained by Verma et al., (2011) they found maximum value of alkalinity in monsoon and minimum during summer.

Total Hardness:

Total hardness of water was found 178.50 ± 47.613 to 300.50 ± 58.660 mg/L in 2012 and 164 ± 55.394 to 316.75 ± 23.824 mg/L in 2013. The maximum hardness of the reservoir water increases in February month in both the year and minimum hardness found in winter season during study period. Like was 'F' value found 3.64 in 2012 which shows significant difference in total hardness of all four sites while in 2013 'F' value was 1.23 which do not show any significant differences in all four sites.

The total hardness was recorded higher in summer, it might be due to decrease in water level and rate of evaporation of water, similar result observed by (Hujare, 2008; Manjare et al., 2010). Total hardness of water increases mainly due to the presence of (Ca²⁺) and magnesium (Mg²⁺) ions in every water body which may increases due the human washing clothes, bathing activities in Morna reservoir.

Calcium Hardness: During first year of study period calcium hardness found 8.30 ± 0.4999 to 43.40 ± 8.7741 mg/L and 8.50 ± 0.6683 to 46.87 ± 5.762 mg/L in 2013. The maximum Calcium hardness found in January month and minimum in monsoon in both the year. 'F' value of all four sites was 0.10 in 2012 and 0.04 in 2013. The maximum desirable limit of calcium in drinking water is 75 mg/l (W.H.O), therefore above recorded value of calcium, it indicate water is use for drinking purpose. Ravikumar et al., (2005) reported the maximum calcium hardness in April month in Ayyanakere tank, Harapanahalli town, Davangere district of Karnataka.

Magnesium Hardness: The magnesium hardness found in this reservoir was 25.82 ± 4.8272 mg/L to 63.34 ± 12.3281 mg/L in the year 2012 and 25.82 ± 4.8272 to 66.20 ± 6.2183 mg/L in 2013. 'F' value of Magnesium hardness was 3.96 which show significant difference in value of all four sites of the reservoir water in 2012 and in 2013, it found 1.54 in 2013 do not show significance difference Maximum hardness of magnesium was found in the month of February and minimum in winter season of both the year of study period. Similar result found by (Patil 2014) about magnesium. The permissible limit of magnesium of drinking water is 50 mg/l (W.H.O) but our result about magnesium was above 66 mg/l, so it may hazardous for drinking purpose.

CHLORIDE:

The chloride value of Upper Morna reservoir was ranged from 68.43 ± 6.2610 mg/L to 140.73 ± 3.338 mg/L in 2012 and 62.98 ± 5.8925 mg/L to 125.40 ± 16.4912 mg/L in 2013. When compared four sites 'F' value obtained as 0.13 in 2012 and 0.85 in 2013, which also not show any changes throughout the year. The chloride value was higher in summer and minimum during winter season in both the year

of study period. Similar result obtained by Shinde et al., (2011).

PHOSPHATE:

As the Upper Morna reservoir is totally surrounded from all sides by field area and totally water in reservoir is used for irrigation purpose, therefore it also necessary to study the phosphate level in water. The phosphate level during the first year of study was found 0.17 ± 0.0506 to 2.11 ± 0.4426 mg/l in 2012 and 0.21 ± 0.0680 to 1.58 ± 0.3077 mg/l in 2013. 'F' value was 0.06 in 2012 and 0.09 in 2013. The phosphate level was higher in monsoon season and lower in summer and winter season. Similar result obtained by (Arvindkumar 1995; Manjare, 2010 and Makode, 2012) that the maximum value of phosphate recoded in August and minimum in October i.e.in winter season. Due to surface water runoff, agriculture run off, washer man activities increases inorganic phosphate in water in rainy season therefore phosphate level increases in monsoon season.

NITRATE

Nitrates is highly oxidized form of nitrogen, in natural water due to runoff fertilizers, decayed vegetable and domestic waste are increases the amount of nitrogen in water.

Nitrate value ranged from 2.16 ± 0.1415 to 8.32 ± 0.6357 mg/l in 2012 and 2.74 ± 0.4699 to 8.30 ± 0.4315 mg/l in year 2013. The nitrates value was higher in monsoon season and recorded lower in late winter and summer season. All four sites in two years of study period shows comparative 'F' values 0.01 in 2012 and 0.09 in 2013 which not fluctuate in both years. The controversial result obtained by Dabhade (2006) i.e. high values of nitrates observed in winter season and gradually increased in summer season. Nitrates is act as nutrient for growth of plants, excess amount of nitrogen helps for rapid growth of algae and other plants in water. Nitrates is found very small amount in nature because ongoing process of growth and decaying. Most stable form of nitrogen is nitrates which enhances the growth of plankton density and primary production (Parida et al., 1999).

Table1 : One Way Analysis Of Variance for the data on various Parameters to compare four sites S1, S2, S3 and S4 of reservoir in the year 2012

S.N.	Parameter	Mean				'F' Value
		S1	S2	S3	S4	
1.	Temperature(°C)	24.75	24.46	24.83	25.33	0.12
2.	pH	7.61	7.78	7.80	7.79	0.63
3.	Turbidity(NTU)	7.37	7.46	7.51	7.71	0.12
4.	T.D.S. (mg/L)	274.23	261.03	286.49	275.61	0.42
5.	Conductivity(µmhos/cm)	317.75	313.58	310.92	323.58	0.11
6.	D.O. (mg/L)	6.43	5.62	5.97	5.69	0.66
7.	CO ₂ (mg/L)	4.80	4.68	5.07	4.99	0.04
8.	CO ₃ (mg/L)	39.92	29.17	27.17	32.83	2.08
9.	HCO ₃ (mg/L)	118.50	131.17	126.58	120.45	0.64
10.	Total Hardness(mg/L)	262.75	226.00	229.25	182.92	3.64*
11.	Calcium(mg/L)	29.26	26.92	27.35	26.21	0.10
12.	Magnesium(mg/L)	56.97	49.15	49.18	38.33	3.96*
13.	Chloride(mg/L)	97.86	92.53	93.69	92.56	0.13
14.	Phosphate(mg/L)	0.74	0.69	0.64	0.71	0.06
15.	Nitrate(mg/L)	5.05	5.04	5.00	4.89	0.01

Not Significant at 0.05 level

Tabulated F_{0.05} (3, 44) = 2.82

Table 2: One Way Analysis Of Variance for the data on various parameters to compare the sites S1, S2, S3 and S4 of reservoir in the year 2013

S.N.	Parameter	Mean				'F' Value
		S1	S2	S3	S4	
1.	Temperature(°C)	24.42	24.08	24.58	25.00	0.15
2.	pH	7.63	7.77	7.62	7.72	0.18
3.	Turbidity(NTU)	7.67	7.70	7.79	7.33	0.28
4.	T.D.S. (mg/L)	276.46	280.76	276.61	274.52	0.02
5.	Conductivity(μmhos/cm)	331.17	339.75	326.33	339.25	0.26
6.	D.O. (mg/L)	5.70	5.55	5.94	5.62	0.21
7.	CO ₂ (mg/L)	4.52	4.80	5.01	5.33	0.14
8.	CO ₃ (mg/L)	37.08	33.08	32.33	35.08	0.35
9.	HCO ₃ (mg/L)	127.45	129.74	122.93	122.32	0.20
10.	Total Hardness(mg/L)	255.33	238.33	227.00	213.17	1.23
11.	Calcium hardness(mg/L)	29.61	27.58	28.82	29.29	0.04
12.	Magnesium hardness(mg/L)	55.07	51.42	48.67	44.97	1.54
13.	Chloride(mg/L)	93.78	95.17	82.92	87.04	0.85
14.	Phosphate(mg/L)	0.65	0.65	0.64	0.72	0.09
15.	Nitrate(mg/L)	4.72	4.94	5.06	5.16	0.09

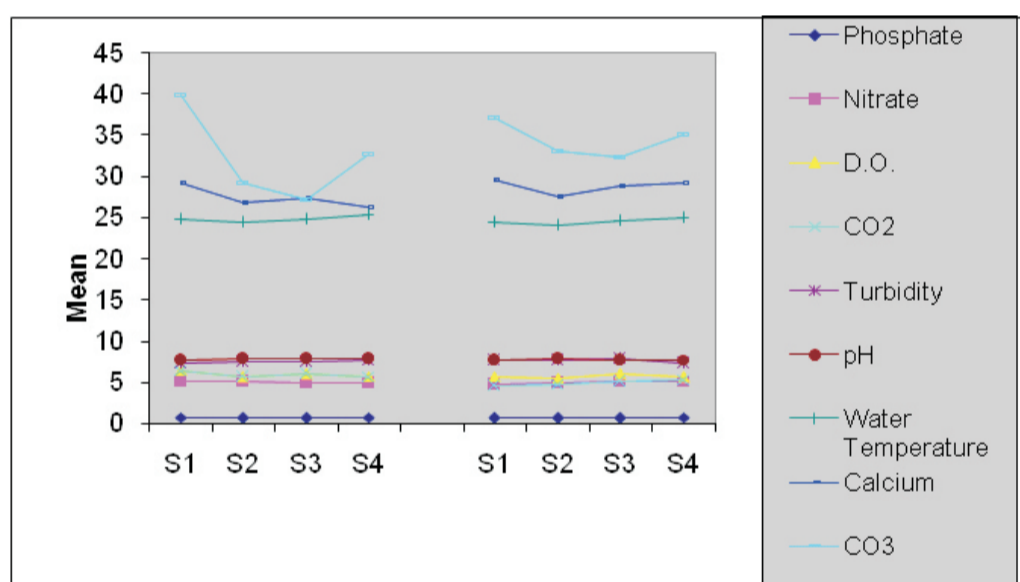


Figure 1: Site wise variation in pH, Turbidity, D.O., CO₂, CO₃, calcium hardness, Nitrates and Phosphate Level of Water during Study Period 2012-2013.

PHYSICO-CHEMICAL ANALYSIS OF UPPER MORNA RESERVOIR, MEDSHI DISTRICT- WASHIM, MAHARASHTRA

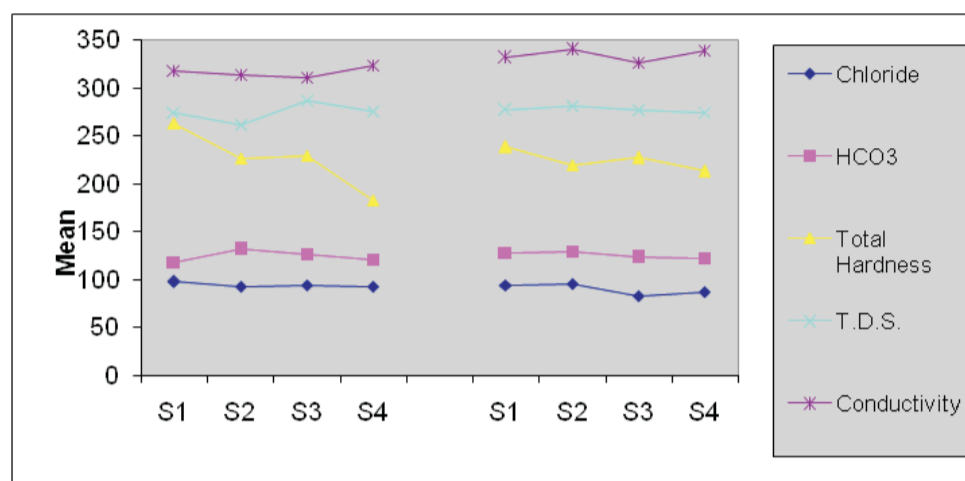


Figure2: Site wise variation Chloride, Total Hardness, HCO₃, TDS, Conductivity level of water during study period 2012-2013.

Table3: Monthly analysed physic-chemical parameters 2012-2013

2012		Parameters analyzed. →													
Month	Temp	pH	Turbidity	T.D.S.	EC	D.O.	CO ₂	CO ₃	HCO ₃	Total Hard.	Ca Hard.	Mg.Hard	Cl-	Phos	Nitrea
Jan	23.75	7.58	6.52	274.32	371.5	7.7	0.98	37.5	134.5	265	43.4	54.82	79.76	0.17	2.16
Feb	24.5	7.7	7.95	283.42	377.5	6.83	1.38	56.5	131.75	300.5	40.9	63.34	68.43	0.26	2.47
Mar	25.5	7.9	8.2	249.29	283.25	4.45	0.98	44.5	163	253.25	41.15	51.75	90.22	0.28	3.18
April	25.63	8.05	8.51	228.83	277.5	5.3	1.68	27.75	98.13	288.5	39.06	60.62	127.48	0.42	5.59
May	29.5	7.9	8.94	249.32	279.25	5.25	3.75	32	99.9	229	34.1	51.27	140.73	0.51	7.75
June	29.75	8.1	9.14	375.36	377.5	6.35	4.5	35.25	101.83	267.5	26.04	58.91	103.16	0.61	7.67
July	27.25	7.9	8.67	375.33	371.5	7.45	5.98	27.25	114.5	200.5	10.84	46.28	93.56	1.13	5.75
Aug	26.75	7.68	8.19	290.78	341	6.48	8.58	22	130.5	193	8.3	41.65	93.03	2.11	8.32
Sep	24.5	7.53	6.82	262.3	335.25	4.75	8.8	23.75	139.25	186.25	8.65	43.33	78.7	1.01	4.97
Oct	22.25	8.03	6.1	236.03	296	3.9	7.28	29.75	127.25	178.5	16.33	39.57	94.15	0.82	4.08
Nov	20.5	7.38	5.95	235.74	272.25	5.25	7.78	27	126.75	199.25	24.77	43.57	87.48	0.65	4.5
Dec	18.25	7.23	5.2	231.37	215	7.4	6.98	24	122.75	141.5	35.68	25.82	73.23	0.36	3.52

2013		Parameters analyzed. →													
Month	Temp	pH	Turb	T.D.S.	Cond	D.O.	CO ₂	CO ₃	HCO ₃	Total Hard	Calcium	Magnesium	Chl	Phos	Nit
January	22.75	7.4	6.55	257.87	357	7.23	1.15	47	131	283	46.87	57.66	76.69	0.21	2.74
February	24	7.78	7.64	293.36	357.25	5.45	1.38	57.75	123.75	316.75	45.45	66.2	62.98	0.36	2.46
March	25.25	8.45	8.08	239.02	313.25	4.68	0.95	48.25	186.25	262.5	43.01	53.55	76.71	0.35	2.71
April	25.5	7.53	8.22	210.01	297	5.18	2.2	32.25	98.5	285	38.86	60.05	121.42	0.41	5.36
May	28.25	7.15	9.06	255.04	303.5	4.18	3.68	27.5	99.3	237.75	34.95	50.62	125.4	0.56	7.53
June	29.75	8.63	9.4	391.07	370	7.03	4.3	35.75	94.02	261.5	27.59	57.07	91.16	0.60	8.3
July	27.25	8.3	8.67	374.95	401.25	6.93	6.05	31.5	122.25	195.75	14.21	44.29	95.1	0.89	5.9
August	26	7.35	8.13	306.06	361.5	5.75	9.23	26.5	128.75	203	9.18	47.29	87.5	1.58	7.9
September	24.75	7.8	7.53	275.33	317	4.45	9.28	23	147.25	204.5	8.5	47.82	91.88	1.11	5.48
October	22.5	7.58	6.63	232.31	346.75	4.25	6.8	29.75	133	174.75	15.61	38.83	83.98	0.74	4.34
November	19.75	7.13	5.91	264.44	320.75	6.05	7.93	26	120.5	213	26.78	45.43	87.01	0.67	4.04
December	18.25	7.13	5.68	225.68	264.25	7.28	6.05	27.5	122.75	164	34.89	31.5	76.91	0.49	2.86

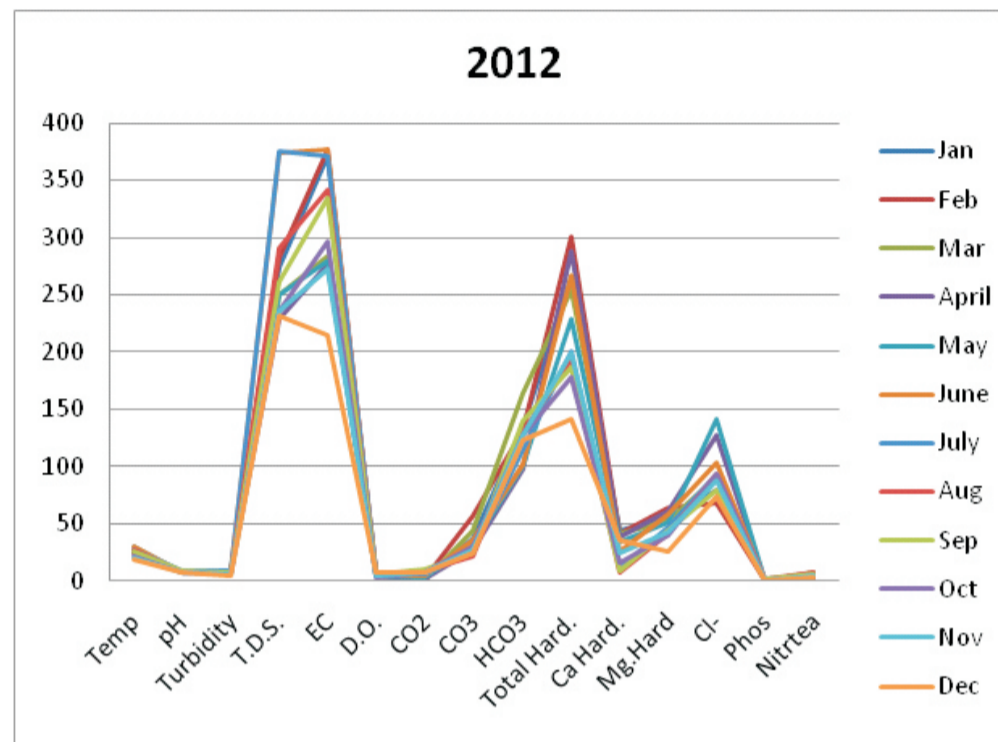


Fig3: monthly fluctuation in physic-chemical parameters in 2012.

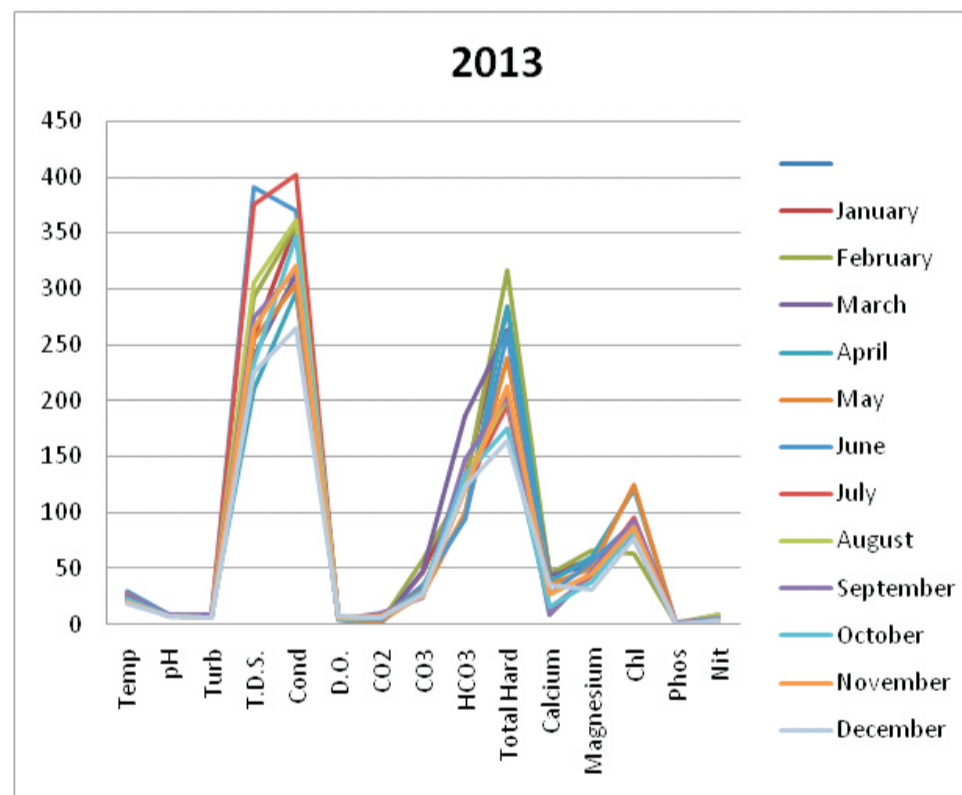


Fig4: monthly fluctuation in physic-chemical parameters in 2012.

CONCLUSION:

The "UPPER MORNA RESERVOIR, MEDSHI" are perennial reservoir and shows seasonal fluctuations in physico-chemical and biological parameters which affects the flora and fauna of the water it might be due to human interventions. Therefore, it was necessary to analyzed the physico-chemical parameters for the improvement of water biochemistry. Water in Upper Morna Reservoir is used by local people not only drinking purposes but also for washing of cloth and utensils, bathing purpose, cleaning animals therefore, it required to give proper guideline to the people situated near the reservoir, and also require maintaining the water quality. Mostly the reservoir water use for irrigation purposes because all the area surrounded the dam is field area, so during runoff water in monsoon the chemical fertilizers, pesticides are came inside reservoir and affects the flora and fauna of water body, so it need to conserve the water properly from it. Anthropogenic activities increases the pollution in reservoir so, it need proper instructions to people near the reservoir.

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