

A Statistical Examination Of Water Quality Of Ghagardara Pond Nanded, Maharashtra State

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Abstract: Present study deals with the study of the physico-chemical parameters of Ghagardara pond for one year in Nanded district (Maharashtra). The water quality in the Ghagardara pond was examined. The parameters like pH, turbidity, chloride, hardness, alkalinity, total dissolved solids, O₂, CO₂, sulphate, iron, ammonia etc were analyzed. Results revealed that all the parameters of pond water were within permissible limits according to Bureau of Indian Standards (BIS). Descriptive statistics such as mean, standard error were calculated & the Analysis of variance (ANOVA) was carried out to compare the parameters at different stations.

Keywords: Statistical analysis, Parameters, pond, Assessment.

1 INTRODUCTION

Water as a vast natural resource has been depleted and turned into scarce commodity due to increased usage catering to the need of ever-expanding population. The quality of water can be identified by physical, chemical and biological characteristics. Some ponds of India have been extensively studied by various workers (Michael, 1969; Saha, 1971; Vashist and Sharma 1975). The present study focuses on evaluation of the physicochemical status of pond water. Our goals are to compare the water quality in the Ghagardara pond in terms of water quality from September 2005 to August 2006.

2. Materials and methods

Ghagardara pond is located on Ghagardara River in Kandhar Taluka, Nanded District (MS). Ghagardara pond is an earthen pond 315 m in length with maximum height 19.84 m full tank level (FTL) 468.70 m & maximum water level (M.W.L.) 471.20 m. Four sampling sites were selected for the study. The water samples were collected for quality assessment from four stations at regular intervals for one year from September 2005 to August 2006. The water quality parameters like temperature, transparency, dissolved oxygen, carbon dioxide and pH were estimated from different sampling stations by standard methods as prescribed by Trivedi and Goel (1984) and APHA (1998). Sulphate and Iron were determined by using UV -Visible Spectrophotometer (UV- 1800).

2.1. Statistical Analysis

Descriptive statistics such as mean, standard error and percentage was calculated wherever necessary (Snedecor and Cochran 1967). The Analysis of Variance (ANOVA) was carried out as described by Zar, (2005). The data was depicted using appropriate graphs and diagrams (Kapur 1971).

3. Result

The water quality parameters of surface water of the Ghagardara pond from the four sampling stations are summarized in Tables-1 to 4. The mean temperature varied from 25.37 ± 0.2394 to 31.25 ± 1.4930 during monsoon seasons respectively. The pH value was maximum (8.2 ± 0.0239) in summer season at station 1 and minimum value was $pH 7.8 \pm 0.1315$ in the monsoon season at station 4. Transparency was highest with a mean value of $74.5 \text{ cm} \pm 3.2275$ obtained at station 3 in summer season and transparency was minimum ($60.75 \text{ cm} \pm 1.7970$) at station 4 in monsoon season. Dissolved oxygen levels fluctuated between 5.5 ± 0.3797 mg/L in summer season at station 1 and 10.24 ± 0.3953 mg/L obtained in winter season at station 2. Free CO₂ showed higher values (0.46 ± 0.0289 mg/L) in summer season at station 3 and lowest value free CO₂ 0.35 ± 0.0354 mg/L in monsoon season at station 2. The maximum amount of total dissolved solids (792 ± 85.0857 mg/L) was recorded in summer season at station 3 and lowest (311 ± 157764 mg/L) was observed in monsoon season at the station 4. TDS levels showed distinct changes during different seasons at all the stations. The chloride concentration varied from 81.25 ± 10.778 mg/L in summer season at station 2 and lowest value was recorded (30.25 ± 0.854 mg/L) in winter season at the station 3. The total hardness in the pond was found to be significantly higher in summer season. The mean hardness fluctuated between 294.72 ± 100.6185 mg/L in summer season at station 3 and the lowest value of the total hardness was recorded (122.32 ± 40.4270 mg/L) at the station 2. The total alkalinity was highest in winter season at station 2 and lowest value was observed in the monsoon season at station 4. The mean concentration of nitrate (5.6 ± 0.5317 mg/L) was obtained in monsoon season at station 3. A decrease was observed in the summer season at station 4. Phosphate concentration was significantly higher in monsoon season at station 4 and lowest value was recorded (1.6 ± 0.1315 mg/L) in summer season at station 1. Ammonia concentration was found to be highest in summer season at station 3 and lowest concentration of Ammonia value was recorded (0.88 ± 0.3960 mg/L) in monsoon season at station 1. Sulphate level was lowest in winter season at station 1. The concentration of Iron was maximum in winter season and lowest in summer season at station 2. The results were statistically analysed using ANOVA and it is observed that that the average Ammonia, sulphate and Iron levels month were significantly at $P < 0.05$.

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Table-1: Seasonal variation of Physico-Chemical Parameters at Station-1

Parameters	Monsoon Season		Winter Season		Summer Season	
	Mean	SE	Mean	SE	Mean	SE
Temperature (°C)	28.5000	±0.6455	26.0000	±0.4564	30.5000	±1.5546
pH	7.7500	±0.0645	7.8750	±0.1315	8.2625	±0.0239
Transparency (cm)	62.0000	±2.5249	65.5000	±1.9685	73.1250	±2.5607
Dissolved Oxygen	8.6750	±0.4250	9.5000	±0.7800	5.5500	±0.3797
Carbon dioxide	0.4000	±0.0500	Nil	Nil	0.4333	±0.1041
Total Dissolved Solid	305.0000	±21.0159	331.2500	±6.5749	432.5000	±34.7311
Chloride	33.2500	±3.8595	26.2500	±0.3227	41.7500	±8.7690
Total Hardness	147.5000	±4.2720	150.7500	±6.9926	167.0000	±2.8577
Calcium	39.5000	±5.7139	36.3400	±4.8960	45.0900	±0.6267
Total Alkalinity	230.7500	±13.4683	270.0000	±5.7735	263.7500	±4.7324
Phenolphthalein A.	35.0000	±0.2041	40.7500	±2.1065	36.6250	±0.8509
Nitrate	4.3500	±0.6958	2.9500	±0.3926	2.5250	±0.1315
Phosphate	2.9500	±0.7422	2.5000	±0.3488	1.6750	±0.1315
Ammonia	0.8875	±0.3960	1.3875	±0.0515	2.6500	±0.4031
Sulphate	13.1000	±0.5115	12.1250	±0.3449	16.2500	±1.1087
Iron	0.9375	±0.0554	0.4375	±0.1068	0.2100	±0.0091

All values are expressed in mg/liter except temperature pH, Transparency .

Table-2: Seasonal variation of Physico-Chemical Parameter at Station-2

Parameters	Monsoon Season		Winter Season		Summer Season	
	Mean	SE	Mean	SE	Mean	SE
Temperature (°C)	29.1250	±1.1434	25.6250	±0.3146	31.2500	±1.4930
pH	7.5750	±0.0479	7.9000	±0.0408	8.1750	±0.0629
Transparency (cm)	63.1250	±1.4197	65.5000	±1.9685	73.1250	±2.5607
Dissolved Oxygen	8.8750	±0.5735	10.2400	±0.3953	8.2250	±0.1031
Free Co ₂	0.3500	±0.0354	Nil	Nil	0.4000	±0.0866
TDS	375.0000	±61.4597	407.5000	±16.5202	742.4250	±71.4299
Chloride	58.0000	±4.5461	49.0000	±1.2910	81.2500	±10.0778
Total Hardness	122.3250	±40.4270	166.2500	±2.3936	275.0000	±32.2749
Calcium	40.3750	±0.4732	42.3750	±0.4802	60.0000	±3.2404
Total Alkalinity	203.7500	±2.3936	325.0000	±21.0159	218.7500	±4.7324
Phenolphthalein A.	52.0000	±2.3805	59.7500	±5.2182	45.2500	±1.7017
Nitrate	5.4250	±0.6872	4.0250	±0.0629	2.9500	±0.2102
Phosphate	6.4000	±0.8073	4.1250	±0.1493	3.0250	±0.1503
Sulphate	15.6500	±0.9768	14.2250	±0.3065	19.2750	±1.2257
Ammonia	1.2625	±0.0688	1.8250	±0.2437	3.0125	±0.4474
Iron	0.8500	±0.0354	0.4000	±0.0979	0.2025	±0.0180

All values are expressed in mg/liter except temperature pH, Transparency

Table-3: Seasonal changes of Physico-Chemical Parameters at Station-3

Parameters	Monsoon Season		Winter Season		Summer Season	
	Mean	SE	Mean	SE	Mean	SE
Temperature (°C)	27.5000	±1.0206	25.75	±0.323	29.3750	±0.7739
pH	7.7500	±0.0645	7.95	±0.155	8.2500	±0.0289
Transparency (cm)	61.0000	±0.9129	68.25	±0.629	74.5000	±3.2275
Dissolved Oxygen	6.5500	±0.4444	9.3	±0.813	7.7750	±1.2010
Free CO ₂	0.4000	±0.0500	Nil	Nil	0.4667	±0.0289
TDS	425.000	±58.3809	457.5	±16.52	792.500	±85.0857
Chloride	38.0000	±3.1885	30.25	±0.854	42.2500	±1.1087
Total Hardness	215.000	±33.4315	268.6	±90.28	294.7250	±100.6185
Calcium	61.4250	±9.9965	99.25	±3.683	103.3000	±4.4859
Total Alkalinity	197.000	±5.7591	216.8	±7.793	214.7500	±5.6329
Phenolphthalein A.	27.3750	±0.7465	30.05	±0.636	28.5500	±0.3202
Nitrate	5.676	±5317	5.038	±0.055	3.9750	±0.2056
Phosphate	6.9000	±0.9192	4.25	±0.773	3.02	±0.1503
Sulphate	17.4500	±1.3883	14.6	±0.242	20.6000	±1.6833
Ammonia	1.3625	±0.0688	1.9	±0.248	3.2000	±0.4564
Iron	0.4625	±0.1638	1.063	±0.069	0.4625	±0.0554

All values are expressed in mg/liter except temperature pH, Transparency

Table-4: Seasonal variation of Physico-Chemical Parameter at Station-4

Parameters	Monsoon Season		Winter Season		Summer Season	
	Mean	SE	Mean	SE	Mean	SE
Temperature (°C)	28.3750	±1.3444	25.37	±0.2394	30.0000	±1.0801
pH	7.7000	±0.0913	7.875	±0.1315	8.1450	±0.0222
Transparency (cm)	60.7500	±1.7970	66.25	±0.6292	72.5000	±3.2275
Dissolved Oxygen	8.7750	±0.5735	9.925	±0.4347	7.8000	±0.1732
Free CO ₂	0.4000	±0.0500	Nil	Nil	0.4000	±0.0500
TDS	311.250	±15.7764	372.5	±20.966	505.000	±48.5627
Chloride	53.0000	±9.2556	39.5	±1.1902	67.5000	±8.5391
Total Hardness	146.500	±8.5781	158.5	±2.3629	267.000	±32.2749
Calcium	34.2500	±0.4787	37.87	±1.983	57.7500	±3.4731
Total Alkalinity	193.750	±2.3936	315	±21.016	210.000	±3.5355
Phenolphthalein A.	49.2500	±2.1360	59.5	±4.7871	47.2500	±2.6887
Nitrate	4.4000	±0.6671	3.125	±0.1315	2.5750	±0.3065
Phosphate	7.1750	±0.8014	5.125	±0.1493	4.0250	±0.1750
Sulphate	17.7500	±0.9811	16.22	±0.3065	21.3100	±1.2528
Ammonia	0.9625	±0.0898	1.525	±0.2437	2.7000	±0.4564
Iron	0.6125	±0.1638	1.2	±0.0645	0.6375	±0.0774

All values are expressed in mg/liter except Temperature, pH, Transparency.

Fig. 1 Monthly variation of temperature at four stations of Ghagardara pond

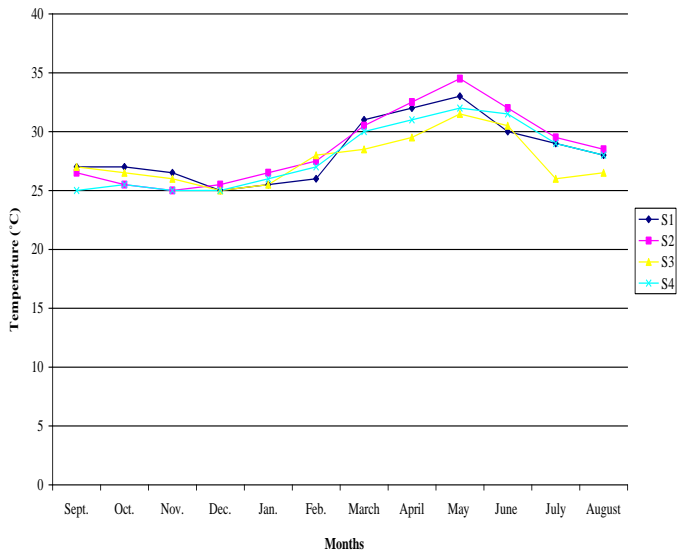


Fig. 4 Monthly variation of dissolved oxygen at four stations of Ghagardara pond

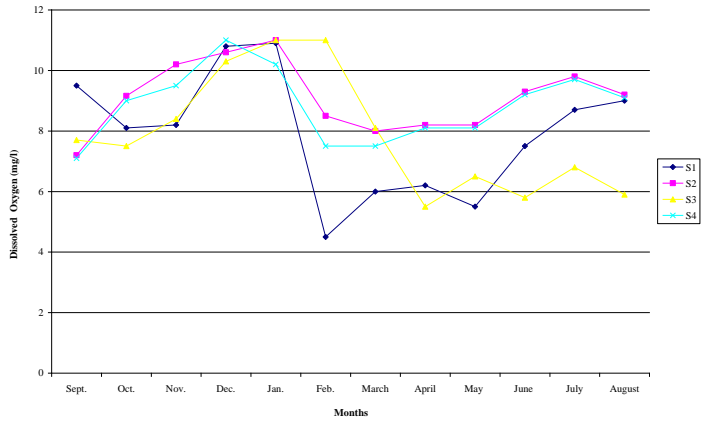


Fig. 2 Monthly variation of pH at the four stations of Ghagardara pond

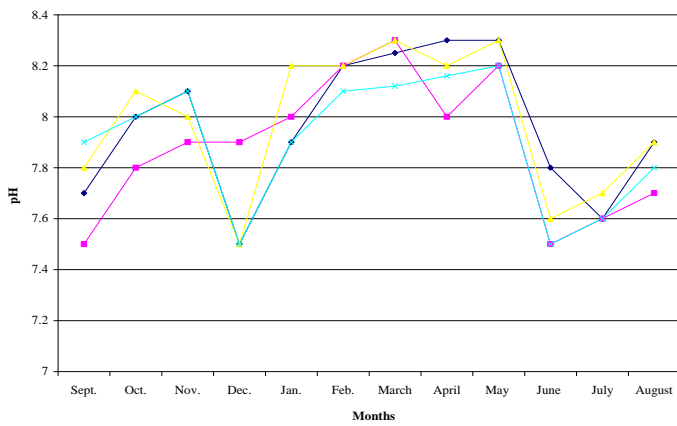


Fig. 5 Monthly variation of carbon dioxide at four stations of Ghagardara pond

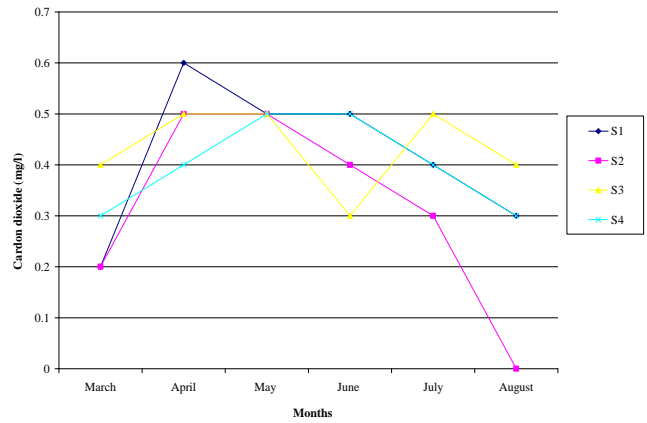


Fig. 3 Monthly variation of transparency at four stations of Ghagardara pond

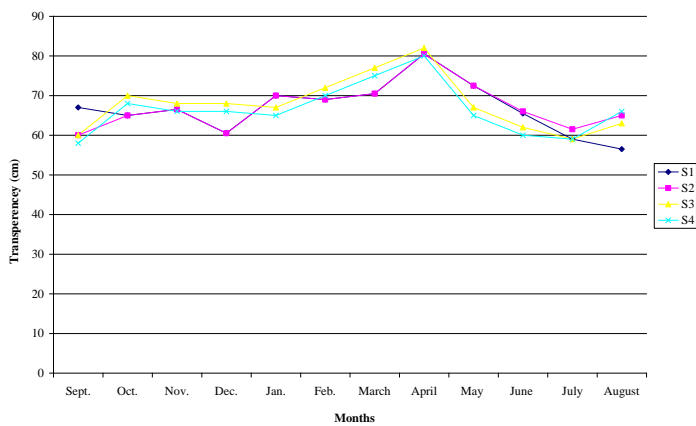


Fig. 6 Monthly variation of total dissolved solids at four stations of Ghagardara pond

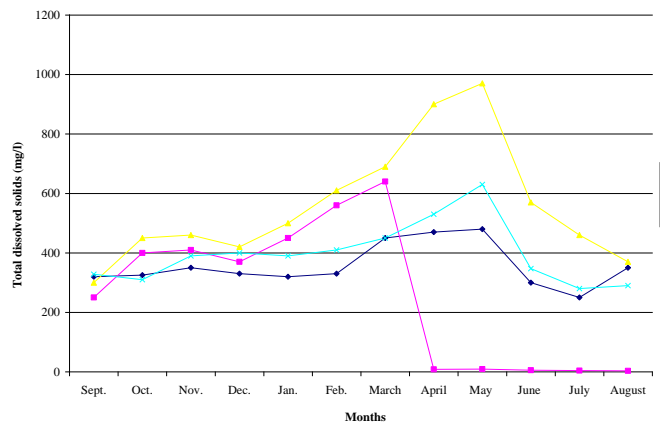


Fig. 7 Monthly variation of chloride concentration at four stations of Ghagardara pond

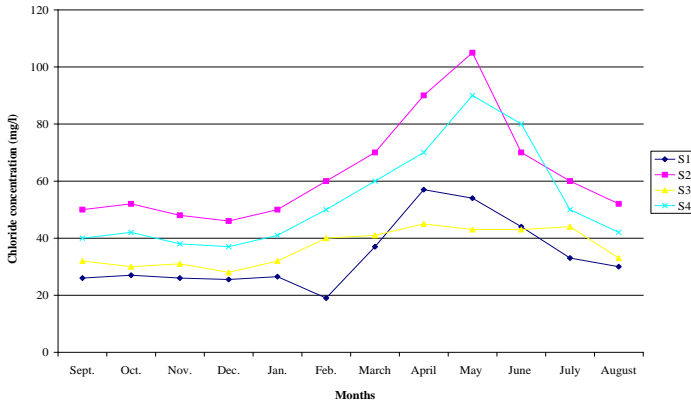


Fig. 11 Monthly variation of phenolphthalein alkalinity at four stations of Ghagardara pond

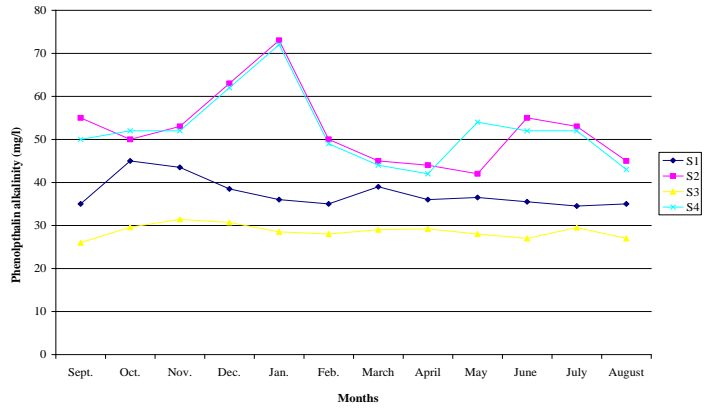


Fig. 8 Monthly variation of total hardness at four stations of Ghagardara pond

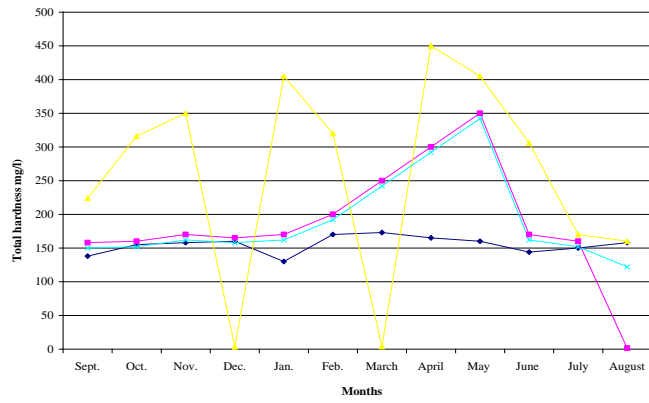


Fig. 12 Monthly variation of nitrate at four stations of Ghagardara pond

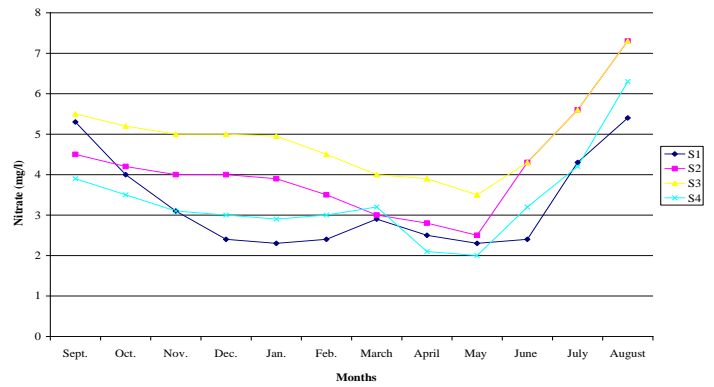


Fig. 9 Monthly variation of calcium at four stations of Ghagardara pond

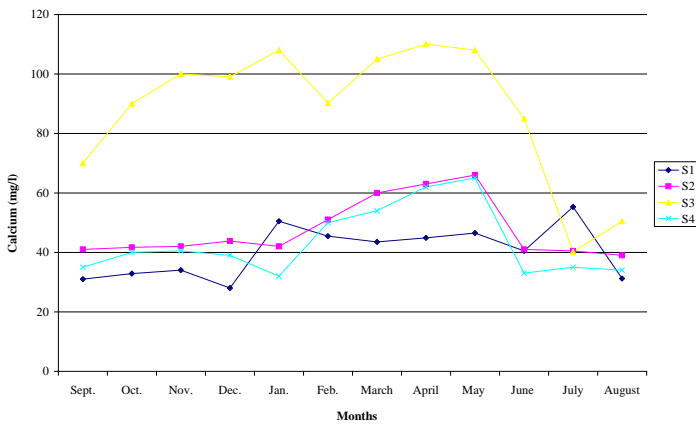


Fig. 13 Monthly variation of phosphate at four stations of Ghagardara pond

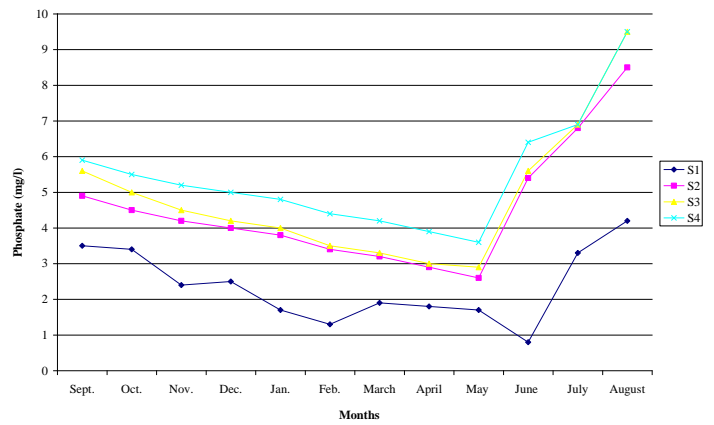


Fig. 10 Monthly variation of total alkalinity at four stations of Ghagardara pond

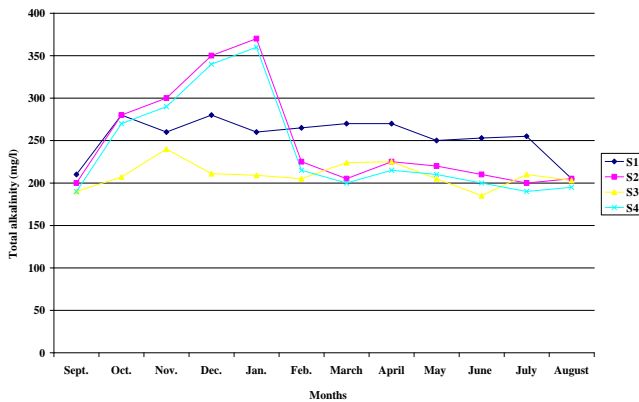


Fig. 14 Monthly variation of ammonia at four stations of Ghagardara pond

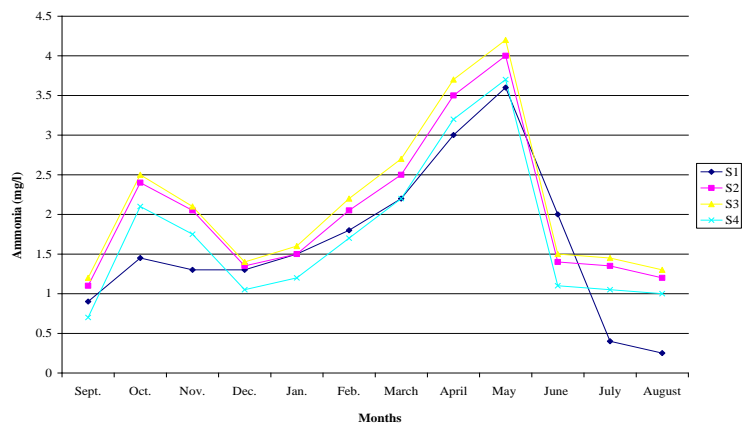


Fig. 15 Monthly variation of sulphate at four stations of Ghagardara pond

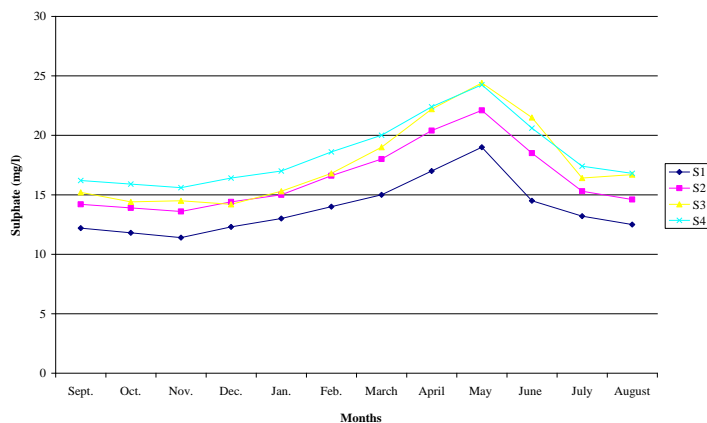
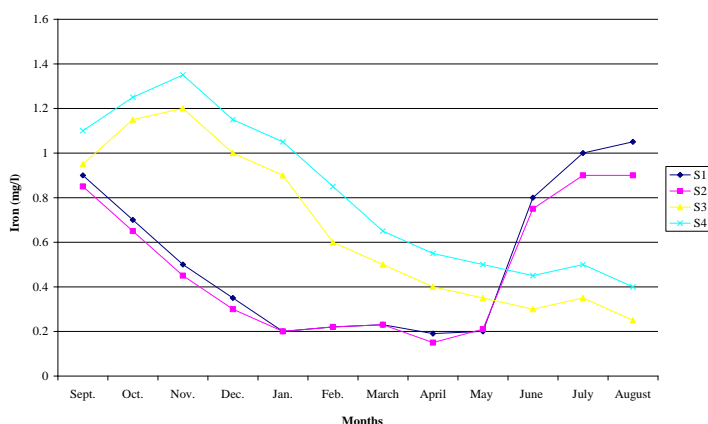


Fig. 16 Monthly variation of iron at four stations of Ghagardara pond



4. Discussion:

The quality of natural water is generally governed by various physico-chemical and biological parameters. Temperature is basically important for certain chemical and biological activities in the organism attributing in aquatic media. The water temperature of the Ghagardara increased during summer season and decreased during winter season. The values obtained in the study correspond to the seasonal studies investigated by Surve et al (2005) and Garg et al (2010). The pH was observed to decline during monsoon and increase during the summer season. Similar observations were made by Jayabhaye et al (2008) & Garg et al (2010). Water was turbid in monsoon season and transparent in summer. The transparency in Ghagardara pond was low during monsoon season & maximum in summer season which can be attributed to settling of the particles at the bottom of the pond. Dissolved oxygen is an important indicator of water quality, ecological status and health of a reservoir. The highest dissolved oxygen concentration of the Ghagardara pond was recorded at station 3 and 4 and these values are found to be within the permissible limits and thus may support diverse populations in the pond. Boyd (1979) and Das (2000) reported that dissolved oxygen concentration (3 mg to 12 mg/L) favors the growth of flora and fauna. The carbon dioxide content of water depends on the water temperature, depth, rate of respiration, decomposition of organic matter, chemical nature of the bottom and geographical feature of the terrain surrounding the water body (Sakhare and Joshi 2002). Free carbon dioxide was minimum in monsoon & maximum in

summer season. Similar observations have been made at Sunrinsor Lake (Sehgal 2003). According to Jhingran and Sugunan (1990), the total dissolved solids up to 200 mg/L was observed in medium productive reservoir and more than 200 mg/L were found in highly productive reservoirs. High chloride level was recorded in summer and relatively low values were recorded in winter season. In the present study, the total hardness was 450 mg/L which falls under the category of hard water. In the present study, the ammonia levels increased in summer season and decreased in monsoon season. The concentration of ammonia in Ghagardara pond was quite similar to that observed by Rawat and Sharma (2005) in Deona tal reservoir and in Ooty lake (Thilanga et al 2005).

Conclusion: It can be inferred that the water quality parameters of Ghagardara pond appears to be within permissible limits for drinking and domestic purposes.

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5. Reference

- [1]. APHA. Standard methods for the examination of water and waste water, 2nd ed. American Public Health Association, Washington, D.C. 1998.
- [2]. Boyd C.E. (1979) water quality in warm water fish ponds carafmaster printers Inc. Auburn. Alabama USA 353 pp.
- [3]. Das A.K. (2003) role of abiotic factors in enhancing fish production from small reservoirs of India workshop on fisheries management in the lentic water system stocking of the reserioir with fish seed 113-127
- [4]. Garge R.K., R.J. Rao, D. Vuhchariya G. Shukla and D.N. Saksena (2010) seasonal variation in water quality and major threats to Ramsagar reservoir India African Journal of Environmental science and technology vol 4 (2) pp 061-076 .
- [5]. Jayabhaye U.M,M.S. pentewar and C.J. Hiware (2008) A study on physico chemical parameter of minor Reservoir sawana, Hingoli District Maharashtra J. Aqua Biol. Vol. 23 (2) : 56-60
- [6]. Jhingran A.G. and Sugunan V.V. (1990) General Guidalene and planning criteria for small reservoirs Fisgeries Management. Proc. Nat. Workshop reservoir Fish 1-8
- [7]. Kapur S.K. (1971) Elements of practical statistics 2nd ed. Oxford and IBN publishing co. New Delhi 493p.
- [8]. Micheal R.G. (1969) Seasonal trends in physico-chemical factors and plankton of freshwater fish pond and their role in fish culture Hydrobiologia 33 145-160

- [9]. Rawat M.S and R.C. Sharma (2005) phytoplankton population of Garhwal limalayam lake Deona tal uttranchal .J. Ecophysiol occup Hlth 5-73-76
- [10]. Saha GN, Sehgal PL, Mitri E, Nandy AG. Studies on the seasonal diurnal variation in physicochemical and biological conditions of a perennial freshwater pond. J. Inland. Fish. Soc. India 1971;8:79-102
- [11]. Sakhre V.B. Joshi P.K. (2002) Ecology of palas – Nilegon Reservoir in Sawyer CH (1960) Chemistry for sanitary Engineers. Mcgraw Hill book co New York.
- [12]. Sehgal H.S. (2003) status paper on fisheries mangment on chohal reservoir. Workshop on fisheries mangment in the lentic water system : stocking of the reservoir with fish seed (Feb 19-20)7-18
- [13]. Snedecor.G.W. Cochran W.G. (1967) statistical method, 6th ed oxford and IBH publishing co. New Delhi. 593.
- [14]. Surve P.R. Ambore N.E. pulle J.S. (2005) Hydrobiological studies of kandhar dam water district Nanded (M.S.) India J. Ecophysiol occupal Health 5,61-63
- [15]. Thilaga A.S subhashini s. sobhana and K.L. Kumar (2005) Studies on nutrient content of the Ooty lake with refrence ot pollution Nat Enviroment poll. Tech 4 -299-302.
- [16]. Trivedi R.K. & Goyal P.K. (1984) Chemical & biological method for water pollution studies – Environmental publication Karad India.
- [17]. Vashisht HS, Sharma BK. Ecology of a typical urban pond in Ambala city of the Haryana State. Ind. J. Ecol. 1975;2:79-86.
- [18]. Zar J.H. (2005) Biostatistical Analysis 4th ed Dorling kidersley (India) Pvt. Ltd.