Ecological studies on Algae of Mahapur Reservoir in Latur district of Maharashtra

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Abstract **- An attempt has been made to assess the water quality and algal periodicity of Mahapur reservoir. The investigation was carried out by collecting water and algal samples from selected sampling stations as ES1 and WS2. The samples were collected at monthly intervals from June 2021 to May 2022.The samples were analysed for the parameters like Temperature, pH, dissolved oxygen, electric conductivity, total dissolved solids, BOD, free CO2, total alkalinity, chlorides, hardness, calcium, and phosphate.**

The algal periodicity reveals that the members of Chlorophyceae were dominant in all seasons, the members of Cyanophyceae were dominant in winter. The members of Bacillariophyceae and Euglenophyceae were dominant in summer.

Index Terms **- Ecology, algae, Mahapur reservoir.**

INTRODUCTION

Water pollution is one of the most serious problem faced by man today. Algae play important ecological role and are being extensively used as indicator of water pollution because they are natural inhabitants of water. The algae has been the object of little applied research because they do not cause as many problems for human as do bacteria and fungi. but in future this situation is likely to change as human and algae interact more often in desirable and undesirable ways. The fresh water sources like rivers, lakes, streams, talaos, dams, reservoirs etc. are polluted due to waste from cities, agriculture and industries. Now a days limnological and hydrobiological studies have attracted by many workers in Maharashtra Gunale and Balkrishnana (1981); Patil and Nandan (1998); Jagdale et.al.(1984); Khapekar and Deshpande (2007); Mahajan and Mahajan (1988); Mahajan and Nandan (2005); to fulfill this lacuna from the Latur district in the Marathwada region of Maharashtra, the present investigation was carried out.

MATERIALS AND METHODS

Manjra reservoir is constructed on Manjra river at Mahapur village. The reservoir is 10 km. away from Latur city and 12 km. away from Renapur city. The reservoir is constructed for irrigation and drinking water purposes. The reservoir is benefited for the peoples of Latur and Renapur Tahsils. The water samples were collected from reservoir by selecting its two sites as sampling stations i.e. ES1 and WS2 (East side 1 and West side 2). The algal samples and water samples were taken once in the third week of each month. The water samples were collected from the depth of 0.5 m. to 0.8 m, just below the surface, the algal samples were also collected from both selected sites. The samples were collected in the morning during 8.30 a.m. to 10.30 a.m. The water samples for analysis were collected in acid washed polythene bottles of 2 litre capacity and the algal samples were collected in acid washed collection bottles. On return to the laboratory, the collections were carefully observed under the light microscope and important points were noted. All collections were preserved in 4% formalin added with 5% glycerine. The identifications of algal taxa were performed by referring to the standard literature on algae Prescott (1951), Philipose (1967); Geitler (1932); Desikachary (1959); Randhwa (1959); Ramnathan (1962); Kriegar and Gerloff (1965). The physico-chemical parameters were analysed by Standard methods of APHA (1986); Trivedi and Goal (1986). The pH was recorded by using pH meter (Equiptronics – Eq 610), while electrical conductivity by conductivity meter (Equiptronics – E 660).

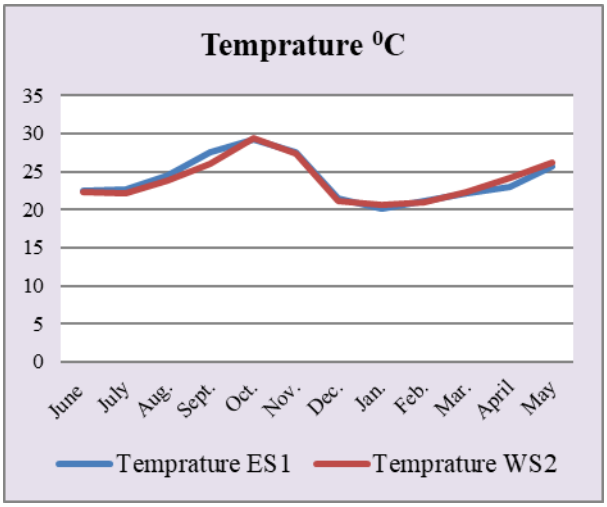
RESULT AND DISCUSSION

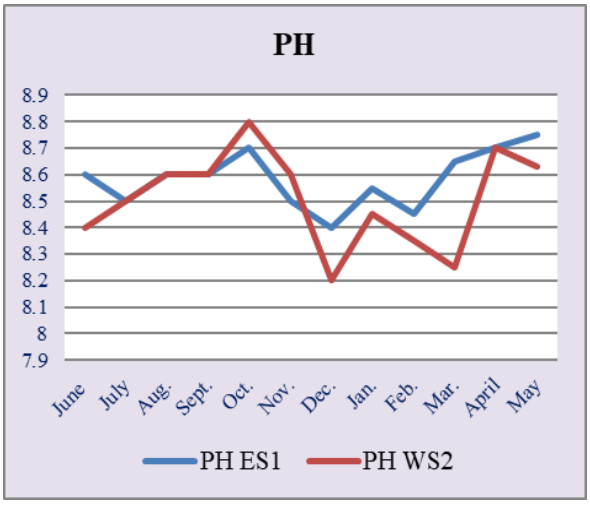
Table. 1: Physico-chemical parameters during June 2021 to May 2022 at ES 1

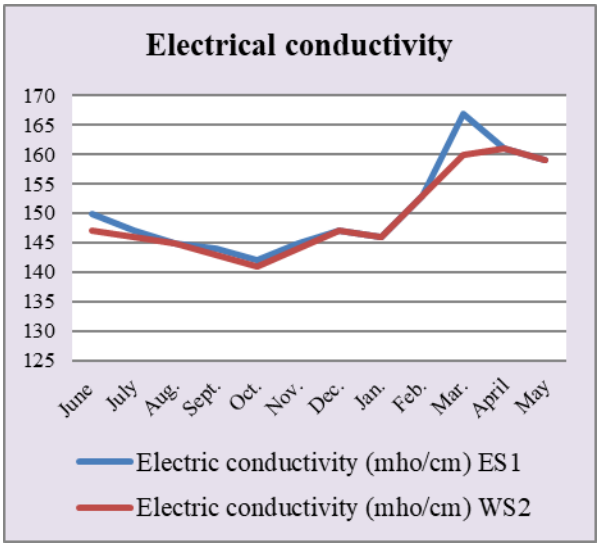
Sr. No.	Name of Parameters	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	April	May
1	Temperature (0^0c)	22.50	22.60	24.50	27.50	29.30	27.60	21.50	20.20	21.20	22.10	23.10	25.80
2	pH	8.6	8.5	8.6	8.6	8.7	8.5	8.40	8.55	8.45	8.65	8.70	8.75
3	Electric conductivity (mho/cm)	150	147	145	144	142	145	147	146	153	167	161	159
4	Dissolved oxygen (Mg/lit)	4.5	5.5	5.7	5.2	5.8	5.1	7.1	7.3	5.5	6.1	6.5	6.7
5	T.D.S. (Mg/lit)	155	154	141	156	148	139	110	119	124	139	141	146.8
6	B.O.D. (Mg/lit)	8.22	8.31	9.12	9.40	13.42	9.18	11.42	8.68	9.10	8.85	8.40	7.60
7	Free CO_2 (Mg/lit)	0.8	0.10	0.12	0.10	0.10	0.8	0.22	0.14	0.60	1.30	1.42	1.46
8	Total alkalinity (Mg/lit)	133	130	126	138	147	132	137	140	138	141	140.6	142
9	Chlorides (Mg/lit)	111.10	108.60	113.5	107	112	124.6	149	143	137	146	152	158.6
10	Total hardness (Mg/lit)	122	124.30	118	126	116.60	130	144	134.4	113.82	117	115.44	112.60
11	Calcium (Mg/lit)	10.32	11.43	11.10	13.20	12.10	18.30	26.70	23.20	13.30	12.90	12.40	11.80
12	Phosphate (Mg/lit)	0.06	0.08	0.09	0.09	0.07	0.10	0.07	0.08	0.07	0.06	0.08	0.07

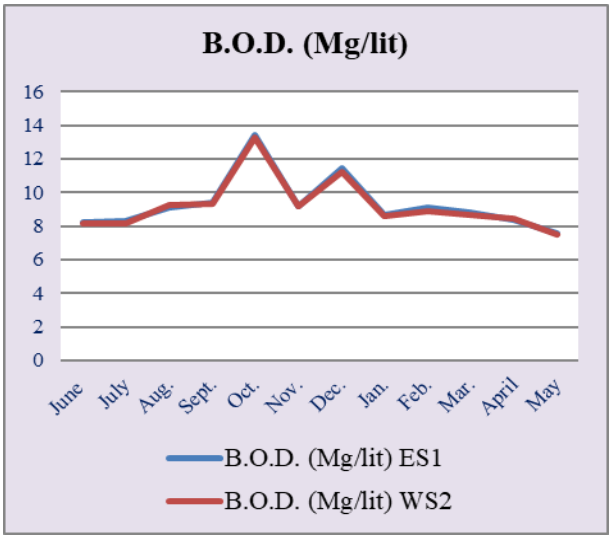
Table. 2 :- Physico-chemical parameters during June 2021 to May 2022 at WS 2:-

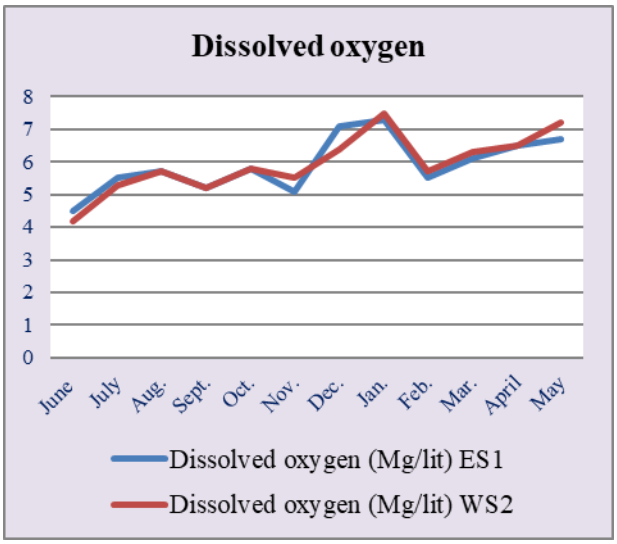
Sr. No.	Name of Parameters	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	April	May
1	Temperature (0^0c)	22.40	22.10	23.80	26.10	29.50	27.40	21.20	20.70	21	22.40	24.20	26.30
2	pH	8.4	8.5	8.6	8.6	8.8	8.6	8.20	8.45	8.35	8.25	8.70	8.63
3	Electric conductivity (mho/cm)	147	146	145	143	141	144	147	146	153	160	161	159
4	Dissolved oxygen (Mg/lit)	4.2	5.3	5.7	5.2	5.8	5.5	6.4	7.5	5.7	6.3	6.5	7.2
5	T.D.S. (Mg/lit)	152	151	139	148	141	132	115	121	123	138	140	145
6	B.O.D. (Mg/lit)	8.18	8.17	9.23	9.30	13.32	9.21	11.22	8.60	8.90	8.65	8.44	7.50
7	Free CO_2 (Mg/lit)	0.8	0.9	0.10	0.11	0.12	0.9	0.15	0.12	0.55	1.20	1.39	1.41
8	Total alkalinity (Mg/lit)	131	129	124	135	143	129	132	138	136	139	142	142.8
9	Chlorides (Mg/lit)	110.10	108.40	112.5	107	112.5	123.6	146	141	139	144	154	159
10	Total hardness (Mg/lit)	127	124.10	116	124.10	116.20	131	143	132.8	114	115.52	114.34	112.10
11	Calcium (Mg/lit)	11.12	11.20	10.10	12.10	12.00	17.18	26.10	22.60	13.10	12.50	12.70	12.60
12	Phosphate (Mg/lit)	0.06	0.07	0.08	0.09	0.08	0.9	0.06	0.08	0.08	0.06	0.08	0.07

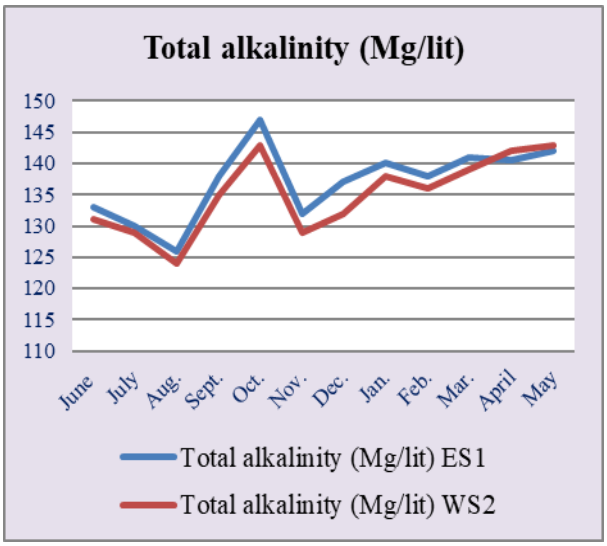


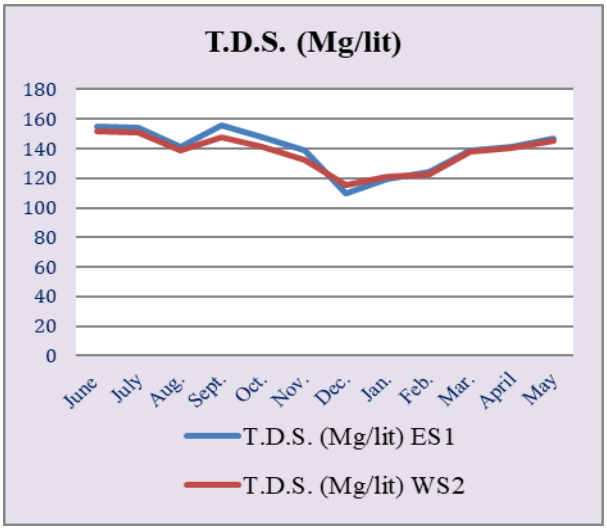


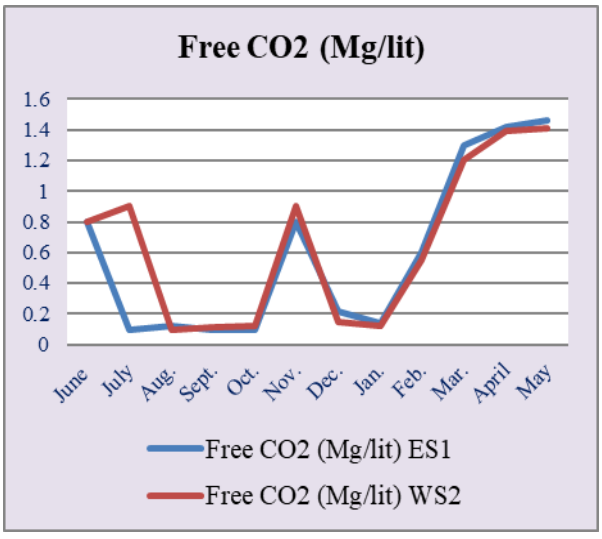

Electrical conductivity
170
165
160
155
150
145
140
135
130
125
June
July
Aug.
Sept.
Oct.
Nov.
Dec.
Jan.
Feb.
Mar.
April
May
Electric conductivity (mho/cm) ES1
Electric conductivity (mho/cm) WS2

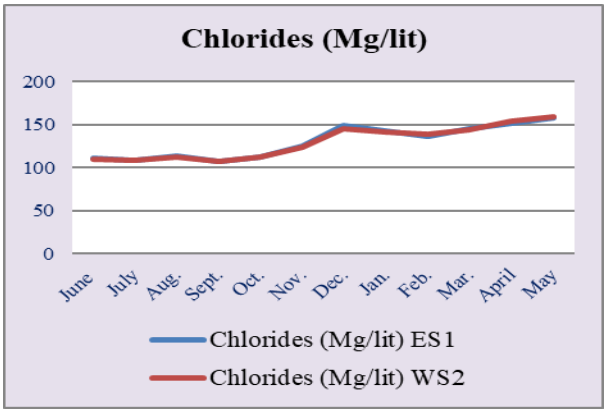

B.O.D. (Mg/lit)
16
14
12
10
8
6
4
2
0
June
July
Aug.
Sept.
Oct.
Nov.
Dec.
Jan.
Feb.
Mar.
April
May
B.O.D. (Mg/lit) ES1
B.O.D. (Mg/lit) WS2

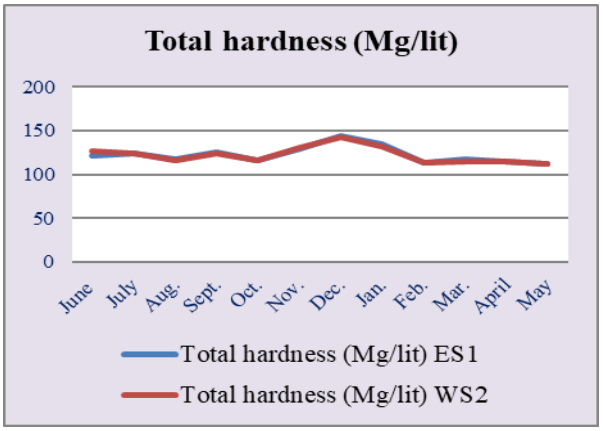

Dissolved oxygen
8
7
6
5
4
3
2
1
0
June
July
Aug.
Sept.
Oct.
Nov.
Dec.
Jan.
Feb.
Mar.
April
May
Dissolved oxygen (Mg/lit) ES1
Dissolved oxygen (Mg/lit) WS2

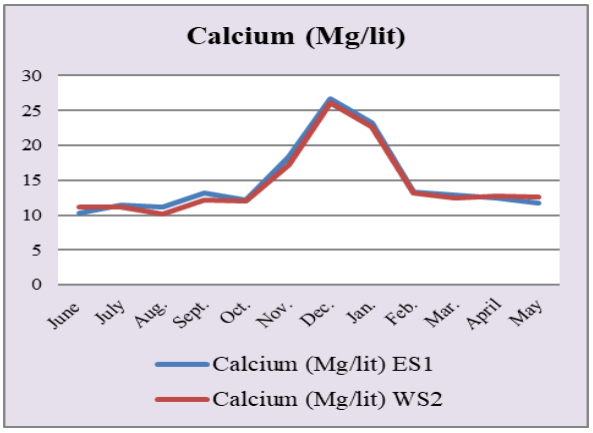

Total alkalinity (Mg/lit)
150
145
140
135
130
125
120
115
110
June
July
Aug.
Sept.
Oct.
Nov.
Dec.
Jan.
Feb.
Mar.
April
May
Total alkalinity (Mg/lit) ES1
Total alkalinity (Mg/lit) WS2

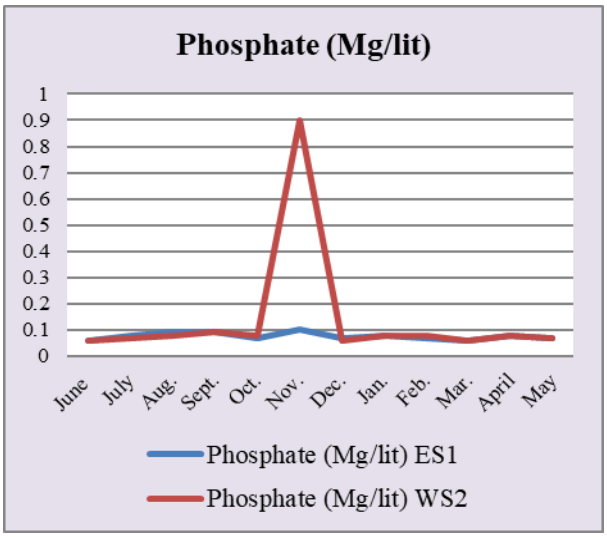

T.D.S. (Mg/lit)
180
160
140
120
100
80
60
40
20
0
June
July
Aug.
Sept.
Oct.
Nov.
Dec.
Jan.
Feb.
Mar.
April
May
T.D.S. (Mg/lit) ES1
T.D.S. (Mg/lit) WS2


Free CO2 (Mg/lit)
1.6
1.4
1.2
1
0.8
0.6
0.4
0.2
0
June
July
Aug.
Sept.
Oct.
Nov.
Dec.
Jan.
Feb.
Mar.
April
May
Free CO2 (Mg/lit) ES1
Free CO2 (Mg/lit) WS2









DISCUSSION

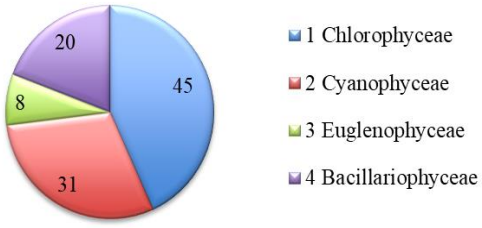
During the present investigation the minimum temperature is 20.200c and maximum temperature is 29.500c. The pH value ranged from 8.4 to 8.75. The Electric Conductivity is measured in between 141 to 167 mho/cm. The dissolved oxygen ranged from 4.2 to 7.3 Mg/Lit. The total dissolved solids ranged in between 110 to 156 Mg/lit. The BOD ranges from 7.50 to13.42 Mg/lit. The values of free CO2 were from 0.08 to 1.46 Mg/lit.The values of total alkalinity is ranges from 124 to 143 Mg/lit. and the values of total hardness were from 112.10 to 143 mg/lit. The values of calcium and phosphate were ranged in between 10.10 to26.10 Mg/lit and 0.06 to0.09Mg/lit respectively.

Results part II: - Total occurrence of algal taxa at both sites (ES1 and WS2) during June 2021 to May 2022.

Sr. No.	Name of Algae	June	July	Aug.	Sept.	Oct.	Nov	Dec.	Jan.	Feb.	Mar.	April	May
	Chlorophyceae												
1	Chlamydomonas globosa				+			+				+	
2	Pandoriana morum					+				+			+
3	Gloeocystis gigas	+	+	+			+	+			+	+	
4	Gloeocystis vesiculosa		+	+	+	+							
5	Cylindrocapsa sp.		+						+				+
6	Stigeoclonium tenue	+		+		+		+			+		
7	Protococcus viridis		+										
8	Oeologonium amplum	+		+				+			+		
9	Oedogonium calvum		+		+		+		+	+		+	+
10	Oedogonium gunnii	+											
12	Oedogonium pisanum			+		+		+			+		+
12	Characium ambiguum		+		+		+	+	+			+	
13	Schoroederia setigera	+								+	+		

14	Pediastrum boryanum					+						+	
15	Pediastrum tetras		+		+					+			+
16	Oocystis elliptica	+					+		+		+		
17	Ankistrodesmas falcatus			+		+				+			
18	Coelastrum microporum	+					+		+				
19	Scenedesmus bijugatus	+	+		+	+	+			+	+	+	+
20	Scenedesmus dimorphous				+	+			+				
21	Scenedesmus obliquus	+		+						+		+	
22	Scenedesmus quadricauda		+				+	+	+				+
23	Ulothrix sp	+		+						+			
24	Ulothrix zonata		+			+			+		+	+	
25	Mougeotia floridana			+	+			+					+
26	Mougeotia maltae		+			+			+			+	
27	Spirogyara biformis			+	+			+		+			+
28	Spirogyara communis	+									+		
29	Spirogyara gracilis		+		+		+		+	+	+	+	
30	Spirogyara macrospora	+		+		+		+		+		+	
31	Spirogyara negelecta												+
32	Closterium acerosum	+											
33	Closterium accutum		+		+			+		+		+	
34	Closterium dianae	+											
35	Closterium lanceolatum		+	+		+	+		+			+	
36	Closterium tumidulum	+											+
37	Closterium venus	+			+			+		+	+		
38	Cosmarium angulosum	+											+
39	Cosmarium contractum		+	+	+	+	+		+	+		+	
40	Cosmarium grandtum	+			+			+			+		+
41	Cosmarium impressulum					+		+	+				
42	Cosmarium laeve		+			+	+	+	+				
43	Cosmarium regnell ii	+				+		+			+		+
44	Cosmarium repandum					+			+				
45	Cosmarium undulatum	+					+	+					
	Cyanophyceae												
46	Chroococcus minutus			+		+			+				
47	Chroococcus minor		+		+	+		+					
48	Gloeocapsa maralis	+				+	+		+			+	
49	Gloeocapsa palea			+			+	+					
50	Gloeocapsa samoensis	+					+	+	+				+
51	Aphanocapsa brunnea		+			+		+	+				
52	Aphanocapsa koordersi	+		+	+	+	+					+	
53	Aphanocapsa montana	+				+			+				
54	Aphanocapsa bullosa		+				+		+		+		
55	Aphanocapsa microscopica	+			+	+		+				+	
56	Aphanocapsa saxicola								+				+
57	Meriusismopedia glauca	+	+			+		+					
58	Spirulina major										+		
59	Oscillatoria amoena	+			+	+	+	+	+				+
60	Oscillatoria annae		+						+				
61	Oscillatoria curviceps					+	+	+					
62	Oscillatoria formosa	+		+		+			+		+		
63	Oscillatoria irrigua						+	+					
64	Oscillatoria okeni	+	+			+						+	
65	Oscillatoria sancta	+		+			+		+				
66	Oscillatoria subbrevis					+	+	+	+		+		+
67	Oscillatoria tenuis		+					+					
68	Phormidium ambiguum				+	+	+		+			+	
69	Phormidium autoumnale		+										
70	Phormidium corium			+			+			+			+
71	Phormidium luridum						+						
72	Phormidium mucicola	+	+					+	+	+	+	+	
73	Phormidium tenue			+									
74	Lyngbya contorta	+					+		+				
75	Lyngbya limnetica												
76	Lyngbya majuscula					+	+	+					
	Euglenophyceae												
77	Euglena elastica	+								+	+		

78	Euglena gaumei											+	
79	Petalomonas prototheca		+							+		+	
80	Phacus aglis					+		+					
81	Phacus caudatus			+						+	+		
82	Phacus curvicauda		+						+		+	+	+
83	Phacus tortous									+			
84	Trachelomonas dubia	+				+	+			+	+	+	+
	Bacillariophyceae												
85	Fragillaria intermedia				+			+					
86	Synedra acus	+				+			+		+	+	
87	Eunotia monodon		+							+			+
88	Mastogloia baltica							+					
89	Gyrosigma acuminatum			+		+				+	+		+
90	Caloneis silicula				+							+	+
91	Navicula cari									+			
92	Navicula cari	+					+				+		+
93	Navicula cari		+				+		+		+	+	
94	Navicula cari	+			+					+		+	
95	Amphora ovalis			+		+					+		+
96	Cymbella cistulla		+	+						+		+	+
97	Cymbella kolbei				+					+	+		
98	Cymbella lanceolata					+					+	+	+
99	Cymbella turgidulla	+		+				+		+			
100	Gomphonema constrictum				+						+		+
101	Epithema sorex	+				+				+		+	
102	Nitzschia amphibia										+		+
103	Nitzschia denticulata	+	+		+						+		
104	Nitzschia obtusa									+		+	+



DISCUSSION

A total of 104 taxa under 45 genera were encountered during the period of investigation of which 45 taxa under 19 genera were belonged to Chlorophyceae, 31 taxa under 10 genera of Cyanophyceae, 08 taxa under 04 genera of Euglenophyceae and 20 taxa under 12 genera were belonged to Bacillariophyceae. In present investigation Chlorophyceae shows the dominance followed by Cyanophyceae. Among the Chlorophyceae the genera like Cosmarium, Closterium, Spirogyra, Scenedesmus and Oedogonium shows the dominance in order of their abundance, among Cyanophyceae the genera like Oscilltoria, Phormidium. Lyangbya were the dominant. The genera Phacus was dominant in Euglenophyceae and among the Bacillariophyceae the genera like Navicula, Cymbella, Nitzschia were dominant. As far as seasonal variation study the members of Chlorophyceae were dominant in all seasons as compared to other groups. The members of Cyanophyceae were dominant in winter, the Bacillariophyceae shows dominance in summer.

REFERENCES

[1] Allen, W.E. (1920). A quantitative and statistical study of the plankton of the Son Joaquin River and tributaries in and near Stockton, California in 1913. Publi 2001. 22: 1-297.

[2] Adoni, A.D.and et.al.(1985) Workbook on Limnology, Pratibha Publishers,Sagar.216pp.

[3] Anand, V.K. (1975). A check list of planktonic algae from Mansar lake, Jammu. Phykos 14(1 & 2): 77-79.

[4] Andhale S.B. (2008). Studies on the flora of Jayakwadi Bird Sanctuary. Ph.D. Thesis, Dr. B.A.M.U. Aurangabad.

[5] Ansari Ziya and Nandan S.N. (2005). Study of Eutrophication of Algal Biodiversity of Mausam river. Plant Diversity and Biotechnology PP: 17-19.

[6] APHA,(1995) Standard methods for examination of water and waste water,(19th Ed.) American Public Health Association,Washington DC,USA.

[7] APHA, Standard methods for examination of water and waste water,(22nd Ed.) American Public Health Association,Washington DC,USA.
[8] Ashtekar, P.V. (1980). Studies on fresh water algae of Aurangabad district. Ph.D. thesis, Marathwada University, Aurangabad.
[9] Aykulu, G., (1978). A quantitative study of the phytoplankton of the river Avon Bristol Br. Phykal J. 13:1 -102.
[10] Barhate, V.P. and J.L. Tarar (1981). The algal flora of Tapi river, Bhusawal Maharashtra, Phykos, 20: 75-78.
[11] Classen. P.W. (1927). Biological studies of polluted areas in Genesee river system, New York state. Ann. Rept. 1992.
[12] Claus, G. and Reimer, C.W. (1961). A Quantitative and Qualitative study of the phytoplankton of the Danube River at Vienna. Revista De Biologia 2(3-4): 261-275.
[13] Collins, F.S. (1928). Green algae of North America. G.E. Strechert and Co. New York.
[14] Desikachary T.V. (1959) Cyanophyceae I.C.A.R. Monographas on Algae New Delhi. Pp. 680.
[15] Eswari, Y. (2002). Hydrobiological studies of Red hills reservoir, North Chennai, Tamil Nadu. J. Aqua. Biol. 17 (1): 13-16.
[16] Fatma, T. (1985). Epiphytic algal flora of fresh water ponds of Lucknow, Chaetophorales. Phykos. 24: 173-174.
[17] Fritsch, F. E. (1903). Observations of phytoplanktons of the river Tames, Ann. Bot. 17:631-647.
[18] Ganapati, S. V. and Chacko, P. J. (1951). An investigation of the river Godavari and effluent of paper mill pollution at Rajahmundry. Proc. Indo-Pacific Fish. Con, Sec. 2: 1-5.
[19] Gonzalves, E. A. (1981). Oedogonials. ICAR Monograph. New Delhi. Pp.: 1-757.
[20] Gunale V.R. and Balkrishnan, M.S. (1981). Biomonitoring of Eutophication in the Pavana, Mula and Mutha rivers flowing thourgh Poona Indian. J. Environ. Hlth. 23(4): 316-322.
[21] Hosmani, S.P. and Bharati, S.G. (1980). Algae as indicators of organic pollution Phykos. 19 (1): 23-26.
[22] Iqbal. F., Ali, M. and Kanwal, N. (2006). Limnological study of river Soan (Punjab), Pakistan. Agricu. Conspectus Scientificus. 71(2): 65-73.
[23] Islam, Nurul and Khatun, M. (1966). Preliminary studies on the phytoplanktons of polluted waters. Sci. Res., Eat regional Lab., Pakistan. 3 (2): 94-109.
[24] Jagdale, M.H., M.M. Salunke, Y.B. Yabhute, S.N. Kodaskar and K.N. Ghuge (1984). Pollution of Godawari river at Nanded Poll. Res. 3:83-84.
[25] Khapekar, R.R. and Deshpande, S.V. (2007). Phytoplankton composition and assessment of pollution status of Naik lake, Nagpur, Maharashtra J. Aqua. Bio. 22(1): 21-26
[26] Iyengar, M. O. P. and Desikachary, (1981). Volvocales ICAR Monograph, New Delhi. 1-532.
[27] Jadhav Milind, Amrapali Bhagat and Savita Salve (2007) Algal Biodiversity of Salim Ali lake of Aurangabad Maharashtra, Abstract, Nat. Conf. of modern trends in Plant Sci Dr. B.A.M.U. Aurangabad, 66.
[28] Jain, D.V. (2002) Ecological studies of algae form Sonvad project Dam and Devbhane Dam, Ph.D. Thesis, North Maharashtra University, Jalgaon.
[29] Kamat, N.D. (1962). Chlorophyceae of Ahmedabad, India Hydrobiologia. 20: 248-279.
[30] Khapekar, R.R. and Deshpande, S.V. (2007). Phytoplankton composition and assessment of pollution status of Naik lake, Nagpur, Maharashtra J. Aqua. Bio. 22(1): 21-26.
[31] Khare, P.K. (1999). Phytoplankton as indicator of water quality and pollution status of Jagat sagar pond, Chhatarpur (M.P.) Geobios 18:107-110.
[32] Krieger, W. and Gerloff, J. (1965). Die Gattang cosmmarium. Ed. by J. carmer. Vol. II, 113 to 240.
[33] Nandan, S.N. (1993). Algal flora of fish pond in Dhule, Maharashtra. Indian Bot. Rept. 12 (land 2): 61-63.
[34] Nandan, S.N. (1993). Study of algal bloom in the water of Baroda river. Indian Bot. Reptr. 12 (1 & 2): 71-73.
[35] Nazneen, S. (1980). Influence of hydrobiological factors of seasonal abundance of phytoplankton in Kinjhar lake, Pakistan. Int. Revu. Ges. Hydrobiologia. 65(2): 269-282.
[36] Phllipose.M.T.(1967).Chlorococcales.ICAR.Monograph,NewDelhi. P. 365.
[37] Pingle, S.D. (1981). Studies on algae of impoundments and streams in Maharashtra, Ph.D. thesis, Poona University.

[38] Prescott G.W. (1951). Algae of the Western great lakes area. Granbrook Institute of Science, Michigan.
[39] Ramanathan, K.R. (1962). Ulotrichales ICAR, New Delhi. 1-188.
[40] Randhawa M.S. (1959). Zygnemataceae ICAR New Delhi. Pp. 478.
[41] Scott, A.M. and Prescott, C.W. (1961). Indonesian desmids. Hydrobiologia 17:1-132, Plts. 1-63.
[42] Singh, R. and K. Swaroop (1979). Limnological studies of Suraha lake (Ballia) II Periodicity of phytoplankton. J. Indian. Bot. Soc. 58: 319-329.
[43] Sirsat D.B., Ambore N.E. and Pulle J.S. (2004). Study of Phytoplankton of fresh water pond at Dharnapuri in Beed District (M.S.) J. Aqua. Biol. 19(2): 7-10.
[44] Smith, G. M. (1950). The fresh water algae of the United states. McGraw Hill Book Co., New York. P: 719.
[45] Trivedi, R.K.and Goel, P.K.1986: Chemical and Biological methods for water pollution studies.Environmental publications,Karad(India),251pp
[46] Talekar Santosh and Jadhav Milind (2009). Biodiversity of desmids in Manjara river in Maharashtra. The Ecotech 1(2): 104-105.
[47] Tiffany, L.H. (1930). The Oedogonaceae. Monograph. Columbus. Ohia.
[48] Tiffany, L.H. and Britton, M.E. (1951). The Zygnemataceae. Ohia.
[49] West, W. and West, G.S. (1904, 1905, 1908, 1912). A monograph of the British Desmidiaceae vols. I-IV. Ray Society, London.
[50] Yadav S.G. and P.V. Ashtekar (2007) A. preliminary survey of Desmids form Bindusara Dam, Beed. Abstract Nat. Conf. on Modern trends in plants sciences, Dr. B.A.M.U. Aurangabad 66.
[51] Zafar, A. R. (1967). Limnology of Hussain Sagar lake, Hyderabad III. The periodicity. Hydrobiologia. 30(1): 96-112.