

## **Characteristics of Water Quality and Hydrophytic Community of Govindgarh Lake Rewa (M.P.)**

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### **ABSTRACT**

The present work provides an ecological study on the hydrophytic community as well as physiochemical study of water body of the Govindgarh Lake Rewa. Four sample locations were selected in the study area representing various type of water quality namely, Bathing Ghats, Gopalbag, Fort Area and Devi temple of the Govindgarh Lake. Ecologically, Govindgarh Lake has many interesting aspects 15.6 k.m. of northern slope of Kamore range serves as the catchments area for 330 ha. large and about 10 m. deep lake which stores an enormous amount of water. This paper presents characteristics of water quality and hydrophytic community of Govindgarh lake which is situated in the Rewa district M.P.

### **INTRODUCTION**

Water, like air and food is a basic human need without which no life can be sustained. Water is so important of human life that there is also strong concern about the fate of freshwater habitats. The water resource scenario of the country reveals that out of a total 400 m.ha-m of available water, 68 m.ha-m. of surface water and 42 m.ha-m. of ground water is utilizable giving a total of 110.4 m.ha-m. As estimated during 1985, 32 m.ha-m. of surface water and 15m.ha.m. ground being utilized for irrigation giving a total of 47 m.ha-m. The total volume of fresh water on the earth surface is small in the relation to the catchments only about 0.01% of the earth water is in rivers and lakes at any one time. Fresh water ecosystem is of a great economic importance as pure and clear water of multipurpose use in the society. Considerable work has been done one pure limnology of fresh water Lentic and Lotic habitats of India in the past. The Govindgarh lake is not only an object of social pride but a great symbol of culture heritage as it built by the popular ruler of this land some two hundred years ago.

Rewa District is a district of Madhya Pradesh state in central India. Rewa Districts is located at the north east of the Madhya Pradesh and covers areas about 6,314 km<sup>2</sup> and a population of 1,972,333 (2001 census), a 27% increase from 1991. Rewa is also known as land of white tigers. Govindgarh lake which only 7000 ha. is totally converted by water body. Its catchments area is 330 ha. large near about 10 m deep lake and driest period the water level never goes below 7 meters which stores enormous amount of

water. Govindgarh lake is being managed jointly by state fishery and irrigation department this has added new dimension of Fisheries culture Irrigation and tourism to this lake.

## OBJECTIVES

This paper presents the characteristics of water quality and hydrophytic community of Govindgarh Lake. The prime objective of this study was to monitor lake water quality based on physical and chemical properties of lake water quality parameters viz., Temperature, pH, Total solid, suspended solid, Dissolved solid, Chlorides, Nitrate, Phosphate, Alkalinity, Total hardness, Dissolved Oxygen (DO), Biochemical Oxygen Demand (BOD) and Chemical Oxygen Demand (COD) for the management of the lake Govindgarh Lake.

## MATERIAL AND METHODS

Monthly water samples were collected at four sampling sites as per the details given below for determination of physico-chemical characteristics of the lake:

The water quality analysis was carried out using standard methods (APHA, 1985).

Bathing Ghats	Gopal Bag	Near Fort	Near Temple
These are the ghats where people take baths, wash utensils and cloths regularly. Water samples were taken from these ghats to assess the impact of human activities on water quality of lake.	This site is located almost at the center of lake along with an approach road.	This site is located near the fort.	This sampling site is situated near the Papara towards the Southern side of the lake.

## RESULTS AND DISCUSSION

The physico-chemical characteristics of water at four sampling sites of Govindgarh lake are given in Tables 1 to 4. The results are given below:

### TEMPERATURE

The water temperature of Govindgarh Lake observed at four sites, varies between 18 to 32.1°C. An average temperature of 23.14°C, 24.78°C, 25.17°C and 24.70°C was observed at Gopalbag near for the near temple and at Bathing Ghat respectively (Table 5). Thermal changes of Govindgarh lake water during different month of the year were not so profound as typical shallow lake. The result indicated minimum temperature of water during winter months and maximum during summer months.

**pH:** There was a narrow variation in pH value of water at four sampling sites of Govindgarh lake. The mean values of pH were observed as 7.47, 7.51, 7.46 and 7.81 for Gopal bag near temple fort and Bathing Ghat, respectively (Table 5). There was no marked seasonal variation in pH values of Govindgarh Lake water (Table 1- 4).

Table 1: Physicochemical Characteristic of water sampled at fort area of Govindgarh Lake Rewa.

Parameter s (mg/l)	Jan	Feb	Mar	Apr	May	June	July	Aug	Sep	Oct	Nov	Dec
Temp °C	18.1	18.3	21	23	27	32	29.1	27.6	26.3	26	25	24
pH	7.37	7.37	7.41	7.37	7.21	7.44	7.61	7.70	7.68	7.51	7.50	7.40
Total solids	670.0	670	680	706	711	750	780	790	807	780	760.0	750.0
Suspended solid	87.0	106.0	109	144	150.0	171	163.0	185.0	187.0	164.0	154.0	130.0
Dissolved solid	595.0	580.0	580.0	580.0	558.0	576	610.0	602.0	609.0	616.0	603.0	615.0
Chloride	25.45	39.41	44.33	49.26	54.10	49.30	44.31	44.32	54.10	59.12	64.03	59.12
Ammonium nitrate	0.63	0.87	0.95	0.96	0.93	1.03	1.06	1.10	1.04	1.08	0.83	0.87
Nitrate	0.22	.51	0.65	0.60	0.73	0.80	0.82	0.92	0.90	0.79	0.40	0.35
Nitrite	0.13	0.17	0.20	0.50	0.52	0.56	0.54	0.75	0.64	0.50	0.27	0.14
Phosphate	0.46	0.78	0.89	0.89	0.85	0.93	0.95	1.03	1.04	0.90	0.52	0.54
Alkalinity	147.0	147.0	158.0	170.0	176.0	184.0	180.0	190.0	194.0	184	175	170.0
T.	212.0	223.0	231.0	242.0	263.0	270.0	271.0	280.0	289.0	275.0	270	261.0
Hardness C.	112.0	126.0	145.0	143.0	150.0	153.0	163.0	173.0	185.0	170.0	162.0	153.0
Hardness D.O.	7.6	7.4	7.2	7.1	6.0	6.8	7.1	7.4	7.1	7.2	7.2	7.2
B.O.D.	3.7	3.0	3.1	3.2	3.1	3.0	4.1	4.3	4.2	3.0	3.4	3.1
C.O.D.	9.7	9.7	18.2	28.3	18.2	28.3	37.7	47.0	37.72	28.30	37.7	28.30
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Table 2: Physiochemical characteristics of water sampled at Bathing Ghat Rewa

Parameters (mg/l)	Jan	Feb	Mar	Apr	May	June	July	Aug	Sep	Oct	Nov	Dec
Temp °C	18	18	20	24	28	32	30.1	29.6	28	27	26	25
pH	7.73	7.82	7.64	7.75	7.48	7.68	8.06	8.12	8.10	7.86	7.76	7.72
Total solids	732.2	786.0	804.0	819.0	848.0	862.0	1020.0	1140.0	980.0	820.0	816.0	802.0
Suspended solid	126.0	135.0	156.0	182.0	190.0	2.5	315.0	340.0	280.0	208.0	138.0	122.0
Dissolved solid	606.0	651.0	648.0	637.0	658.0	657.0	705.0	800.0	700.0	612.0	678.0	680.0
Chloride	39.2	39.2	44.3	49.2	54.2	69.3	82.0	74.4	69.3	44.3	39.2	44.0
Ammonium	.86	.94	.92	1.06	1.12	1.25	1.73	1.82	1.78	1.20	1.14	.88
Nitrate	.75	.82	.80	.95	1.09	1.18	1.52	1.64	1.33	1.10	1.06	0.54
Nitrite	.42	.38	.49	.62	.80	.90	.96	1.08	1.03	.98	.85	.32
Phosphate	1.15	1.22	1.08	1.30	1.42	1.59	1.86	1.98	2.05	2.06	1.98	1.52
Alkalinity	180.0	192.0	204.0	212.0	216.0	232.0	236.0	228.0	212.0	288.0	2.4	196.0
Total Hardness	264.0	272.0	276.0	288.0	300.0	316.0	324.0	328.0	212.0	288.0	204.0	196.0
C. Hardness	152.0	156.0	168.0	176.0	184.0	192.0	196.0	188.0	172.0	168.0	176.0	180.0
D.O.	7.6	7.4	7.3	6.9	6.8	6.4	6.9	7.7	7.2	7.0	6.8	6.7
B.O.D.	4.5	4.8	5.2	5.6	5.8	6.0	6.1	6.4	6.0	5.5	4.8	4.0

Table 3: Physiochemical characteristics of water sampled at Gopalbag Rewa

Parameters (mg/l)	Jan	Feb	Mar	Apr	May	June	July	Aug	Sep	Oct	Nov	Dec
Temp*	18.0	18.2	22	21	26	31	29.1	27.5	26.3	25	24	22
pH	7.36	7.46	7.40	7.39	7.23	7.43	7.63	7.90	7.67	7.53	7.40	7.30
Total solids	650	675	680	700	703	745	778	793	800	790	760.0	750.0
Suspended solid	89	103	113	149	153	175	167	181	199	172	160.0	135.0
Dissolved solid	599	584	585	563	565	580	626	115	620	625	618.0	628.0
Chloride	24.43	39.43	44.35	49.25	24.22	49.28	44.35	44.36	54.23	59.16	64.14	59.15
Ammonium	.60	.89	.97	.90	.96	1.00	1.09	1.13	1.00	1.07	0.84	0.82
Nitrate	.31	.55	.69	.72	.77	.83	.87	.97	.94	.82	0.53	0.82
Nitrite	.15	.19	.24	.54	.55	.63	.57	.72	.67	.53	0.29	0.16
Phosphate	.45	.83	.93	.97	.90	.98	.97	1.08	1.65	.94	0.56	0.59
T. Alkalinity	149	153	163	169	182	189	185	195	198	189	182.0	173.0
T. Hardness	229	209	239	250	267	280	279	289	295	286	275.0	260.0
C. hardness	118	130	146	149	156	159	169	178	186	180	170.0	160.0
D.O.	7.8	7.6	7.5	7.3	7.1	6.3	6.8	7.1	7.3	7.4	7.4	7.5
B.O.D.	3.9	3.4	3.5	3.6	3.4	3.1	4.5	4.7	4.8	4.3	3.2	3.0
C.O.D.	9.9	9.9	18.5	28.34	18.5	28.36	37.77	47.4	37.78	28.40	37.81	28.37

(Note : \* °C)

Table 4: Physiochemical characteristics of water sampled at Devi temple Rewa

Parameters (mg/l)	Jan	Feb	Mar	Apr	May	June	July	Aug	Sep	Oct
Temp*	18.2	18.4	20	24	28	32.1	29.2	27.8	26.4	27
pH	7.38	7.48	7.42	7.39	7.38	7.22	7.45	7.62	7.80	7.69
Total solids	686	690	694	708	712	752	786	792	808	789
Suspended solid	88	108	112	148	152	174	166	180	189	170
Dissolved solid	598	582	582	560	560	578	620	612	610	619
Chloride	26.46	39.42	44.34	49.27	54.20	49.27	44.34	54.20	59.13	64.05
Ammonium	0.64	0.88	0.96	0.98	0.95	0.1.06	1.08	1.12	1.05	1.02
Nitrate	0.33	0.52	.68	0.70	0.76	0.82	0.88	0.95	0.92	0.80
Nitrite	0.14	0.18	0.26	0.26	0.52	0.54	0.60	0.58	0.70	0.66
Phosphate	0.48	0.80	0.90	0.95	0.88	0.96	0.98	1.06	1.00	0.92
T. Alkalinity	148	152	160	172	180	188	184	192	196	188
T. Hardness	216	228	236	248	264	272	276	184	292	280
C. hardness	116	128	140	148	154	164	172	184	170	164
D.O.	7.7	7.5	7.4	7.2	7.0	6.9	7.2	7.6	7.3	7.4
B.O.D.	3.8	3.2	3.4	3.5	3.3	3.2	4.2	4.6	4.5	4.0
C.O.D.	9.8	9.8	18.4	28.32	18.4	28.32	37.76	47.2	37.76	28.32

**Table 5: Average value of Physiochemical Parameter of water at Four Sampling sites of Govindgarh Lake Rewa.**

Parameter s (mg/l)	Bathing Ghat		Gopal Bag		Temple area		Fort area	
	Range	Mean +_ SD	Range	Mean +_ SD	Range	Mean+_ SD	Range	Mean+_ SD
Temp*	18.32	24.70+_4.61	18.0-31.0	24.14+_4.06	18.2-32.1	25.177+_4.38	18.1-32.0	24.78+_4.17
pH	7.48-8.12	7.81+_1.48	7.23-7.90	7.47+_0.60	7.22-7.80	7.50+_1.24	7.21-7.70	7.46+_1.87
Total solids	732.0-1140	869.08+_117.01	650-800	735.33+_51.79	686-808	744.41+_44.52	670-807	739.08+_47.00
Suspended Solid	122-340	199.75+_78.65	89.0-199.0	149.66+_33.56	88.0-198.0	148.91+_32.12	87-195	146.58+_32.65
Dissolved Solid	636-800	669.33+_51.24	115.0-628.0	558.91+_141.83	560.0-620	595.5+_22.35	576-616	591.83+_20.89
Chloride	30.20-82.0	54.07+_5.48	24.22-64.14	46.36+_12.62	24.46-64.5	48.84+_10.63	24.45-64.03	48.81+_10.62
Ammonium	86-1.82	1.22+_1.37	0.60-1.13	0.93+_1.88	0.64-1.12	0.95+_1.75	0.63-1.10	0.94+_3.09
Nitrate	0.15-1.64	1.06+_1.01	0.30-0.57	0.69+_3.31	0.33-0.95	0.68+_1.0	0.22-0.92	0.64+_1.01
Nitrite	.32-1.08	0.73+_0.718	0.15-0.72	0.43+_0.2	0.14-170	0.42+_21	0.13-0.75	0.41+_1.23
Phosphate	1.08-2.06	1.60+_0.898	.452-1.65	0.90+_1.72	0.48-1.06	0.83+_1.50	0.46-1.04	0.81+_1.74
T. Alkalinity	180-236	208.33+_17.76	149-198	177.25+_15.96	148.0-196	176+_15.63	147-194	173.16+_14.87
T. Hardness	264-328	297.33+_18.71	218-295	263.91+_24.96	216-292	261.33+_23.93	212-289	257.25+_24.39
C. hardness	152-196	175.66+_13.47	118-186	158.41+_20.33	116-184	154.83+_19.67	112-185	152.91+_20.21
D.O.	6.4-7.7	7.05+_0.612	6.3-7.8	7.25+_0.78	6.9-7.7	7.29+_1.27	6.0-7.6	7.07+_1.09
B.O.D.	4.0-6.4	5.39+_732	3.0-4.8	3.78+_0.63	3.2-4.6	3.7+_0.35	3.0-4.3	3.43+_1.03
C.O.D.	9.8-66.08	35.35+_16.69	9.9-47.4	27.58+_11.63	9.8-47.2	27.51+_11.67	9.7-47.0	26.59+_11.00

**Total solids:** The mean total solids were recorded as 735,744,739 and 869 mg/l for four sites respectively. Result revealed comparatively higher loads of total solids at Bathing ghats of Govindgarh lake. The higher concentration of solids at Bathing ghats may be due to human activities such as bathing, washing utensil, washing etc.

**Suspended Solids :** The suspended solids ranged between 89 to 199 mg/l, 88 to 198 mg/l, 87 to 195 mg/l and 122 to 340 mg/l for Gopal bag, Temple area and at Bathing ghats, respectively (Table 5). Result indicated comparatively higher concentration of suspended solids during the monsoon months and lower during the winter months. Moderate concentrations were observed during the summer months.

**Dissolved Solids-** Dissolved solids under present investigation varied between 115 to 628 mg/l, 560 to 620 mg/, 576 to 616 mg/l and 636 to 800 mg/l for Gopalbag, Temple area, Fort area and Bathing ghats, respectively. The Bathing ghats of Govindgarh lake again exhibited higher contents of dissolved solids in he water. The minimum concentrations were recorded at Gopal bag area of the lake.

**Chlorides:** Bathing ghats of Govindgarh lake exhibited relatively higher concentration of chloride in water to be followed by temple area, Fort area and Gopal bag area. Higher concentration of chloride in water at bathing ghats may be attributed to human activities. The water of these ghats is regularly used for bathing washing activities (Table 5).

**Ammonium Nitrogen:** Average ammonium nitrogen content was found to be higher at bathing ghat (1.22mg/l) as compared to fort area (0.94mg/l), and Gopal bag area (0.93 mg/l). The Bathing ghat of Govindgarh lake are added with organic mater due to human interference.

**Phosphate:** The phosphate content varied between 0.45 to 1.65 mg/l at Gopal bag, 0.48 to 1.06mg/l at Temple area, 0.46 to 1.04 mg/l at fort area and 1.08 to 2.06 mg/l at Bathing ghats. Bathing ghats of Govindgarh lake exhibited higher concentration of phosphate (1.60mg/l) in water followed by Gopal bag (0.90 mg/l), Temple area (0.83mg/l) and fort area (0.81mg/l).

**Alkalinity:** Total alkalinity varied between 149 to 198 mg/l, 148 to 196mg/l, 147 to 194mg/l and 180 to 236 mg/l for Gopal bag, Temple area, Fort area and bathing ghats, respectively (Table 5).Higher average concentration of total alkalinity was found at bathing ghats (208.0mg/l) as compared to fort area (173.16mg/l),temple area (176.0 mg/l) and Gopalbag (177.25mg/l).

**Total Hardness:** Hardness is the property of water which prevents the foam formation with soap and increases the boiling points of water. The total hardness of Govindgarh lake water was found to be varied between 216-292 mg/l at temple areas, 212 to 289 mg/l at fort area, 218 to 295 mg/l at Gopalbag and 264 to 328 mg/l at Bathing ghats. Like other parameters Bathing ghats also exhibited higher values of total hardness in water



(297.33 mg/l) followed by Gopal bag (263.91 mg/l, Temple area (291.22mg/l and fort area (257.25mg/l).

**Dissolved Oxygen:** The dissolved oxygen content of Govindgarh lake varies between 6.9 to 7.7 mg/l at temple area ,6.0 to 7.0 mg/l at fort area ,6.3 to 7.8 mg/l at Gopal bag and 6.4 to 7.7 at Bathing ghats. An average DO content was minimum at Bathing ghats (7.05mg/l) as compared to Gopal bag (7.25mg/l), temple area (7.29mg/l), and fort area (7.07 mg/l).

**Biochemical Oxygen Demand (BOD):** The BOD of water samples under present investigation varied between 3.0 to 4.3mg/l , 4.0 to 6.4mg/l ,3.2 to4.6 , and 3.0 to 4.8 mg/l for fort area ,bathing ghats temple area and Gopal bag area respectively (Table 5). The higher value of BOD at bathing ghats of Govindgarh lake might be due to influx if sewage in to the lake during the rainy months. This added sewage might have offered more microorganisms for decomposition and thus resulted in the greater demand of oxygen. The addition of phosphate due to detergent used during bathing activities might have also caused excessive growth of algae and consequently have reduced oxygen content.

**Chemical Oxygen Demand (COD):** The values of COD were found in the range of 9.7 to 47.0 mg/l near fort, 9.8 to 66.08 mg/l at Bathing ghat, 9.8 to 47.2 mg/l at Temple site and 9.9 to 47.4 mg/l at Gopalbag. The average values of COD recorded for four sites were 26.50mg/l, 35.35 mg/l, 27.51 mg/l and 27.58 mg/l respectively (Table 5). Result indicated relatively higher value of COD for the water of bathing ghats.

## MACROPHYTE VEGETATION

Results given in Table 7 shows that the *Azolla pinnata* was the dominant species during rainy season comes under 70-80 IVI class to be followed by *Ottelia alismoides* (50-60) and *Najas minor* (30-40). In summer season again *Azolla pinnata* dominated the community with IVI value of 51.76 followed by *Najas minor* (43.43) and *Nymphoides cristatum* (42.41). Almost same pattern has been observed during the winter season. After critical examination of results the mycrophytes community of Govindgarh lake may be considered a community of *Azola pinnata*, *Najas minor* , *Vallisanoaria spiralis* and *Hydrilla verticillata*. Winter season showed higher species diversity (4.32) followed by summer (3.28) and rainy season (2.96). It is oblivious form the result that submerged species dominated the macrophytic community of Govindgarh Lake. The causes of this are unicellular but it may be due to the rather good water quality of this lake as suggested. The result of the present investigation reveals that the colonization for macrophytes in the lake is poor. The nature of substation may also be important is influencing the distribution of rooted vegetation.

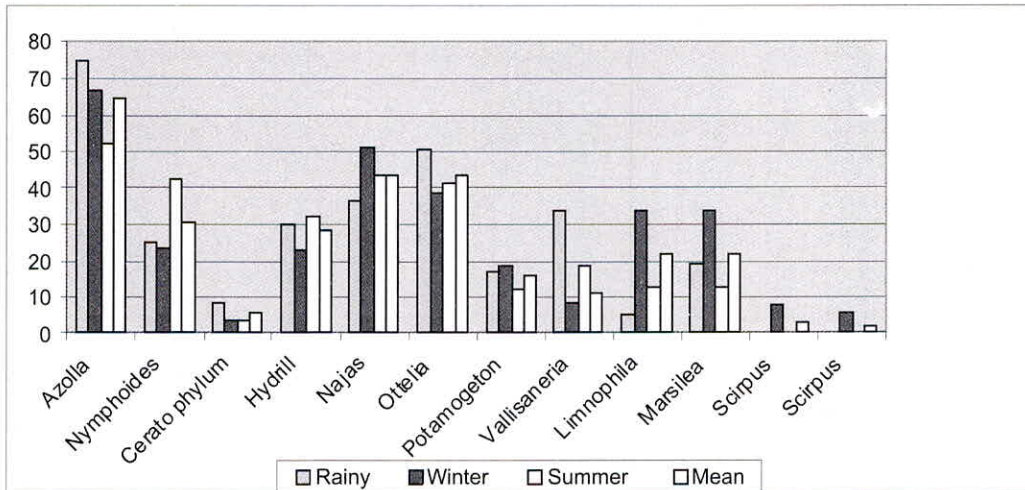
Twelve species of macrophytes were recorded in the lake (Table 6). These were *Azolla pinnata*, *Nymphoides cristatum*, *Certaophyllum demersum*, *Hydrilla verticillata*, *Najas minor*, *Ottelia alismoides*, *Potamogeton pectinatus*, *Limnophila heterophila*,

Table 6: Seasonal density abundance and frequency of different species of macrophytes

Life forms	Species	Density	Rainy abundance	Frequency	Density	Winter abundance	Frequency	Density	Summer Abundance	Frequency
Floating	<i>Azolla pinnata</i> ,	7.78	17.50	44.44	5.56	25.00	22.22	4.44	20.0	22.22
	<i>Nymphoides cristatum</i>	0.89	2.67	33.33	0.56	1.06	33.33	1.11	2.00	56.56
Submerged	<i>Cerataophyllum demersum</i> ,	1.22	5.50	22.22	0.56	5.00	11.11	0.44	4.00	11.11
	<i>Hydrella verticillata</i> ,	6.22	11.20	55.56	4.88	11.00	44.44	5.77	8.67	66.67
	<i>Najas minor</i>	8.11	12.17	66.67	13.00	14.63	88.89	10.77	16.17	66.67
	<i>Ottelia alismoides</i> ,	2.44	7.33	33.33	1.33	6.00	22.22	1.55	7.00	22.22
	<i>Potamogeton pectinatus</i> ,	2.67	6.0	44.44	2.67	4.80	55.56	1.66	5.00	33.33
Emergent	<i>Valisnaria spiralis</i>	6.67	10.00	66.67	8.67	19.50	44.44	7.33	22.00	33.33
	<i>Limnophila heterophila</i> ,	1.00	9.00	11.11	2.23	21.00	11.11	4.11	12.33	33.33
	<i>Marsilea quadrifolia</i> ,	2.56	4.60	55.56	2.56	14.60	55.56	1.66	5.00	33.33
	<i>Scirpus anticalatus</i> ,	-	-	-	0.55	2.50	22.22	-	-	-
	<i>Eriocaulon setaceum</i>	-	-	-	1.1	10.00	11.11	-	-	-

**Table 7: Important Value Indices (IVI) of the different Macrophytes.**

Life forms	Species	Rainy	Winter	Summer	Mean
Floating	<i>Azolla pinnata,</i>	74.76	66.68	51.76	64.40
	<i>Nymphoides cristatum</i>	25.10	23.44	42.41	30.32
Submerged	<i>Cerato phylum demersum,</i>	8.25	3.84	3.81	5.30
	<i>Hydrill verticillata,</i>	29.89	22.97	32.19	28.35
	<i>Najas minor,</i>	36.24	50.83	43.43	43.50
	<i>Ottelia alismodes,</i>	50.51	38.69	41.44	43.52
	<i>Potamogeton pectinatus,</i>	17.12	19.06	12.13	16.17
	<i>Vallisneria spirals</i>	33.51	8.35	18.99	10.85
Emergent	<i>Limnophila heterophila,</i>	5.22	33.76	12.34	21.84
	<i>Marsilea quadrifolia</i>	19.41	33.76	12.34	21.84
	<i>Scirpus anticulatus,</i>	-	7.74	-	2.58
	<i>Eriocaulon setaceum</i>	-	5.50	-	1.83



**Fig. 1 : Graphical presentation of the of Macrophytes**

Marsilea quadrifolia, Scirpus anticulatus, Vallisneria spiralis and Eriocaulon setaceum.

The Macrophytic vegetation was limited to comparatively shallower water of lake. Three vegetation life forms namely, floating submerged and emergent were characterized by the distinct assemblage their species. Out of twelve species two species *Azolla pinnata*, *Nympheoides cristatum* were free and rooted floating, respectively. Six species *Certaophyllum demersum*, *Hydrilla verticillata*, *Najas minor*, *Ottelia alismoides*, *Potamogeton pectinatus*, *Vallisneria spiralis* belong to submerged group. Other species

like *Limnophila heterophila*, *Marsilea quadrifolia*, *Scirpus anticulatus*, and *Ericaulon setaceum* were emergent macrophytes, The submerged plants were distributed to about 1.3 m deep into water where as emergent plant were distributed towards the margin. Floating plants were distributed at the margin and deep in the water. *Nymphoides cristatum* was not found as deep as *Azolla pinnata*.

The submerged species contributed about 50% of total vegetation to be followed by emergent (16.6%) and floating (13.3%) species. There have marked variation in the density frequency and abundance of he studied plants during the three season. Some species like *Najas minor*, *Hydrilla verticillata* and *Potamogeton pectinatus* showed comparatively higher values pf density and frequency. Result Table 7 indicated that *Azolla pinnata* was the dominant species among floating plants in all three seasons. Maximum IVI value was recorded during the rainy months (74.76) for this species to be followed by winter (66.68) and summer month (51.76). *Najas minor*, *Hydrilla verticillata* and *Vallisnaria spiralis* together dominated among the submerged group. The graphical representation of macrophytes.

## CONCLUSION

The present study was undertaken to assess the water quality and macrophytic vegetation of Govindgarh lake. The diversity of the zooplankton are controlled by the several physico-chemical factors of water, temperature, Dissolved oxygen and organic matter are the important factors which control the zooplanktons growth. A large number of the rotifers indicate high eutropic nature of the water body. For proper environmental management of the wetlands it is imperative to undertake a systematic study involving scientific inputs. The present study would provide important information on Govindgarh lake which may be useful for proper planning and management of the resources for benefit of society.

## REFERENCE

1. APHA.1985. Standard Methods for the Examination of Water and Waste Water, American Public Health Association, Washington D.C.