Diversity And Seasonal Abundance Of Phytoplankton Of River Narmada Madhya Pradesh (India).

*Shailendra Sharma, **Karam Singh, **Ram Prajapati,***C.M.Solnki,*** Dhavni Sharma, ***Taniya Sengupta, *Tushar Gandhi, **Meenakshi Chouhan,*Amrita Vyas

*Department of Zoology, Shri Umiya Girls College, Mandleshwar -451221 (M.P.) INDIA.
Email: shailendra.b.sharma@gmail.com
**Department of Zoology, Holkar Science College, Indore-452003 (M.P.) INDIA.
***Department of Botany, P.M.B.Gujarati Science College, Indore

Abstract: Phytoplankton which are predominantly atrophic and primary producers of organic matter in aquatic habitat, float in water and moved passively by wind or water current. They stand at the base line of many food webs in aquatic environments and are in turn dependent on the activities of other microbial organisms, which convert organic material into inorganic nutrients required by plants. Phytoplankton of the Narmada River consisted mainly of green algae (***Chlorophyceae***) Diatoms (***Bacillariophyceae)*** and the blue green algae (***Myxophyceae***). ***Chlorophyceae*** consisted of 23 genera some of the Zygnema, ***Eudorina Species***. ***Chlosterium Species***. ***Spirogyra***, ***Pediastrum simplex***, ***Pediastrum duplex*** and ***Chlorella*** were more dominant forms. Diatoms ***(Bacillariophyceae)*** was represented by 7 genera where as ***Myxophyceae*** by 10 genera respectively. In Narmada river the temporal succession of phytoplankton groups is noticed as ***Chlorophyceae > Cyanophyceae > Bacillariphycease .***The species composition, distribution, abundance of phytoplankton population are governed by various physico-chemical factors of the water body. The population of Plankton fluctuates in different seasons and months.
[Shailendra Sharma, Karam Singh, Ram Prajapati, C.M.Solnki, Dhavni Sharma, Taniya Sengupta, Tushar Gandhi, Meenakshi Chouhan, Amrita Vyas. Diversity and Seasonal Abundance of Phytoplankton of River Narmada Madhya Pradesh (India). World Rural Observations 2011;3(2):14-28]. ISSN:1944-6543 (print); 1944-6551 (online).

Keywords: Diversity; Seasonal Abundance; Phytoplankton; Narmada Madhya Pradesh

1. Introduction

Plankton abundance and distribution are strongly dependent on factors such as ambient nutrients concentration the physical state of the water column, and the abundance of other plankton.

Plankton are of immense value as food and play an important role in the disposal of sewage and in the natural purification of polluted waters. However some plankton, from a harmful bloom that may cause high morality among the aquatic organisms and pose a serious hazard in the water supply for domestic and industrial use.

This scheme divides the plankton community into broad producer, consumer and realer groups. In reality, the tropic level of some plankton is rust straight forward, for example, although most dinoflageuates are either photosynthetic producers or heterotrophic consumers many species are mixotrophic depending upon their circumstances.

Phytoplankton (from Greek Phyton), autotrophic, prokaryotic or Eukarotic algae that live near the water surface where there is sufficient light to support photosynthesis. Among the more important groups are the diatoms, cynobacteria and dinaflagelates.

Planktons are minute organisms and is essential links in food chain in aquatic system. Phytoplankton's and zooplanktons are the major group of plankton. Phytoplanktons play a phenomenal role in the biosynthesis of organic material while zooplankton forms important components of secondary production. The zooplankton forms of link between phytoplankton and micro invertebrates which in turn provide food to fishes and aquatic birds. Planktonic primals in fresh water are dominated by rotifers cladocerans and copepods. Rotifers are most sensitive bioindicators of water quality and their presence may be used as a reference to the physico-chemical characteristics of water.

The information about the fresh water planktonic organisms is scanty in India. The basic knowledge of fresh water plankton is very limited. The detailed study on their biological and ecological relation is required. A real contribution to the planktonic studies has been pointed out by Hutchinson (1991), Ward and Whipple (1959) Schindler & Noven (1971) Fernando (1980) Malone and Neale (1981) and Duncan (1983).

Studies on the phytoplankton communities of rivers started with Roy (1949. 1966), Chacko & Ganapati (1949), Chacko, Shrinivasan & Evangeline (1955), Chakraborty et al., (1959), Iyengar & Venkataraman (1962), Laxmi-Narayana, (1965) besides many other rivers Venkateshwarlu, (1969), Venkateshwarlu & Jayanti, (1969) and Dutta et al.,

(1979), Prasad & Saxena, (1980), since late (1950s), River Ganga and River Yamuna Roy et al., (2002) have been investigated Gopal & Sah (1993) Krishnamurti et al., (1994).

2. Material and Methods

Description of Narmada River

The Narmada river, hemmed between Vindhya and Satpuda ranges, extends over an area of 98,796 km². And lies between east longitudes 72 degrees 32' to 81 degrees 45' and north latitudes 21 degrees 20' to 23 degrees 45' lying on the northern extremity of the Deccan Plateau. The basin covers large areas in the states of Madhya Pradesh (86%), Gujarat (14%) and a comparatively smaller area (2%) in Maharashtra. There are 41 tributaries, out of which 22 are from the Satpuda range and the rest on the right bank are from the Vindhya range.

3. Study Area/Sampling Station:

The water samples would be collected from the various selected sampling station in the Narmada river which are as under. Before finally fixing the sampling stations a general survey of River was made, samples were collected and estimated from various regions in which Narmada river flow. Accordingly & study areas were fixed.

A. Omkareshwar:

Omkareshwar is a famous place of pilgrimages, situated 77 km from Indore in Khandwa District. Madhya Pradesh shaped like the holy Hindu Symbol. 'OM', this sacred island, on the conflux of the river Narmada and Kaveri is visited by pilgrims from all over the country to seek blessing at the temple of Shri Omkar Mandhata.

It's Latitude (D M S) – 22º15' 1" N and Longitude – (DMS) 76º8' 48" E

B. Mandleshwar:

Mandleshwar is a small town and a Nagar Panchayat Khargon District in the Madhya Pradesh state of India (Asia). It is a town of historical and religious importance situated on the banks of Narmada river at a distance of 8 km east from Maheshwar, which was the capital of Holkar States and 99 km from Indore.

It's Latitude– 22º18 Latitude (DMS) 22º10' 60" N and Longitude –75º67. Longitude (DMS) 75º0' 0" E.

C. Maheshwar:

Maheshwar is a small town in Khargone district of Madhya Pradesh state in central India. It is located 91 km. away from Indore (4 hour by bus), the commercial capital of the state. The town lies on the North bank of the Narmada river.

It's Latitude– 22º18 Latitude (DMS) 22º10' 60" and Longitude –75º58, Longitude (DMS) 75º54' 60" E.

D. Barwani:

Barwani, also known as Barwani or Siddh Nagar, is a city and a municipality in Barwani District in the state of Madhya Pradesh, India. The town is situated near the left bank of the Narmada river. The great Narmada river flows through Barwani (Just 5 km from city). Barwani is located 150 km away from Indore.

It is Latitude– 22º03, Latitude (DMS) 22º1' 60" N and Longitude –749.9, Longitude (DMS) 74º54' 0" E.

Biological Estimation:

1. Collection, preservation and Identification of Plankton:

The plankton samples were collected following Lind (1979, Welch 1953), Wetzel (1975), by filtering 40 Liters of water through plankton net having pore size 64 µ. The concentration plankton samples were fixed in 4% formalin and Lugal's solution for zooplankton and phytoplankton study respectively.

The phytoplankton were identify with the help of keys given by pres cott (1962), Smith (1950), Agarkar (1975), Edmondson (1959).

Zooplankton were identified with the help of keys' provided by Pemak (1978), Sehgal (1083), Needham and Needham (1962), Tonapi (1980), APHA (1980).

Counting of the individual plankton was done by "Lac Keys" dropping method (1935) using the formula.

$$\text{Plankton units/Liter} = \frac{N \times C}{y} \times 10$$

N = Number of plankton counted in 0.1ml Concentrate.
C = Total volume of concentrate in ml.
Y = Total volume of water filtered for sample in liters.

The phytoplankton density was expressed on units/liter and zooplankton density was expressed on individuals/liter.

4. Results and discussion

A list of Phyto planktonic population of Narmada river.

Table 1. Monthly variations in phytoplankton density (units/l) at station I in Narmada River during 2008-09

S. No.	Name of Group & Species	Aug.	Sept.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	April
CHLOROPHYCEAE										
1	***Eudorina Species***	12	25	30	37	44	26	28	25	30
2	***Closteridium Species***	-	12	30	44	25	18	29	15	25
3	***Chlorella Species***	-	13	16	36	26	19	-	15	-
4	***Actinastrum Species***	-	-	-	31	23	19	-	-	-
5	***Crucigenia Species***	-	-	-	21	22	19	12	30	-
6	***Scenedesmus***	-	-	13	22	19	26	23	29	-
7	***Pediastrum Simplex***	-	32	64	52	44	32	12	22	42
8	***Pediastrum Duplex***	-	22	32	44	32	26	-	13	14
9	***Microspora Species***	18	19	22	26	13	14	-	-	-
10	***Oedogonim Species***	-	13	13	22	23	18	-	-	-
11	***Spirogyra Species***	-	32	38	44	52	32	23	26	14
12	***Zygnema Species***	-	13	19	82	100	126	132	31	42
13	***Closterium Species***	-	19	13	14	13	44	26	19	12
14	***Euastridium Species***	-	22	26	29	42	44	20	21	-
18	***Ulothrix Species***	-	22	26	29	30	12	19	22	-
19	***Volvox Species***	22	19	18	22	26	30	35	8	32
20	***Cosmarium Species***	32	-	35	29	26	22	21	18	8
21	***Tetraspore Species***	23	-	-	24	35	40	48	2	13
22	***Chlamydomonas Species***	22	18	22	25	-	-	33	36	40
23	***Lepocinclis Species***	33	-	-	19	37	32	34	42	18
	Total	**162**	**281**	**417**	**652**	**632**	**599**	**495**	**374**	**290**
CYANOPHYCEAE										
1	***Anacytis Species***	87	98	100	86	89	104	92	62	45
2	***Oscillatoria Species***	-	72	83	72	44	42	54	32	108
3	***Spirulina Species***	25	32	38	40	22	36	44	32	44
4	***Anabaena Species***	20	21	26	40	32	46	62	42	32
5	***Nostoc Species***	12	19	33	20	23	32	22	26	32
6	***Melosira Species***	-	38	46	23	44	48	52	54	56
7	***Synedra Species***	23	34	46	48	33	29	12	22	32
8	***Cyclotella Species***	38	18	29	34	36	48	50	32	28
9	***Cymbella Species***	-	-	13	22	36	13	14	19	22
10	***Diatoma Species***	23	34	45	36	29	38	22	51	30
	Total	**228**	**366**	**459**	**421**	**388**	**436**	**424**	**372**	**429**
BACILLARIOPHYCEAE										
1	***Asterionella Species***	-	22	26	19	26	32	37	38	34
2	***Melosira Species***	-	-	-	13	19	22	26	32	19
3	***Fragilaria Species***	44	26	22	19	20	22	26	38	26
4	***Gomphonema Species***	-	38	52	34	32	19	19	17	19
5	***Surevilla Species***	-	40	52	32	26	20	19	44	53
6	***Microcystis Species***	38	42	36	22	29	34	33	19	80
7	***Lyngbya Species***	13	20	29	42	50	34	23	11	12
8	***Nodularia Species***	34	40	43	48	38	29	27	17	12
9	***Rivularia Species***	34	40	53	37	18	56	25	37	31
	Total	**163**	**268**	**313**	**266**	**258**	**268**	**235**	**253**	**286**

Table 2. Monthly variations in phytoplankton density (units/l) at station II in Narmada River during 2008-09

S. No.	Name of Group & Species	Aug.	Sept.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	April
CHLOROPHYCEAE										
1	***Eudorina Species***	-	-	33	-	50	31	18	18	19
2	***Closteridium Species***	-	-	-	13	24	26	33	38	25
3	***Chlorella Species***	-	26	30	33	18	19	42	-	18
4	***Actinastrum Species***	24	-	-	50	44	39	32	26	44
5	***Crucigenia Species***	-	-	-	12	19	32	33	38	19
6	***Scenedesmus***	-	-	-	13	21	26	22	33	34
7	***Pediastrum Simplex***	-	-	13	24	36	42	23	41	32
8	***Pediastrum Duplex***	-	-	12	19	22	19	13	25	34
9	***Microspora Species***	-	13	13	19	-	-	-	-	-
10	***Oedogonim Species***	23	-	-	24	19	30	35	44	34
11	***Spirogyra Species***	-	-	29	44	32	38	18	19	13
12	***Zygnema Species***	-	-	12	18	22	24	30	20	14
13	***Closterium Species***	-	-	-	13	-	-	-	-	-
14	***Euastridium Species***	-	-	-	-	13	19	-	15	-
18	***Ulothrix Species***	30	-	12	51	31	32	18	19	-
19	***Volvox Species***	12	13	18	22	-	-	-	12	13
20	***Cosmarium Species***	30	18	33	-	-	12	19	30	15
21	***Tetraspore Species***	-	-	18	22	26	12	21	23	13
22	***Chlamydomonas Species***	12	19	22	26	8	13	-	-	18
23	***Lepocinclis Species***	12	-	-	18	31	27	20	15	17
	Total	**143**	**89**	**245**	**421**	**416**	**441**	**377**	**416**	**362**
CYANOPHYCEAE										
1	***Anacytis Species***	-	-	-	-	12	15	-	18	19
2	***Oscillatoria Species***	31	-	-	13	15	12	-	-	19
3	***Spirulina Species***	31	32	-	-	18	19	23	24	27
4	***Anabaena Species***	31	26	25	-	23	27	28	35	38
5	***Nostoc Species***	31	29	18	15	-	-	19	27	30
6	***Melosira Species***	-	-	12	18	29	44	34	12	19
7	***Synedra Species***	22	-	19	29	34	37	43	24	30
8	***Cyclotella Species***	-	13	-	18	19	21	27	29	33
9	***Cymbella Species***	-	23	37	20	20	19	32	28	18
10	***Diatoma Species***	18	20	20	-	18	27	30	32	13
	Total	**164**	**143**	**131**	**113**	**188**	**221**	**236**	**229**	**246**
BACILLARIOPHYCEAE										
1	***Asterionella Species***	12	13	20	13	19	29	30	18	19
2	***Melosira Species***	20	18	28	29	20	20	13	15	20
3	***Fragilaria Species***	31	-	-	25	12	12	12	25	30
4	***Gomphonema Species***	10	13	20	-	-	13	20	26	21
5	***Surevilla Species***	12	13	21	-	-	-	-	12	19
6	***Microcystis Species***	10	13	20	12	12	12	13	21	27
7	***Lyngbya Species***	13	13	15	20	20	25	12	12	23
8	***Nodularia Species***	24	20	23	15	15	20	12	12	43
9	***Rivularia Species***	10	14	18	19	20	18	20	12	12
	Total	**142**	**117**	**165**	**133**	**118**	**149**	**132**	**153**	**214**

Table 3. Monthly variations in phytoplankton density (units/l) at station III in Narmada River during 2008-09

S. No.	Name of Group & Species	Aug.	Sept.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	April
CHLOROPHYCEAE										
1	***Eudorina Species***	-	-	-	37	20	27	30	23	20
2	***Closteridium Species***	-	-	20	36	41	32	19	20	22
3	***Chlorella Species***	20	22	-	25	18	19	20	20	20
4	***Actinastrum Species***	-	-	12	12	20	25	22	18	20
5	***Crucigenia Species***	-	20	20	43	51	70	26	25	20
6	***Scenedesmus***	-	-	20	43	50	54	30	34	25
7	***Pediastrum Simplex***	22	24	-	27	34	37	23	20	20
8	***Pediastrum Duplex***	-	20	30	24	24	-	-	-	-
9	***Microspora Species***	-	12	24	19	19	19	20	-	-
10	***Oedogonim Species***	-	20	25	31	34	43	13	-	-
11	***Spirogyra Species***	-	12	20	32	44	32	20	20	-
12	***Zygnema Species***	50	34	44	80	125	170	60	57	56
13	***Closterium Species***	-	20	12	18	20	44	20	20	-
14	***Euastridium Species***	-	31	32	44	32	40	26	20	12
18	***Ulothrix Species***	12	-	18	33	34	26	12	-	-
19	***Volvox Species***	-	23	24	30	18	27	35	37	38
20	***Cosmarium Species***	-	-	19	20	26	32	20	12	18
21	***Tetraspore Species***	12	-	13	15	20	21	24	29	30
22	***Chlamydomonas Species***	23	24	18	20	20	27	30	19	12
23	***Lepocinclis Species***	13	18	20	12	12	13	19	24	26
	Total	**152**	**280**	**371**	**601**	**662**	**758**	**469**	**398**	**339**
CYANOPHYCEAE										
1	***Anacytis Species***	-	13	13	31	26	31	20	20	25
2	***Oscillatoria Species***	32	44	51	44	33	26	20	25	33
3	***Spirulina Species***	31	44	44	32	20	49	30	18	24
4	***Anabaena Species***	25	32	26	24	26	38	26	23	28
5	***Nostoc Species***	20	32	37	26	19	26	19	13	25
6	***Melosira Species***	12	13	18	26	20	20	12	20	26
7	***Synedra Species***	23	31	36	44	20	20	12	18	21
8	***Cyclotella Species***	33	12	18	19	19	20	12	12	25
9	***Cymbella Species***	13	23	20	20	12	13	19	21	20
10	***Diatoma Species***	24	26	12	12	25	12	18	20	30
	Total	**213**	**270**	**275**	**278**	**220**	**255**	**188**	**190**	**257**
BACILLARIOPHYCEAE										
1	***Asterionella Species***	-	12	18	22	19	12	12	20	25
2	***Melosira Species***	-	-	12	19	19	20	32	26	38
3	***Fragilaria Species***	23	21	-	-	24	19	27	32	41
4	***Gomphonema Species***	25	50	57	38	44	23	20	18	20
5	***Surevilla Species***	20	34	38	24	20	18	13	34	33
6	***Microcystis Species***	24	13	12	12	25	22	20	20	13
7	***Lyngbya Species***	23	24	30	33	34	20	27	28	30
8	***Nodularia Species***	23	31	-	-	23	31	34	50	52
9	***Rivularia Species***	24	26	-	27	20	20	12	15	37
	Total	**162**	**211**	**167**	**175**	**228**	**185**	**197**	**243**	**289**

Table 4. Monthly variations in phytoplankton density (units/l) at station IV in Narmada River during 2008-09

S. No.	Name of Group & Species	Aug.	Sept.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	April
CHLOROPHYCEAE										
1	***Eudorina Species***	-	-	12	19	19	12	-	-	-
2	***Closteridium Species***	-	44	52	57	70	44	-	-	-
3	***Chlorella Species***	-	13	20	31	44	21	20	20	-
4	***Actinastrum Species***	-	12	20	25	32	25	20	20	-
5	***Crucigenia Species***	-	-	-	20	31	44	20	-	-
6	***Scenedesmus***	-	26	38	44	27	67	26	-	-
7	***Pediastrum Simplex***	-	22	19	22	26	12	-	53	12
8	***Pediastrum Duplex***	-	23	21	26	13	52	15	24	-
9	***Microspora Species***	-	38	44	33	20	12	12	12	-
10	***Oedogonim Species***	10	26	25	20	20	26	38	40	-
11	***Spirogyra Species***	27	50	28	34	39	26	20	12	12
12	***Zygnema Species***	-	38	44	100	175	180	100	110	200
13	***Closterium Species***	-	34	35	38	24	44	50	25	25
14	***Euastridium Species***	-	-	13	20	32	13	18	12	-
18	***Ulothrix Species***	23	31	26	22	12	12	29	19	12
19	***Volvox Species***	24	31	12	12	20	36	34	37	-
20	***Cosmarium Species***	12	12	12	36	21	33	24	12	12
21	***Tetraspore Species***	33	23	20	20	36	29	12	24	26
22	***Chlamydomonas Species***	24	12	12	37	38	44	33	45	39
23	***Lepocinclis Species***	12	12	24	39	34	12	12	20	26
	Total	**165**	**447**	**477**	**655**	**733**	**744**	**483**	**485**	**364**
CYANOPHYCEAE										
1	***Anacytis Species***	-	32	30	54	44	30	20	20	38
2	***Oscillatoria Species***	31	32	26	27	19	19	25	32	44
3	***Spirulina Species***	18	20	19	22	24	15	25	25	32
4	***Anabaena Species***	20	33	12	12	31	33	42	18	19
5	***Nostoc Species***	-	-	12	26	18	12	10	14	20
6	***Melosira Species***	31	-	-	-	12	10	14	13	12
7	***Synedra Species***	34	-	-	-	10	15	18	18	20
8	***Cyclotella Species***	33	-	-	20	23	18	19	10	18
9	***Cymbella Species***	25	23	-	-	-	13	12	12	18
10	***Diatoma Species***	23	24	12	12	20	18	12	13	19
	Total	**215**	**164**	**111**	**173**	**201**	**183**	**197**	**175**	**240**
BACILLARIOPHYCEAE										
1	***Asterionella Species***	34	44	50	25	30	32	34	56	49
2	***Melosira Species***	24	26	29	44	-	44	56	23	39
3	***Fragilaria Species***	44	46	49	20	30	33	50	51	50
4	***Gomphonema Species***	31	44	12	12	20	19	12	13	30
5	***Surevilla Species***	31	32	37	31	31	44	50	23	24
6	***Microcystis Species***	24	26	20	20	12	13	31	44	12
7	***Lyngbya Species***	20	12	12	31	31	31	44	45	51
8	***Nodularia Species***	20	12	37	44	12	45	25	20	12
9	***Rivularia Species***	25	26	12	12	-	-	23	12	19
	Total	**253**	**268**	**258**	**239**	**166**	**261**	**325**	**287**	**286**

Phytoplankton of this Narmada River consisted mainly of green algae (***Chlorophyceae***) Diatoms (***Bacillariophyceae)*** and the blue green algae (***Myxophyceae***) phytoplankton population represented by ***Chlorophyceae*** group followed by ***Bacillariphycae*** and ***Myxophyceae***. ***Chlorophyceae*** consisted of 23 genera some of the ***Zygnema***, ***Eudorina Spices***. ***Chlosterium Species***. ***Spirogyra***, ***Pediastrum simplex***, ***Pediastrum duplex*** and ***Chlorella*** were more dominant forms. diatoms ***(Bacillarioplyceae)*** was represented by 7 genera where as ***Myxophyceae*** by 10 genera respectively. The dominant groups each family are listed in the Table 1, 2, 3 and 4.

Figure 1. Monthly Variation in Phytoplankton (Chlorophyceae) density at Station-I (Omkareshwar) of Narmada river (Aug. 08 to Apr. 09)

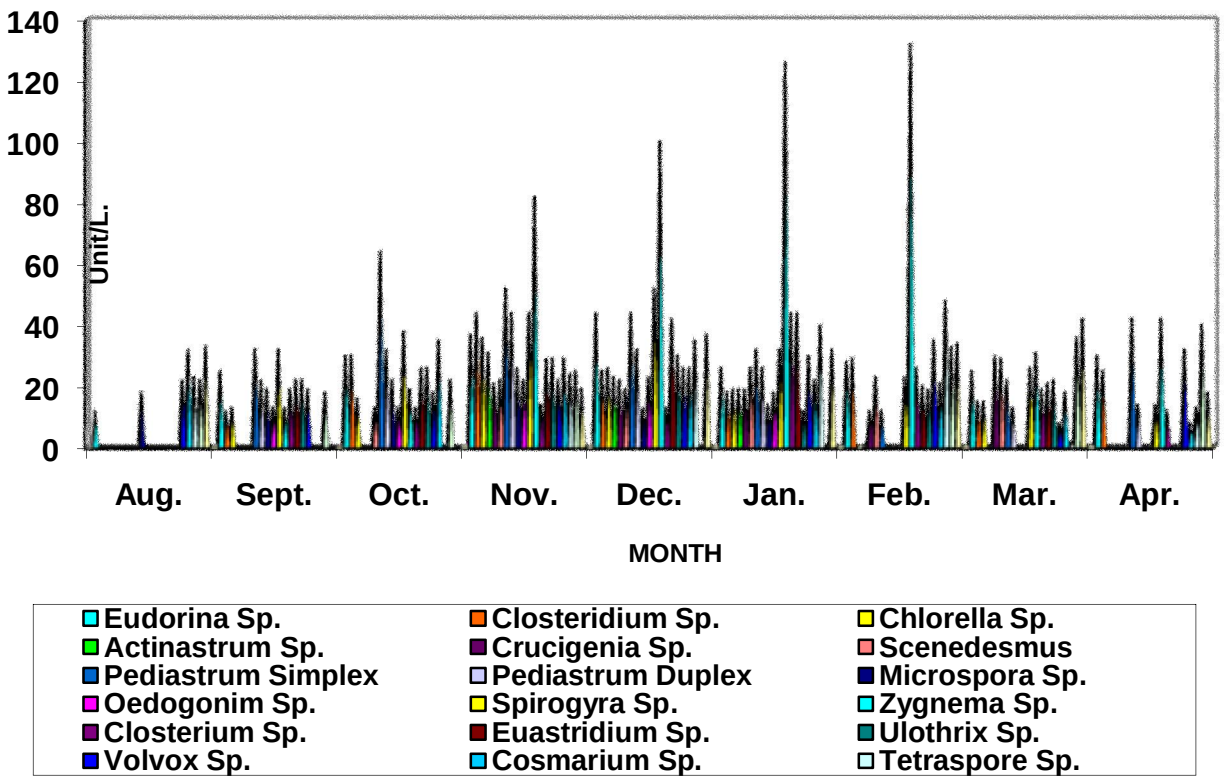


Figure 2. Monthly Variation in Phytoplankton (Cyanophyceae) density at Station-I (Omkareshwar) of Narmada river (Aug. 08 to Apr. 09)

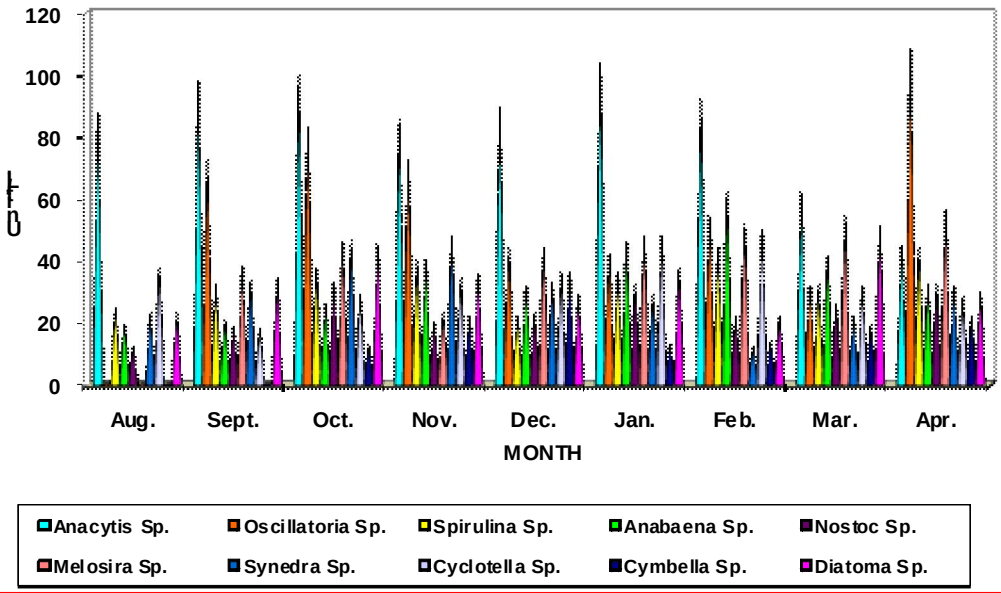


Figure 3. Monthly Variation in Phytoplankton (Bacillariophyceae) density at Station-I (Omkareshwar) of Narmada river (Aug. 08 to Apr. 09)

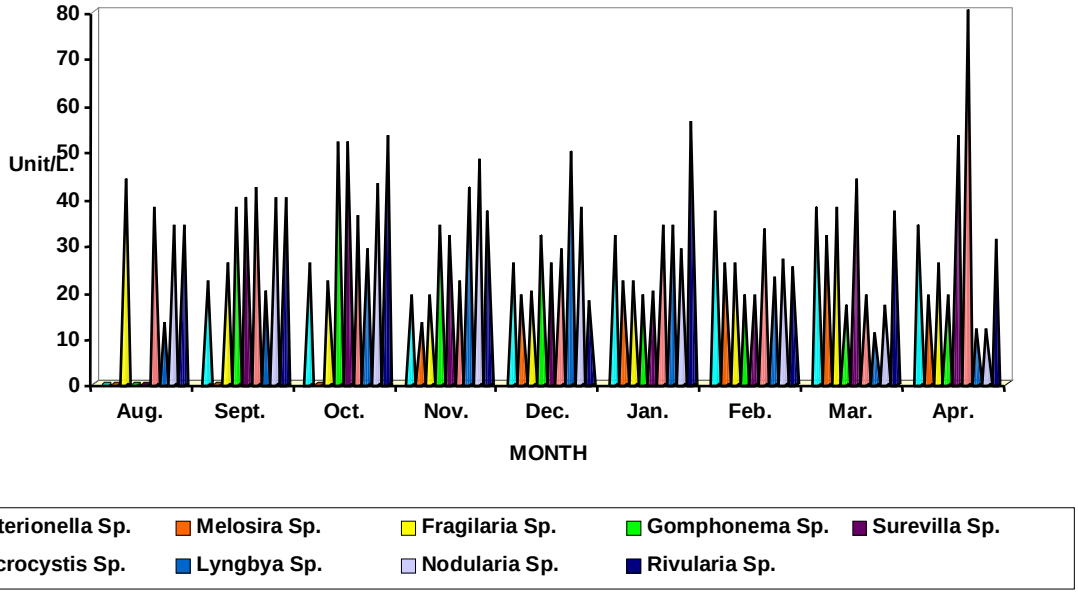


Figure 4. Monthly Variation in Phytoplankton (Chlorophyceae) density at Station-II (Mandleshwar) of Narmada river (Aug. 08 to Apr. 09)

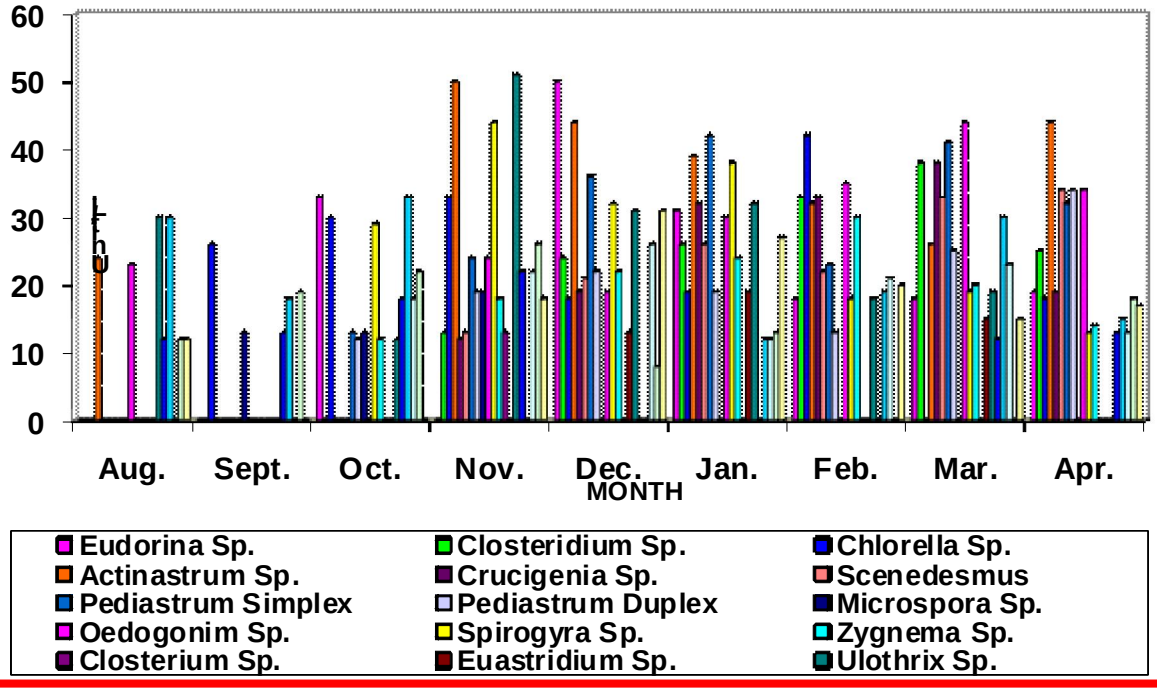


Figure 5. Monthly Variation in Phytoplankton (Cyanophyceae) density at Station-II (Mandleshwar) of Narmada river (Aug. 08 to Apr. 09)

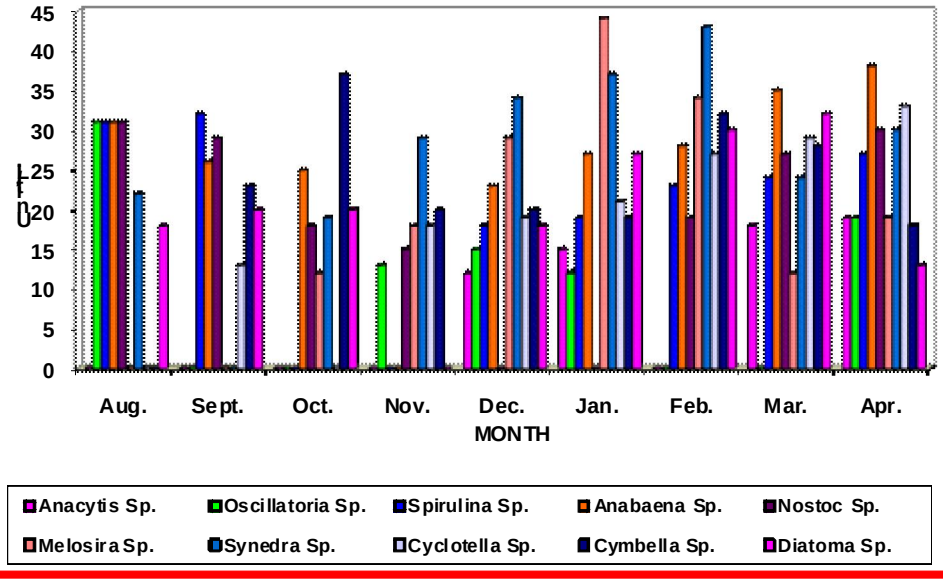


Figure 6. Monthly Variation in Phytoplankton (Bacillariophyceae) density at Station-II (Mandleshwar)of Narmada river(Aug. 08 to Apr. 09)

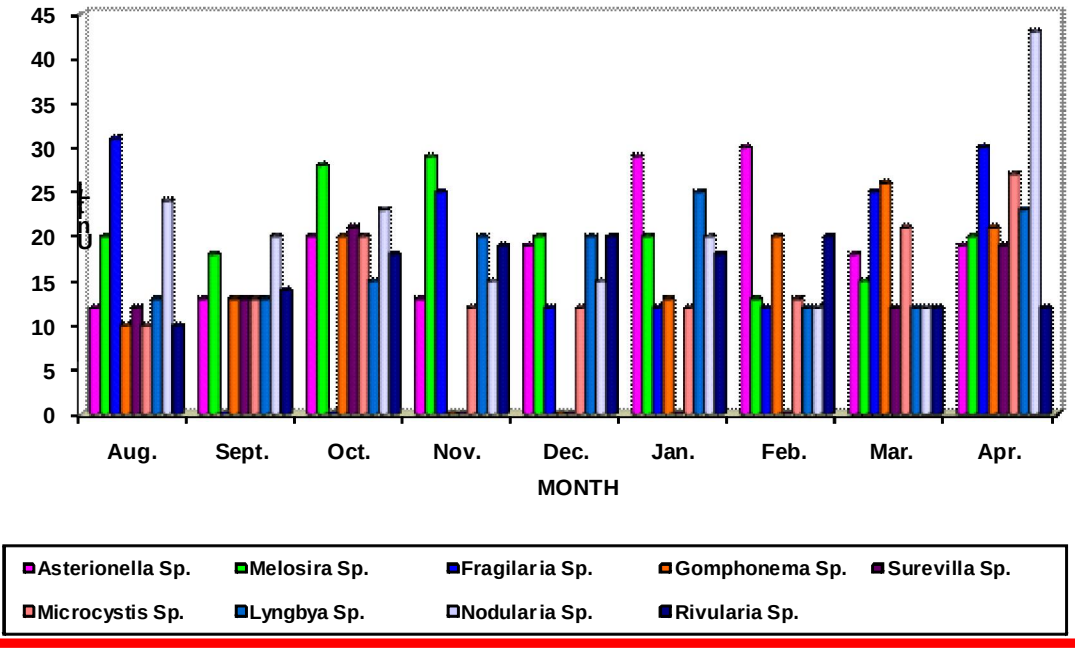


Figure 7. Monthly Variation in Phytoplankton (Chlorophyceae) density at Station-III (Maheshwar) of Narmada river (Aug. 08 to Apr. 09)

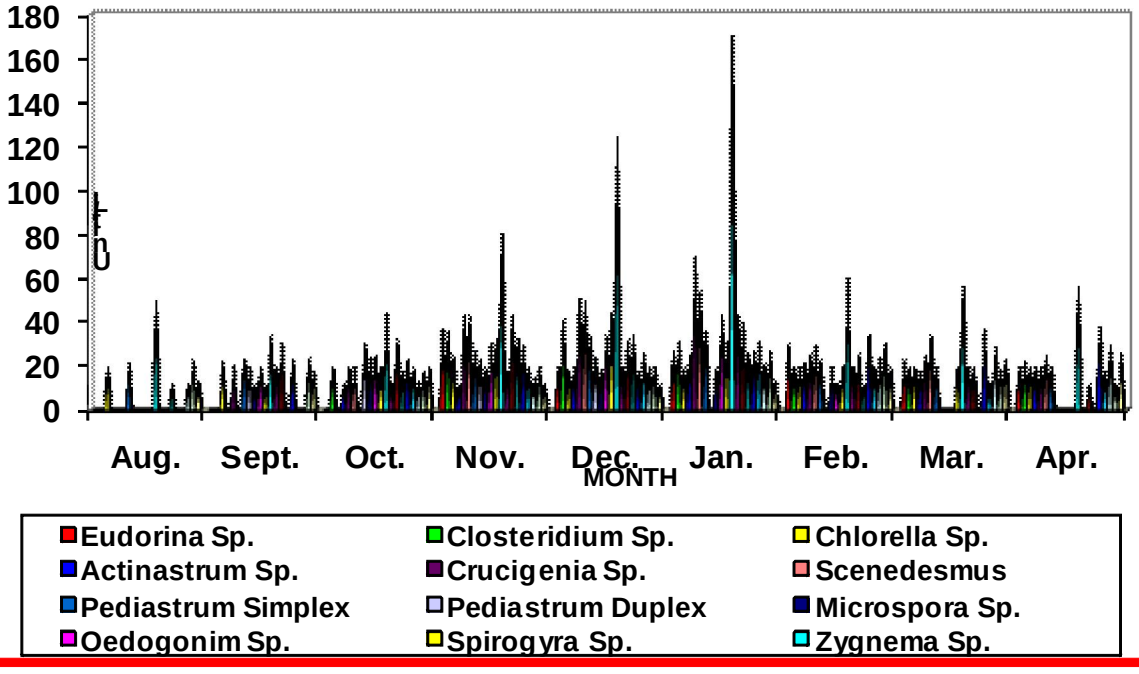


Figure 8 Monthly Variation in Phytoplankton (Cyanophyceae) density at Station-III (Maheshwar) of Narmada river (Aug. 08 to Apr. 09)

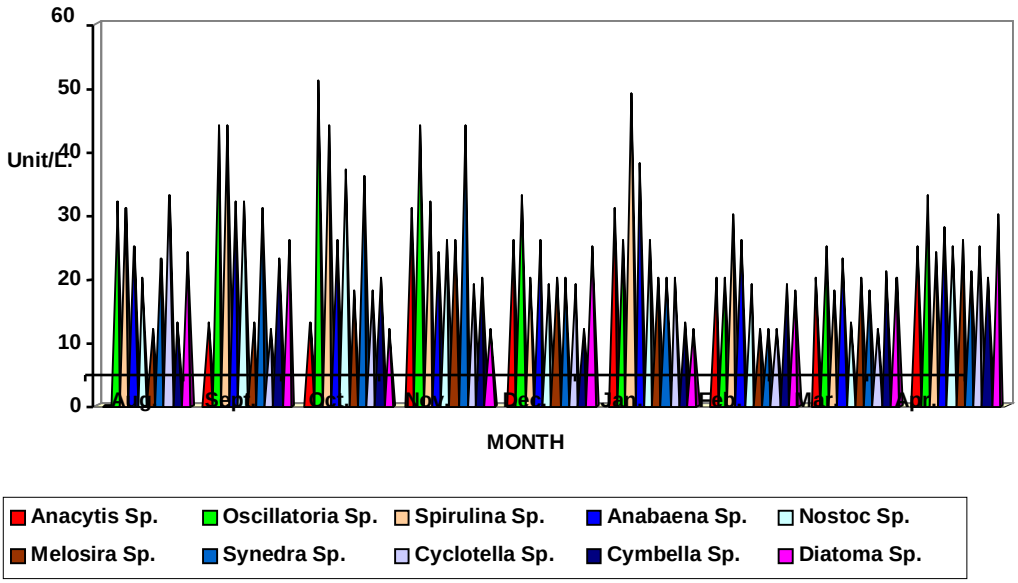


Figure 9 Monthly Variation in Phytoplankton (Bacillariophyceae) density at Station-III (Maheshwar) of Narmada river (Aug. 08 to Apr. 09)

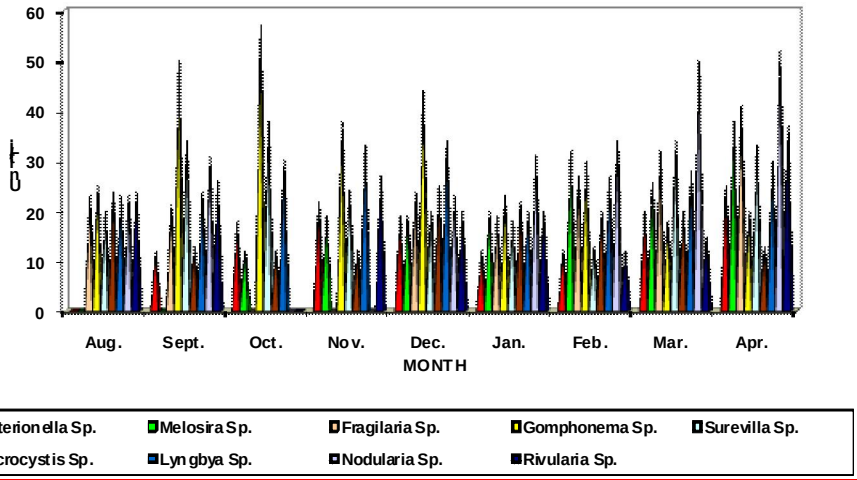


Figure 10 Monthly Variation in Phytoplankton (Chlorophyceae) density at Station-IV (Barwani) of Narmada river (Aug. 08 to Apr. 09)

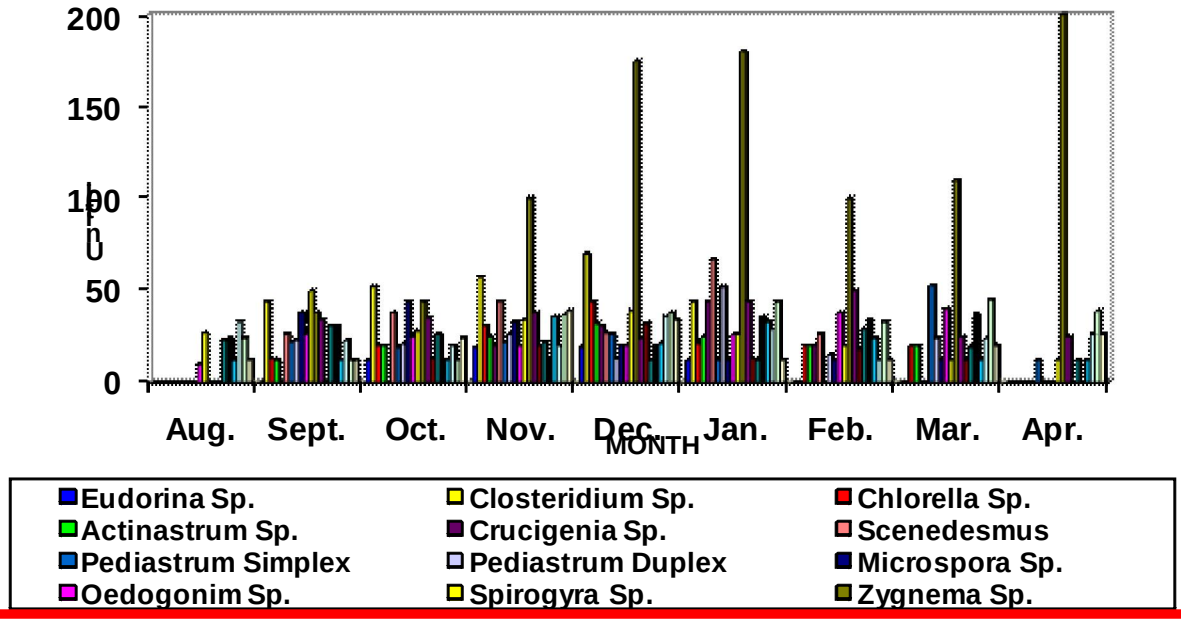
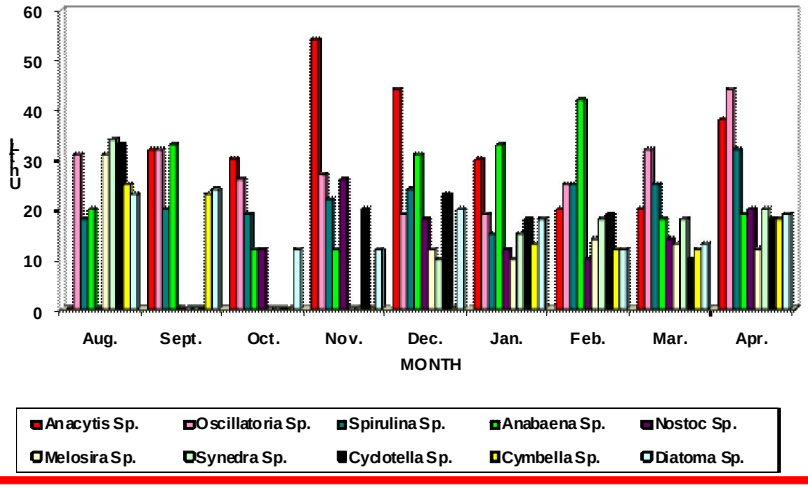
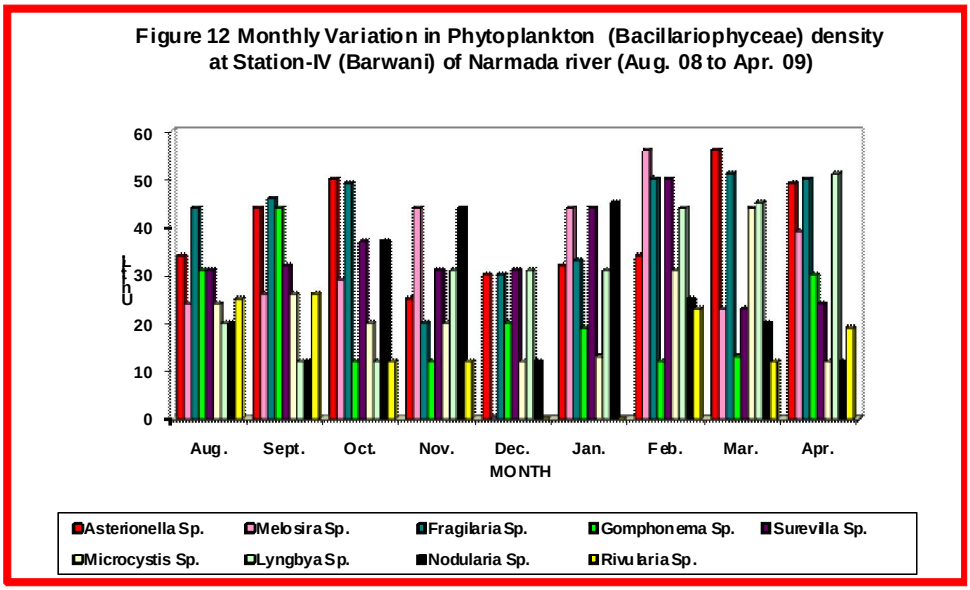


Figure 11 Monthly Variation in Phytoplankton (Cyanophyceae) density at Station-IV (Barwani) of(Narmada river (Aug. 08 to Apr. 09)





In general, on the annual basis the average number of phytoplankton was 125.0 units/l. in 2008 and 1248 unit/l. in 2009. The total number of phytoplankton was composed of 1505 of which ***Chlorophyceae*** were 733 (48.70%) ***Bacillariophyceae*** 313 (20.79%) and ***Myxophyceae*** were 459 (30.49%) in 2008. But in 2009, the total number of phytoplankton was recorded 1458 of which ***Chlorophyceae*** the major constituents with 758 in numbers (51.98%) followed by ***Bacillariophyease*** 325 (22.29%) and ***Myxophyceae*** 436 (29.90%) Respectively.

Among the phytoplankton, chlorophyton showed an increasing trends from January to April whereas from August to September, The trend was in negative fashion in October a sudden rise in total number of phytoplankton and another negative trend in November and December was reported during the working spawn. (2008-2009).

Group Wise –

***Chlorophyceae* – (Green algae)**

The green algae was recorded its medium in April 103 and 105 units/l. while minimum in August 12 and 13 units/l. respectively during both years of investigation. However, this group dominated during summer months and considerably was low in number during rainy months of the both years (2008-09).

***Bacillariophyceae* (diatoms)**

Bacillariophyceae attained its maximum growth in April that is 87 and 85 units/l. in both the years (2008-09) and the minimum in August 10 and 8 units/l. during both years (2008-09).

This results of ***Bacillariophyceae*** indicated that they were more in numbers in summer seasons and low in numbers during rainy seasons.

***Myxophyceae* (Blue green algae)**

Myxophyceae reached in high peak in January (89 units/l. and 76 units/l.) during 2008-09 respectively and minimum peak in August (5 units/l. and 6 units/l.). These groups were more common during summer seasons and minimum in rainy season of both years.

Total of the plankton (Phyto & Zooplankton) showed a typical bimodal curve representing two minima maxima and two minima (Table 1 to 4) (Figure 1 to 12.)

In Narmada river the temporal succession of phytoplankton groups is noticed as ***Chlorophyceae*** > ***Cyanophyceae*** > ***Bacillariphycease.***

Chlorophyceae

The group ***Chlorophyceae*** dominated the river plankton in all the collections at all the stations forming in general 48.7% of total phytoplankton (Table 1 to 4). The peak of the group is recorded during winter months.

In the present study among ***Chlorophyceae*** the group ***Chloroccocals*** appears as dominant during winter season, but the number records faster in summer. The other group which comes next in order to dominance is conjugals but these maintain almost a similar density in winter and summer.

The least recorded group during the present study among ***Chlorophyceae*** is ***Utricals***. In the present study the group ***Chlorophyceae*** has a positive correlation with total dissolved oxygen, and a negative correlation with temperature pH and phosphate.

Among ***Chlorophyceae*** the most dominant species is ***Zygnema*** species. And ***Pediastrum*** simplex stands as second in order of dominance. ***Zygnema*** Species showed its maximum density at the station IV. This indicates that ***Zygnema*** Species prefers the limonitic waters. This species is recorded in the maximum density during the months of winter and it loses its growth at the onset of the summer.

Cyanophyceae

In the present study this group is observed to constitute 26.12% of total phytoplankton. The contribution of ***Cyanophyceae*** in the Narmada River is almost half of ***Chlorophyceae***, through it has appeared as second dominant group in the river. The density of ***Cyanophyceae*** is reported the maximum at station I. The peak of the group is observed during summer month. Many other reports like Siddiqui and Pandey (2001), Rao et al., (2002), and Pathan (2002), Reports two peaks of ***Cyanophyceae***. In the present study ***Cyanophyceae*** shows positive correlation with transparency, pH, alkalinity and dissolved oxygen (Table 4).

Bacillariophyceae

The group ***Bacillariophyceae*** constitutes the diatoms and it characteristics of lentic water bodies specially the river. In the present study this group is observed to constitute 20.79% of total phytoplankton.

During the present study ***Surevilla*** species is most dominant species among the ***Bacillariophyceae*** group. The highest density of this species is recorded at station IV and lowest density is records at station II. The second dominant species is the ***Gomphonema*** species. The highest density of ***Gomphonema*** species is records at the station III and lowest at the station II.

REFERENCES

1. **APHA (1998):** Standard methods for Examination of water and waste water American public health Association 20th Ec. APHA, New York.
2. **APHA (1998):** Standard methods for Examination of water and waste water American public health Association 20th Ec. APHA, New York.
3. **Abhay Kumar Singh (2002):** Quality Assessment of surface and sub-surface water of Damodar River basin, India J. Environ. HLTH 1 Vol. 44 (1) PP. 41-49.
4. Barik, R. M. and R. K. Patel (2004): "Seasonal variation of water quality of Atharabanki River Paradip. "Indian J. Env. Port. Vol. 24(3) PP. 161-166.
5. Dodson, S. (2005): Introduction to Limnology. ISBN 0-07-284935-1.
6. G. T. Tonapi (1962): Fresh water animals of India an ecological approach. Head Department of Zoology, University of Poona. Ganeshkhind Poona 411007.
7. Ganapati, S. V. (1955): Hydrobiological investigation on the stanly Reservoir and of the river Cauvery at Mattur Dam. Mat. Kam. Vol. 6 (2): PP. 1-8.
8. Ganguly, T., Kumar, B., Sen, A. K. and Bhunia, A. B. (1999): Assessment of water quality of Damodar river through comparative analysis of Bioindicators and physico chemical determinations. J. Env. & Poll. Vol. 6 (2 & 3): PP. 189-196.
9. George; M. G., Qasim, S. Z. and Siddiqui, A. G. (1966): A Limnologycal survey of the river Kali
10. Golterman, H. L. (1975): River ecology (Edited by B.A. Whitton) Black-Weel Scientific Publications Oxford, London, Edinburg Melbourne PP. 39-80.
11. Hosmani, S.; and Shankar P; (2002): Phytoplankton-zooplankton relationship in four fresh water bodies of Dharwar. Indian J. Environ & Ecoplan Vol. 6 (1): PP 23-28.
12. Hussain, M. F. and Ahmed, I. (2002): "Variability in Physico-chemical parameters of Panchin river (Itanagar) Indian J. Environ. Vol. 44 (4). PP. 329-336.
13. Jayabhaye, U. M., V. R. Madlapure and B. S. Salve (2007): Phytoplankton Diversity of Parola

Dam Hingoli, Maharashtra. J. Aqua. Biol. Vol. 22 (2) PP 27-32.

14. Kalff. J. (2002): Limnology prentice hall New Jessy PP 592

15. Khan A.M. (2001) Seasonal vacation in primary production in Isapur Dam, Maharashtra j. Aqua Biol., Vol. 16(2), 1933.

16. Khanna, D. R. and Bhutiani, Rakesh (2003): Limnological status of satikund pond at hardwar (U.A.) Indian J. Environ. Sci. 7 (2): PP 131-136.

17. Khanna, D. R. and Singh, R. K. (2000): Seasonal fluctuation in the plankton of Suswa river at Raiwala (Dehradun). Environ. Cons. J. Vol. 1(2 & 3): PP 89-92.

18. Khanna, D. R. and Singh, R. K. (2002): Seasonal fluctuation in the plankton of Suswa river at Raiwal (Dehradun) Environ. Conservation J. Vol. 1(2&3): PP. 89-92.

19. Pathan, S. et al., (2002): some physico-chemical parameters and primary productivity of river ramganga (Uttranchal). Him. J. Env. Zool. Vol. 16(2) PP: 151-158.

20. Pawar, S. K., J. s. Pulle and K. M. Shendge (2006): The study on Phytoplankton of Pethwadaj Dam, Taluka Kandhar District Nanded, Maharashtra J. Aqua. Biol. Vol. 21 (1): PP 1-6.

21. Pawar, S., Sharma, D. K. and Mishra, R. (2001); Physico-chemical and microbiological aspects of water pollution in cheelar Reservoir, Shajapur. Abstract National sem. Khargone: 34.

22. Pearshall (1978): Phytoplankton in the English lakes I proportion in the water of some dissolved substances of biological importance J. Ecol. Vol. (18): PP 306-320.

23. Shastree, Natin K. Pathak, Shubha and Islam, M. S. (1993): Phytoplankton as biological indicators in lantic hydro Jphere. Advances in Limnology PP. 113-132 Ed. By H. R. Singh Pub. By Narendra Publishing House, Delhi.

24. Shrivastava, C. S. (2002) Ecology and Dynamic of plankton in lotic habitat Ph. D. Thesis D.A.V.V. Indore M.P.

25. Srivastava, R. K. and Seena Srivastava (2003): "Assessment of water quality of river Gour at Jabalpur." Indian J. Env. Prot. Vol. 23(3), PP: 282-285.

26. Suvarna, A. Chetana and Somashekar R. K. (2000): Study on the phytoplankton constituents of river Cauvery and its Tributaries. Indian J. Environ. & Ecoplan. Vol. 3(1): PP. 49-56.

27. Suvarna, A. Chetana and Somashekar, R, K. (2000): Study on the phytoplankton constituent of river Cauvery, and its Tributaries, Indian, J. Environ. 7 Ecoplan Vol. 3(1) PP. 49

28. Tungawat, R. K., Sheikh, A. S. and Arvind, M. Shukla (2001); Observation on phytoplankton population dynamics in Teelar Dam Shajapur. Abstract national sem. Khargone: 20.

29. Verghese Susan P. singh Monika and Mishra Anjali (2005): An Assessment of water quality of river Yamuna during Mansoon at Agra City" Indina J. Env. Prot. Vol. 25 (10) PP: 893-898.

30. Zafar, A. R. (1966): Limnology of Hussain Sagar Lake, Hyderabad, India Phykos. Vol. (5): PP 115-216.

31. Ward, H. B. and Whipple, G. C. (1954). Fresh water biology 2nd edition. John Wiley and sons. New York.

32. Welch, P. S. (1952): Limnological methods. Blakiston Co; Philadelphia. Pa.

33. Wetzell, R. G. (2001): Limnology: Lake and river Ecosystem, 3rd ed. Academic Press. ISBN –12-744760-1.

2/26/2011