



## Diversity status of Phytoplankton and Zooplankton local selected region

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**Abstract:** The studies included the local habitat of Lake River and ponds, which are most important, share the habitat in local flora and fauna in eastern Uttar Pradesh (U.P.) India. The study was conducted to assess the mainly phytoplankton and zooplankton status of the Ramgarh lake, Maheshra tal, and Rapti river in Gorakhpur district of Uttar Pradesh, India by examining the biological parameters. The most important planktonic group encountered in the present study was cyanophyceae, Bacillariophyceae and Zygnematophyceae genera which existed in the Ramgarh lake, Maheshra tal, and Rapti river water of the habitat. The study found that the members of protozoans group animal contribute 44 percent of the total zooplankton population during the year of the study period.

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### Introduction

Plankton is the various set of organisms present in water (or air) that can't propel themselves against a present day (or wind). Despite the fact that microscopically small, organisms called plankton play vital function in aquatic ecosystems. They offer the base for the complete aquatic food web. The word plankton comes from the Greek word planktos, which means that "drifter." their name fits, due to the fact plankton do not swim on their own or stay in a single region like coral. They go with the flow approximately within the water, permitting tides, currents, and specific factors decide in which they pass.

There are major kinds of plankton: phytoplankton, which is probably flora, and zooplankton, which may be animals. Zooplankton and distinctive small marine creatures devour phytoplankton and then become food for fish, crustaceans, and specific large species. Phytoplankton makes their meals via photosynthesis, the approach of using chlorophyll and daytime to create electricity. Like different plant life, phytoplankton takes in carbon dioxide and launch oxygen. Phytoplankton account for approximately 1/2 of the photosynthesis in the world, making them one of the global's most crucial producers of oxygen of oxygen. Phytoplankton depends upon nutrients observed of their surroundings, which includes phosphate, nitrate, and calcium, to thrive. At the same time as plankton populations are wished for thriving aquatic ecosystems, too much

plankton in single vicinity can create a severe environmental problem. Even as a plankton populace unexpectedly swells, it's far known as a "bloom." while this takes place with sure styles of phytoplankton that launch risky toxins, the location may additionally revel in a pink tide or other essential algal bloom. The ones temporary situations can motive excessive fish mortality and distinctive damage to the aquatic ecosystem. Contaminated fish which might be stuck and served to people can also motive contamination or even death.

Because of the fact the aquatic food chain relies upon so closely on plankton, the survival of these tiny vegetation and animals is essential for healthful aquatic ecosystems. Climate exchange and rising sea temperatures pose serious risks to plankton populations. In contemporary years, freshwater surroundings has serious threats from human activities which include industrial effluents, agricultural sports, metropolis waste manage problems, and boom in urbanization.

Despite the fact that there's emerging consensus that range enhances productiveness and stability in communities of higher organisms. Biodiversity is one of the vital trends of ecosystems. In marine environment, the species type of phytoplankton is generally high, stricken by several species of diatoms coming from periphyton and benthic communities.

**Material and Methods**

**Study area**

Water samples of Ramgarh Lake, Rapti river and Maheshra tal were collected monthly in the mid month  $\pm$  1day at three sampling sites (Ramgarh lake-Nauka Vihar, Rapti River- Takiya Ghat and Maheshra

Tal-Fertilizer) from September 2020 to December 2020. Samples from the surface and bottom layers were collected at each site using one liter water sampler bottle. All the glass wares were rinsed with 10 % HCl, deionized water and double distilled water.

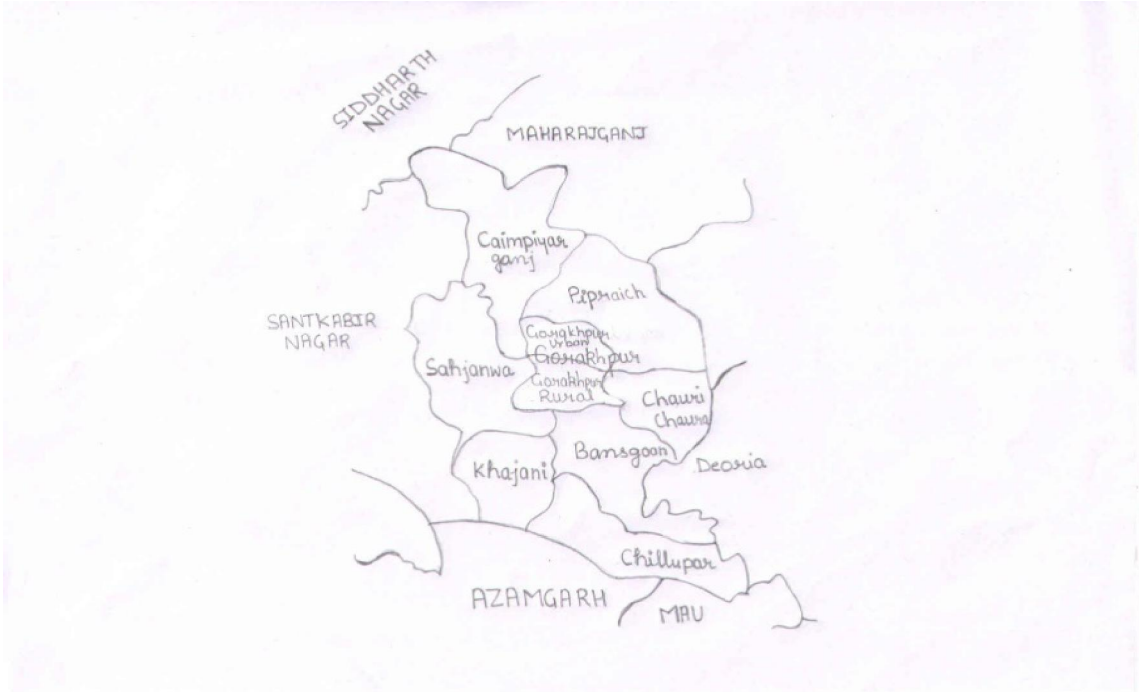


Fig. 1 Map showing area of Gorakhpur district

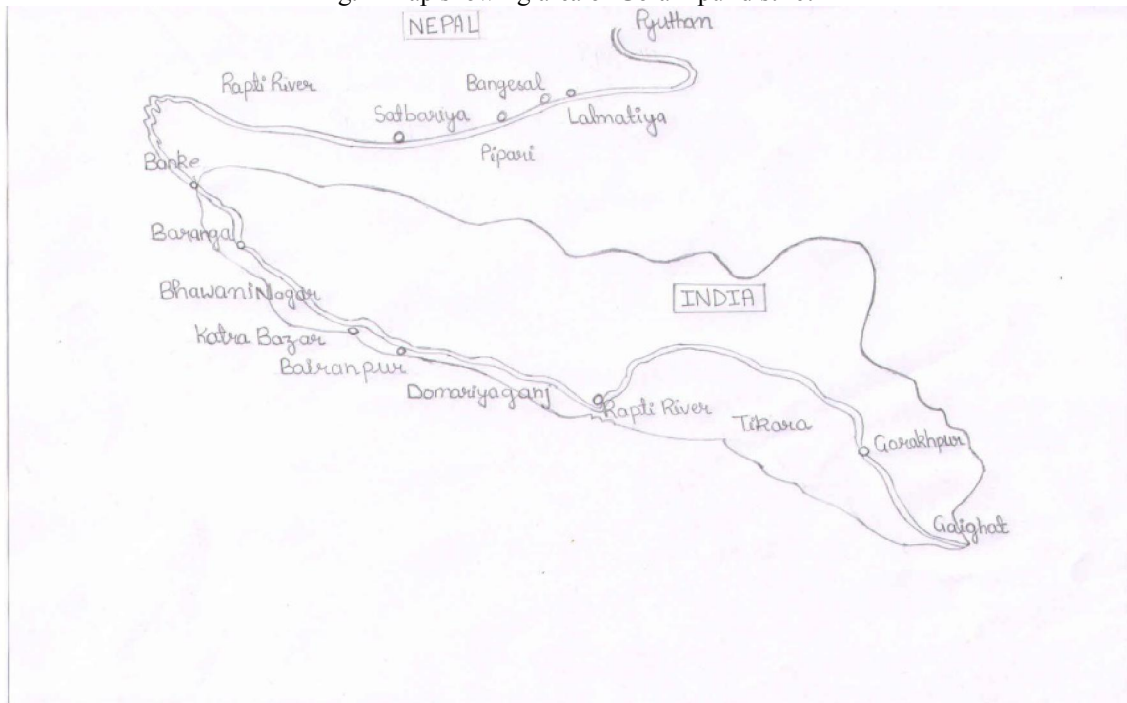


Fig. 2 Map showing area Rapti River in Gorakhpur region

Water analysis for various physicochemical parameters the parameters were within the following range in the study total Alkalinity 43-62 ppm, pH 6.8-7.7, Dissolved oxygen 6.3-7.3 mg/L, total Ammonia 0.29-1.59 µg at N/l [1].

### Qualitative and quantitative estimation of Plankton

The plankton samples were collected from the surface only from the same spots and at the same time when and where from the water samples were taken. Each sample was collected by filtering 50 liters of surface water through a bolting silk net made of 20 µm mesh size means of a bucket of 10 liters capacity. The plankton concentrate thus obtained was immediately preserved in 5% formaldehyde solution. This sample was thoroughly mixed before further analysis. The samples were then brought to the laboratory, Department of Zoology, Deen Dayal Upadhyaya Gorakhpur University Gorakhpur for qualitative and quantitative analysis of plankton. The water samples containing the plankton were dropped on the slides and were then observed under a microscope for the assessment of plankton diversity. A sub sample of 1 ml was transferred to Sedgwick-Rafter plankton counting cell for differential numerical analysis. The organisms were identified up to species wherever possible and up to genera in other cases. The quantity of each species or genus was then calculated as numbers per liter in the lake water by Welch's (1935) [2] formula:

$$n = (a \cdot 1000) / c$$

Where n = number of plankton per liter of original water.

a = average number of plankton in all counts in Sedgwick Rafter Cell.

C = volume of original concentration in ml.

l = volume of original water expressed in liters.

### Results

Depending upon the climatic and biological conditions of the Ramgarh Lake, Maheshra tal and Rapti river the water changed from light grey to deep green during different months of the year. During the rainy season i.e. August to September, it was light to deep gray, while during April to May and November to December it was deep green due to abundant growth of plank tonic algae.

The temperature of the surface and bottom water was recorded every month (on 15<sup>th</sup> ± 1 day) for one year. In 2020 month of September to December, the average

surface temperature during the winter season was 15°C and that of the bottom was 12°C.

The lake water remained less turbid during the winter and monsoon months. The transparency was low in summer (20.3 cm in 2020) and monsoon (19.0 cm in 2020), and did not differ much at various sampling stations.

### Plankton

#### Phytoplankton:

The member of the phytoplankton genus i.e. *Melosiravarians*, *Nodulariaspumigena*, *Asterionellopsis formosa*, *Micro cystisaerugionosa*, *Aphanizomenonflos-aqaue*, *Nostocales rivularia*, *Nostocales nostoc*, *Nostocales anabena*, *Naviculale spinnularia*, *Naviculale sstaunoneis*, *Ulotrichales ulothrix*, *Ulotrichales protist*, *Desimidia lesclosterium*, *Desimidiales desmidium*, *Spirogyra*, *Mischoccalesopio Cyclium*, *Volvox*, *Pennalesalcheton*, *Anabena azollae*, *Oscillatoria*, *Fragllaria synegrotesca*, *Asterionella formosa*, *Stephanodiscus atraea*, *Tabelloria*, *Fenesrata*, *Euglena* represented the phytoplankton community of Ramgarh Lake, Maheshra tal and Rapti river constituted the dominant groups of phytoplankton. A list of phytoplankton collected from the Ramgarh lake, Maheshra tal and Rapti river and their monthly occurrence has been given in the Table 2.

The member of the families Melosiraceae, Aphanizomenonaceae, Tabellariaceae, Microcystaceae, Cyanophyceae, Bracillariophyceae, Ulophyceae, Zygnematophyceae, Xanthophyceae, Cholorophyceae, Npstocaceae, Oscillatoriaceae, Fragilariaceae, Stephanodiscaceae, Tabellariaceae, Euglenaceae represented the phytoplankton community of Ramgarh Lake, Maheshra tal and Rapti river constituted the dominant groups of phytoplankton. A list of phytoplankton collected from the Ramgarh lake, Maheshra tal and Rapti river and their monthly occurrence has been given in the Table 2.

During the year 2020, the phytoplankton population exhibited two clear cut phases one running from September to December called the 'Autumn phase', The phytoplankton of the Autumn phase chiefly included members of by cyanophyceae and supported by Zygnematophyceae, braccillariophyceae. The members of cynophyceae made their maximum appearance from September to December. In the rest of the months either they were absent or if present they were scanty in numbers and poor in forms.

The members of families cyanophyceae, bacillariophyceae represented the phytoplankton community of Ramgarh Lake, Maheshra tal and Rapti

river. Among these families Melosiraceae, Aphanizomenonaceae, Tabellariaceae, Microcystaceae, Cyanophyceae, Bracillariophyceae, Ulophyceae, Zygnematophyceae, Xanthophyceae, chlorophyceae, and Nostocaceae, Oscillatriaceae, Fragilariaceae, Stephanodiscaceae, Tabellariaceae, Euglenaceae were observed predominant throughout the year and were comprised of 19 genera (Melosiraceae-01 genera, Aphanizomenonaceae-01 genera, Tabellariaceae-02 genera, Microcystaceae-01 genera, Cyanophyceae-02 genera, Bracillariophyceae-02 genera, Ulophyceae-01 genera, Zygnematophyceae-01 genera, Xanthophyceae-01 genera, Volocaceae-01 genera and Nostocaceae -01 genera, Oscillatoriaceae-01 genera, Fragilariaceae-02 genera, Stephanodiscaceae-01 genera, Euglenaceae-01 genera), chiefly including *Melosira varians*, *Nodularia pumigena*, *Asterionellopsis formosa*, *Microcystis aeruginosa*, *Aphanizomenon flosaquae*, *Nostocales rivularia*, *Nostocales nostoc*, *Nostocales anabena*, *Naviculales pinnularia*, *Naviculales stauroneis*, *Ulotrichales sulothrix*, *Ulotrichales protist*, *Desimidiales closterium*, *Desimidiales desmidium*, *Spirogyra*, *Mischoccales opiocytium*, *Volvox Anabaena azollae*, *Oscillatoria*, *Fragllaria synegrotesca*, *Asterionella formosa*, *Stephanodiscus astraea*, *Tabelloria fenesrata* and *Euglena* (Table 2).

The most important planktonic group encountered in the present study was cyanophyceae and Zygnematophyceae. *Nostocale* and *Desimidiale* encountered as other genera which existed in the lake, tal and river water of the habitat.

In Bacillariophyceae group represented by two genera i.e. *Naviculate spinnularia* and *Naviculales stauroneis*. Members of this group exhibited luxuriant growth from September 2020 to December 2020. The data reveals that diatoms preferred to colonize during the warmer part of the year and they had a lean population during winter.

### Zooplankton:

The zooplankton of the families Amoebidae, Pelomyxidae, Diffugiidae, Acanthocidae, Fasciolidae, Nassulidae, Glaucomidae, Arcellidae, Parameciidae, Cyclindrocorporida, Haplolamidae, Picarilaimide, Monhysteridae, Stephanellidae, Glossiphoniidae, Erpobdellidae, Thamnocephalidae, Triopsidae, Cyzidae, Dophniidae, Cyprididae.

The various groups of zooplankton recorded during the period of investigation were, (a) Protozoa (b) Nematoda (c) Ectoprocta (d) Arthropoda. Besides insects nymph larvae and protozoans.

The data pertaining to the population dynamics of zooplankton and its different components like Protozoa, Nematoda, Ectoprocta and Arthropoda

are given in Table 1. These data reveal that the population density of zooplankton in the Ramgarh lake, Maheshra tal and Rapti river recorded a cyclic pattern, being lowest in the rainy season, then rising through early part of winter and gradually reaching to its peak in the early part of summer in the month of April. Protozoans and aquatic insects though appeared occasionally but in negligible numbers, hence, have not been considered in the present study.

The protozoans contribute 42 percent of the total zooplankton population during the year of 2020. The period from September to December was observed to be conducive for its growth whereas the period from March to June recorded its lean population (Table 1). Sixteen genera represented this group *Amoeba verrucosa*, *Amoeba proteus*, *Amoeba vespertilio*, *Amoeba vulgaris*, *Amoeba gibbosa*, *Pelonyxa palustris*, *Difflligia muriformes*, *Acanthocystis*, *Lionotus fasciola*, *Nassula ornate*, *Glaucoma pyriformis*, *Monochilum ovale*, *Ophryoglena flava*, *Paramecium Caudatum*, *Paradoxorhabditis paradoxus*, and *Arcella*.

The nematode contributed 18 percent to the total zooplankton population in the year, recording their presence throughout the year. The nematode was represented by the families – Cyclindrocorporidae, haplodamidae, parameciidae, picarilamidae, monhysteridae.

The member of the phylum arthropoda belongs to the family streptocephalidae, tropsidae, arcellidae, Thamnocephalidae, Cyzidae, Dophniidae, cyprididae it belongs to the genera viz. *Streptocephalus dichotomus*, *Branchinella kugenumaensis*, *Triops longcaudatus*, *Eocyzius pulmosus*, *Triops longcaudatus*, *Dophnia carinata*, *Dophnia lumholtzisars*, *Ceriodophina*, *Scapholebris*, *Monia (female)*, *Monia (Male)* and *Ostracod*. Water quality is influenced by geological, hydrological, climatic and anthropogenic factors water temperature is considered as one of the important factors that controls aquatic life.

Table 1. Seasonal fluctuations in Zooplankton diversity in Ramgarh Lake, Rapti River and Maheshra tal during September 2020 to December 2020.

S.N.	Taxonomic group	Family	Zooplanktons	River/lake/Tal	Sample 1	Sample 2	Sample 3
1	Protozoa	Amoebidae	<i>Amoeba verrucosa</i>	Rapti	+	+	+
				Ramgarh	+	+	+
				Maheshra	+	+	+
2	Protozoa	Amoebidae	<i>Amoeba proteus</i>	Rapti	+	+	+
				Ramgarh	+	+	+
				Maheshra	+	+	+
3	Protozoa	Amoebidae	<i>Amoeba vespertilio</i>	Rapti	+	+	+
				Ramgarh	+	+	+
				Maheshra	+	+	+
4	Protozoa	Amoebidae	<i>Amoeba vulgaris</i>	Rapti	+	+	+
				Ramgarh	+	+	+
				Maheshra	+	+	+
5	Protozoa	Amoebidae	<i>Amoeba gibbosa</i>	Rapti	+	+	+
				Ramgarh	+	+	+
				Maheshra	+	+	+
6	Protozoa	Pelomyxidae	<i>Pelonyxa palustris</i>	Rapti	+	+	+
				Ramgarh	+	+	+
				Maheshra	-	-	+
7	Protozoa	Diffugiidae	<i>Diffugia muriformes</i>	Rapti	+	+	+
				Ramgarh	+	+	+
				Maheshra	+	+	+
8	Protozoa	Acanthocistidae	<i>Acanthocystis</i>	Rapti	-	-	+
				Ramgarh	+	+	+
				Maheshra	+	+	+
9	Protozoa	Fasciolidae	<i>Lionotus fasciola</i>	Rapti	+	+	+
				Ramgarh	-	-	-
				Maheshra	-	-	-
10	Protozoa	Nassulidae	<i>Nassula ornata</i>	Rapti	+	+	+
				Ramgarh	+	+	+
				Maheshra	+	+	+
11	Protozoa	Glaucoidae	<i>Glaucoma pyriformis</i>	Rapti	+	+	+
				Ramgarh	+	+	+
				Maheshra	+	+	+
12	Protozoa	Glaucoidae	<i>Monochilum ovale</i>	Rapti	+	+	+
				Ramgarh	+	+	+
				Maheshra	+	+	+

13	Protozoa	Ophryoglenidae	<i>Ophryoglena flava</i>	Rapti	+	+	+
				Ramgarh	+	+	+
				Maheshra	+	+	+
14	Protozoa	Parameciidae	<i>Paramecium Caudatum</i>	Rapti	+	+	+
				Ramgarh	-	-	+
				Maheshra	+	+	+
15	Protozoa	Parameciidae	<i>Paradoxorhabditis Paradoxus</i>	Rapti	+	+	+
				Ramgarh	+	+	+
				Maheshra	+	+	+
16	Protozoa	Arcellidae	<i>Arcella</i>	Rapti	+	+	+
				Ramgarh	+	+	+
				Maheshra	+	+	+
17	Nematoda	Parameciidae	<i>Paradoxorhabditis cranganorensis</i>	Rapti	-	+	-
				Ramgarh	+	+	+
				Maheshra	+	+	+
18	Nematoda	Parameciidae	<i>Paradoxorhabditis jodhpurensis</i>	Rapti	-	-	-
				Ramgarh	+	+	+
				Maheshra	+	+	+
19	Nematoda	Cylindrocorporidae	<i>Gobindonema flicaudatum</i>	Rapti	+	+	+
				Ramgarh	+	+	+
				Maheshra	+	+	+
20	Nematoda	Haplolamidae	<i>Helicotylenchus crenacauda</i>	Rapti	+	+	+
				Ramgarh	+	+	+
				Maheshra	-	-	+
21	Nematoda	Picarilaimidae	<i>Picarilaimus caudatus</i>	Rapti	+	+	+
				Ramgarh	+	+	+
				Maheshra	+	+	+
22	Nematoda	Picarilaimidae	<i>Albunema indicum</i>	Rapti	+	+	+
				Ramgarh	+	+	+
				Maheshra	+	+	+
23	Nematoda	<u>Monhysteridae</u>	<i>Monhystera pseudomacrura</i>	Rapti	+	+	+
				Ramgarh	+	+	+
				Maheshra	+	+	+
24	Ectoprocta	<u>Stephanellidae</u>		Rapti	+	+	+
			<i>Colony of statoblast</i>	Ramgarh	+	+	+
				Maheshra	+	+	+
25	Ectoprocta	<u>Stephanellidae</u>	<i>Statoblast</i>	Rapti	+	+	+
				Ramgarh	+	+	+
				Maheshra	+	+	+
26	Ectoprocta	Glossiphoniidae	<i>Glossiphonia</i>	Rapti	+	+	+

			<i>webri</i>	Ramgarh	+	+	+
				Maheshra	+	+	+
27	Ectoprocta	Erpobdellidae	<i>Herpobdella hexaculata</i>	Rapti	+	+	+
				Ramgarh	+	+	+
				Maheshra	+	+	+
28	Arthropoda	Streptocephalidae	<i>Streptocephalus dichotomus</i>	Rapti	+	+	+
				Ramgarh	+	+	+
				Maheshra	+	+	+
29	Arthropoda	Thamnocephalidae	<i>Branchinella kugenumaensis</i>	Rapti	+	+	+
				Ramgarh	+	+	+
				Maheshra	-	-	-
30	Arthropoda	Triopsidae	<i>Triops longicaudatus</i>	Rapti	-	-	-
				Ramgarh	+	+	+
				Maheshra	-	+	+
31	Arthropoda	Cyzidae	<i>Eocyzius plumosus</i>	Rapti	-	-	-
				Ramgarh	+	+	-
				Maheshra	-	-	-
32	Arthropoda	Dophniidae	<i>Dophnia carinata</i>	Rapti	+	+	+
				Ramgarh	+	+	+
				Maheshra	-	-	-
33	Arthropoda	Dophniidae	<i>Dophnia lumholtzisars</i>	Rapti	-	-	-
				Ramgarh	+	+	+
				Maheshra	-	-	+
34	Arthropoda	Dophniidae	<i>Ceriodophina</i>	Rapti	+	+	+
				Ramgarh	+	+	+
				Maheshra	+	+	+
35	Arthropoda	Dophniidae	<i>Scapholebris</i>	Rapti	-	-	-
				Ramgarh	+	+	+
				Maheshra	+	+	+
36	Arthropoda	Daphniidae	<i>Moina (female)</i>	Rapti	-	-	-
				Ramgarh	+	+	+
				Maheshra	-	-	-
37	Arthropoda	Daphniidae	<i>Moina (Male)</i>	Rapti	-	-	-
				Ramgarh	+	+	+
				Maheshra	-	-	-
38	Arthropoda	Cyprididae	Ostracod	Rapti	-	-	-
				Ramgarh	-	-	-
				Maheshra	+	+	+

**Table 2.** Seasonal fluctuations in phytoplankton diversity in Ramgarh Lake, Rapti River and Maheshra tal during September 2020 to December 2020.

S.No.	Family	Phytoplanktons	River/lake/Tal	Sample 1.	Sample 2.	Sample 3.
1	Melosiraceae	<i>Melosira varians</i>	Rapti	+	+	+
			Ramgarh	+	+	+
			Maheshra	+	+	+
2	Aphanizomenonaceae	<i>Nodularias pumigena</i>	Rapti	+	+	+
			Ramgarh	+	+	+
			Maheshra	+	+	+
3	Tabellariaceae	<i>Asterionellopsis formosa</i>	Rapti	-	-	+
			Ramgarh	-	-	-
			Maheshra	+	+	+
4	Microcystaceae	<i>Microcystis aeruginosa</i>	Rapti	+	+	+
			Ramgarh	+	+	+
			Maheshra	+	+	+
5	Cyanophyceae	<i>Aphanizomenon flos-aquae</i>	Rapti	-	-	-
			Ramgarh	+	+	+
			Maheshra	-	-	-
6	Cyanophyceae	<i>Nostocales rivularia</i>	Rapti	+	+	+
			Ramgarh	+	+	+
			Maheshra	+	+	+
7	Cyanophyceae	<i>Nostocales nostoc</i>	Rapti	+	+	+
			Ramgarh	+	+	+
			Maheshra	+	+	+
8	Cyanophyceae	<i>Nostocales anabena</i>	Rapti	+	+	+
			Ramgarh	+	+	+
			Maheshra	+	+	+
9	Bacillariophyceae	<i>Naviculale spinnularia</i>	Rapti	+	+	+
			Ramgarh	+	+	+
			Maheshra	+	+	+
10	Bacillariophyceae	<i>Naviculales stauroneis</i>	Rapti	+	+	+
			Ramgarh	+	+	+
			Maheshra	+	+	+
11	Bacillariophyceae	<i>Pennales alchetrion</i>	Rapti	+	+	+
			Ramgarh	-	-	-



			Maheshra	+	+	+
12	Ulophyceae	<i>Ulotrichale sulothrix</i>	Rapti	+	+	+
			Ramgarh	+	+	+
			Maheshra	+	+	+
13	Ulophyceae	<i>Ulotrichale sprotist</i>	Rapti	+	+	+
			Ramgarh	+	+	+
			Maheshra	+	+	+
14	Zygnematophyceae	<i>Desimidiale sclosterium</i>	Rapti	+	+	+
			Ramgarh	+	+	+
			Maheshra	+	+	+
15	Zygnematophyceae	<i>Desimidiales desmidium</i>	Rapti	+	+	+
			Ramgarh	+	+	+
			Maheshra	-	-	-
16	Zygnematophyceae	<i>Spirogyra</i>	Rapti	+	+	+
			Ramgarh	+	+	+
			Maheshra	+	+	+
17	Xanthophyceae	<i>Mischoccales opiocytium</i>	Rapti	+	+	+
			Ramgarh	+	+	+
			Maheshra	+	+	+
18	Volocaceae	<i>Volvox</i>	Rapti	-	-	+
			Ramgarh	+	+	+
			Maheshra	+	+	+
19	Nostocaceae	<i>Anabena azollae</i>	Rapti	+	+	+
			Ramgarh	+	+	+
			Maheshra	+	+	+
20	Oscillatoriaceae	<i>Oscillatoria</i>	Rapti	+	+	+
			Ramgarh	+	+	+
			Maheshra	+	+	+
21	Fragilariaceae	<i>Fragllaria synegrotesca</i>	Rapti	+	+	+
			Ramgarh	+	+	+
			Maheshra	+	+	+
22	Fragilariaceae	<i>Asterionella Formosa</i>	Rapti	+	+	+
			Ramgarh	+	+	+
			Maheshra	+	+	+
23	Stephanodiscaceae	<i>Stephanodiscus Astraea</i>	Rapti	+	+	+
			Ramgarh	+	+	+
			Maheshra	+	+	+
24	Tabellariaceae	<i>Tabelloria Fenesrata</i>	Rapti	+	+	+
			Ramgarh	+	+	+
			Maheshra	+	+	+
25	Euglenaceae	<i>Euglena</i>	Rapti	+	+	+
			Ramgarh	-	-	-
			Maheshra	-	-	-

## Discussion

All physical processes like growth, respiration, photosynthesis, reproduction and transpiration are largely influenced by temperature. Variation in temperature affects the vegetation as well as morphological characters of the plants. However, extreme temperatures have harmful effects in the form of desiccation, chilling and freezing injury. The temperature of a place is influenced by altitude, latitude, plant cover, water, content of soil, and steepness of slope and direction of mountain chains.

The winter season is accompanied with clear but shorter days, dry atmosphere, and lowers intensity of sunlight and occasional rainfall. The summer season are characterized by high atmospheric temperature, bright sunshine, longer days, fast winds and dry air.

The phytoplankton production of Ramgarh Lake, Maheshra tal and rapti river closely follows the trend suggested by [3], which shows an increase in population from March onwards, reaches its peak in September - October followed by decrease till reaching the minimum some times in January and February. However, [4] has reported two distinct phases of primary production in a shallow pond at Varanasi - one during late summer months and the other in late monsoon months. [5] has reported the maximum production in October. All these observations indicate that a period from July to November provides propitious conditions for plankton production.

It possibly caused due to increase in nitrates and phosphate levels due to heavy input of organic wastes coupled with high temperature during early rain showers, enables the phytoplankters to multiply rapidly and ultimately reaching the maximum in the month of November. The Afterwards fall in the number of phytoplankton population was observed closely associated with the decrease in nutrient levels.

A continuous increasing trend in the level of free CO<sub>2</sub> with the start of summer touches its maximum value during the month of May and June. This results ultimately an increase in hydroxyl ion concentration there by alkalinity of the lake. This increase in alkalinity provides conducive medium for the growth of phytoplankton after rainy season.

The plankton population on which the whole aquatic life depends directly or indirectly is governed by a number of physical and chemical factors [6]. In the following study an attempt has been made to correlate some physical and chemical factors with the fluctuations in plankton population.

Temperature plays an important role in the physical environment of the organism. It universally regulates distribution and activities of the plants and animals. [7] temperature is a determining factor in the seasonal distribution of plankton. Whereas [8] have opined that temperature is less important when compared with certain other factors in influencing the abundance of plankton. [9]to has not observed any pronounced effect of temperature on total phytoplankton production. It is indicative of the fact that over all plankton population behaves in differently to pH fluctuation in alkaline range. This finding is in conformity to the findings of earlier observation made by [10,11]. [11] have observed the peak value of free carbon dioxide coinciding with the peak value of plankton in some place in the river Ganga. Pahwa and Meherotra (1966) [11] and [12] have observed the plankton population directly correlated with chloride concentration.

The dominance of cyanophycean algae over bacillariophycean ones observed in the present study is similar to the findings of [14,15,16,17,18,19] has reported that diatoms constitute the major component of phytoplankton.

The taxonomy of zooplankton and their seasonal fluctuation in relation to different physico-chemical factors have been variously discussed by [19,20,21, 22,23].

The correlation between temperature and zooplankton hold contradictory statements. According to [24] zooplanktons avoid high temperature of the upper layer where as [25]observed those zooplanktons do not have a peak when temperature is very low. Similarly a direct correlation has been observed between the abundance of zooplankton and temperature by [26].

The zooplankton population of Ramgarh Lake, Maheshra and Rapti river showed a direct correlation with dissolved oxygen. It is generally assumed that the zooplankton depends upon the phytoplankton abundance and as such the peak of the latter follows the fall of the former. On the other hand, it has been shown by [27] that both the zooplankton and phytoplankton occur simultaneously. [28] have, however, put forth the "Grazing theory" to explain the interrelationship between zooplankton and phytoplankton. According to this theory when the zooplankton population is large, the consumption of phytoplankton is so great (i.e. they fail to show abundance). Contrary to this zooplankton population is small, the phytoplankton have a chance to multiply rapidly resulting in the production of a peak. While discussing phytoplankton-zooplankton relationship

currently, emphasis to this theory has been given by many workers [29] 1965).

Many workers assume that the abundance of zooplankton does not depend to a great extent on the quantity of phytoplankton. According to [30], the quantity of zooplankton depends on the concentration of nanoplankton including bacteria. Later, [31] suggested that tripton rather than phytoplankton is the main food of zooplankton. Working on Lake Pontchartrain, [32] observed that suspended organic matter rich with bacteria formed the food of zooplankton instead of phytoplankton.

The study provides the role of phytoplankton and zooplanktons as bio-indicators in detecting the health and trophic status of aquatic bodies. Some species withstand the extreme conditions and survive well in the polluted environment indicating high tolerance level while sensitive species were absent representing their low tolerance.

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