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# Planktonic Diversity and Density in Keerat Sagar Pond at Mahoba District of Uttar Pradesh, India

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***Abstract:***
*This research has been undertaken to investigate the seasonal fluctuation of planktons and to examine the healthiness of water by analyzing the diversity and density of planktons in Keerat Sagar pond at Mahoba district. Samples were collected from four sites (A, B, C and D) of pond throughout a year from December 2002 to November 2003. After analyzing, it was concluded that sixteen species of phytoplanktons and seventeen species of zooplanktons, belongs to three and four genera respectively were found sufficiently in Keerat Sagar pond and noticed that maximum and minimum density of planktons were present in summer and winter season. The sufficient availability of phytoplanktons and zooplanktons indicated that pond was healthy and fit for the purpose of fish and prawn culture because both types of planktons are the good bioindicator of aquatic pollution as well as water quality status and occupies the first and second tropic level in aquatic grazing food web.*

***Keywords:*** *Phytoplanktons, Zooplanktons, Diversity, Keerat Sagar pond, Mahoba.*

## 1. Introduction

Keerat Sagar pond (1060-1100 AD) is one of the most important historical place of Mahoba district. It was established by 13th King Kirtiverman of Mahoba in 1060 B.C. and situated on the west site of Mahoba. The global location of Mahoba is $25^0$01'30"N-$25^0$39'40"N latitude and $79^0$15'00" E- $80^0$10'30" E longitude. In recent decades, rapid industrialization, urbanization and extensive anthropogenic activities made the Keerat Sagar pond contaminated.

Aquatic environment depicts ecological features that lead to the establishment of a very dynamic system in which the plankton community plays an important role (Drusilla *et. al.* 2007). Planktons are microscopic aquatic organisms having little or no resistance to water current and live in the free floating suspended states in open water (APHA, 1985). They are considered as the best index of biological productivity and the nature of aquatic habitat (Gosh *et.al.*2011). Raid (1961) reported that, a planktonic population on which whole aquatic life depends is directly or indirectly governed by many biological conditions and tolerance of organisms in various aquatic conditions. Two broadly group of planktons are phytoplanktons and zooplanktons. The phytoplanktons serve as the producers in the food chain of aquatic ecosystem. They are small photosynthetic active autotrophic organisms which helpful to understand the tropic status and to access the fish production potential of aquatic ecosystem (Melack, 1976). Majority members of phytoplanktons belong to chlorophyceae, cynophyceae, baccillariophyceae and myxophyceae group of algae (Kumar and Khare, 2015). Zooplanktons are small filter feeder organism, which feeds on bacteria and other microbes. They are regarded as the connecting link between primary producers (mostly phytoplankton) and higher consumers in aquatic food webs. They constitute important food items of many omnivorous and carnivores fish (Shrifun, 2007) and occupies the intermediate position in the aquatic food web as well as mediate the energy transfer from lower to higher ladder of tropic level (Water, 1977). Majority members of zooplanktons belong to protozoans, rotiferans and crustaceans. Planktons are the good bioindicator for assessment of aquatic pollution of any water reservoir (Sarwade and Kamble, 2014) hence healthy water indicates the healthy life of aquatic biota in lotic and lentic ecosystem.

## 2. Material and Methods

*2.1. Study Area*
Keerat Sagar Pond.

*2.2. Duration of Sample Collection*
Twelve months (December-2002 to November-2003) was selected for data collection which covered winter, autumn summer and spring season.

*2.3. Sites*
Four sampling sites were selected for study purpose

- Site A: It is located at the southern side and situated near the Inlet.
- Site B: It is located at the eastern side which is deep, bathing and washing ghats with many trees on its embakemnent.
- Site C: It is located at the northern side which is also deep with thin aquatic vegetation on its bank.
- Site D: it is located at the tail end in the northern side which is the outlet from where two canal have been dug out for irrigation.

*2.4 Planktons*
Phytoplanktons and zooplanktons were collected by means of plankton net (Welch, 1952) and preserved in 4 % formalin at the site for laboratory investigation. In each collection 25 liter of surface water was collected by means of mug and filtered through the plankton net. This filtrate contained planktons (phytoplankton and zooplankton). All the planktons were identified upto species level as per (George 1961), (Endmondson 1992) and (Peumal *et.al* 1988). Analysis of each species was calculated as no. /liter of the water by the Welch's formula. The qualitative and quantitative examination was done in the laboratory by the standard methods (A.P.H.A, 1985 18th Ed.) and (Trivedi and Goyal, 1986).

$$n = [(ax1000)\ C]/\ l$$

Where's,

- → n= No. of plankton per liter.
- → a= Average No. of plankton in all count in a counting cell.
- → c= Volume of original concentrate (in liter).
- → l= Volume of original water (in liter).

| **Plankton** | | | | | | |
|---|---|---|---|---|---|---|
| **Phytoplankton** | | | **Zooplankton** | | | |
| **Chlorophyceae** | **Baccillariophyceae** | **Myxophyceae** | **Protozoa** | **Rotifera** | **Copepoda** | **Cladocera** |
| • Coelastrum<br>• Spirogyra<br>• Zygnema<br>• Ulothrix<br>• Tetraspora<br>• Protococcus<br>• Actinastrum<br>• Scnedesmus | • Navicula<br>• Frustalia<br>• Synedra<br>• Diatoma | • Microcystis<br>• Tetraspedia<br>• Anabena<br>• Oscilotaria | • Paramecium<br>• Euglena<br>• Euglypha<br>• Vorticella | • Brachionus<br>• Filinia<br>• Keretella<br>• Testudinella<br>• Asplanchna<br>• Philodina | • Cyclops<br>• Mesocyclops<br>• Egg & Nauplii<br>• Diaptomus | • Daphnia<br>• Cariodaphnia<br>• Alonella |

*Table 1: List of Recorded Planktons in Keerat Sagar Pond*

| Month | Chlorophyceae | | | | Baccillariophyceae | | | | Myxophyceae | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | A | B | C | D | A | B | C | D | A | B | C | D | Total |
| DEC. | 315 | 346 | 352 | 375 | 99 | 108 | 110 | 117 | 200 | 190 | 215 | 195 | ***2622*** |
| JAN. | 322 | 350 | 344 | 366 | 98 | 103 | 108 | 123 | 236 | 234 | 236 | 233 | ***2754*** |
| FEB. | 320 | 346 | 359 | 362 | 111 | 124 | 131 | 141 | 230 | 232 | 243 | 235 | ***2834*** |
| MAR. | 385 | 403 | 410 | 421 | 154 | 164 | 166 | 170 | 236 | 240 | 229 | 248 | ***3226*** |
| APR. | 371 | 395 | 392 | 404 | 200 | 211 | 209 | 266 | 272 | 260 | 272 | 273 | ***3525*** |
| MAY | 457 | 483 | 509 | 549 | 222 | 237 | 239 | 250 | 309 | 312 | 305 | 320 | ***4192*** |
| JUN. | 519 | 550 | 538 | 588 | 232 | 250 | 253 | 265 | 365 | 368 | 365 | 385 | ***4679*** |
| JUL. | 511 | 528 | 536 | 540 | 206 | 233 | 214 | 258 | 330 | 327 | 342 | 347 | ***4372*** |
| AUG. | 471 | 496 | 465 | 490 | 191 | 191 | 198 | 207 | 330 | 325 | 328 | 335 | ***4027*** |
| SEP. | 480 | 485 | 492 | 509 | 176 | 192 | 183 | 200 | 266 | 375 | 273 | 292 | ***3923*** |
| OCT. | 432 | 436 | 432 | 442 | 152 | 154 | 177 | 160 | 256 | 285 | 251 | 300 | ***3477*** |
| NOV. | 450 | 437 | 430 | 493 | 150 | 147 | 182 | 243 | 250 | 275 | 225 | 278 | ***3560*** |
| *Total* | ***5033*** | ***5255*** | ***5259*** | ***5539*** | ***1991*** | ***2114*** | ***2170*** | ***2400*** | ***3280*** | ***3423*** | ***3284*** | ***3441*** | |

*Table 2: Monthly Variations in Phytoplanktonic Density (2002-2003).*

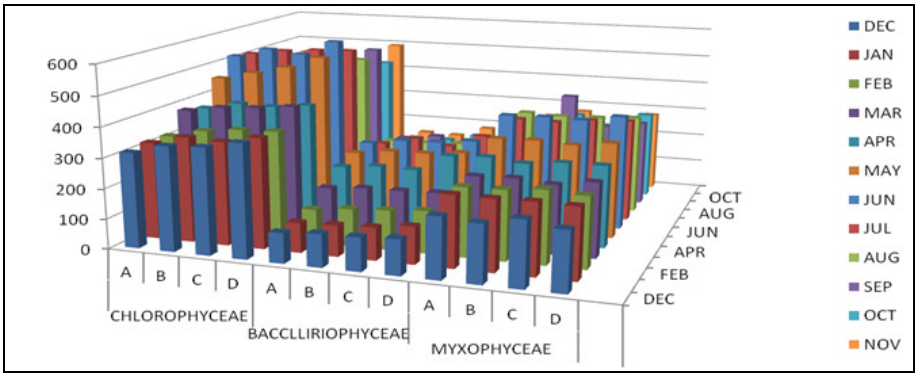


*Figure 1: Phytoplanktonic Diversity at Different Sampling Sites.*

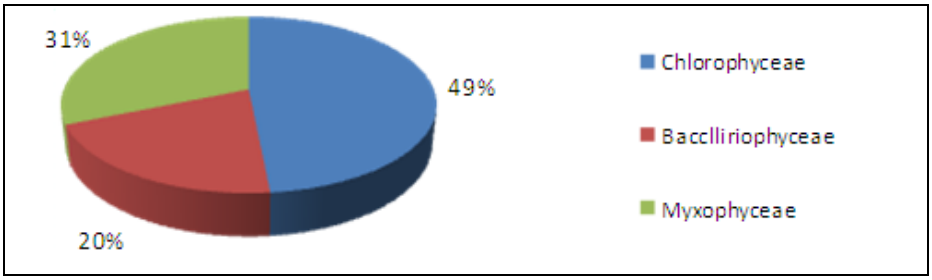


*Figure 2: Density of phytoplanktons in Keerat sagar pond*

| Month | PROTOZOA | | | | ROTIFERA | | | | CRUSTACEAN | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | COPEPODA | | | | CLADOCERANS | | | | |
| | A | B | C | D | A | B | C | D | A | B | C | D | A | B | C | D | TOTAL |
| DEC. | 44 | 42 | 33 | 41 | 34 | 35 | 36 | 35 | 31 | 32 | 34 | 31 | 21 | 18 | 20 | 24 | ***511*** |
| JAN. | 50 | 44 | 46 | 44 | 35 | 35 | 37 | 35 | 36 | 38 | 37 | 39 | 23 | 24 | 24 | 26 | ***573*** |
| FEB. | 62 | 60 | 63 | 57 | 43 | 50 | 51 | 49 | 44 | 44 | 47 | 45 | 22 | 26 | 25 | 22 | ***710*** |
| MAR. | 69 | 62 | 64 | 67 | 36 | 46 | 41 | 41 | 54 | 55 | 61 | 52 | 27 | 26 | 33 | 30 | ***764*** |
| APR. | 74 | 74 | 80 | 68 | 68 | 82 | 82 | 79 | 62 | 69 | 69 | 64 | 50 | 55 | 53 | 52 | ***1081*** |
| MAY | 91 | 88 | 90 | 85 | 84 | 96 | 94 | 91 | 70 | 76 | 73 | 74 | 60 | 61 | 66 | 70 | ***1269*** |
| JUN. | 101 | 107 | 102 | 106 | 118 | 151 | 142 | 145 | 85 | 87 | 80 | 79 | 80 | 76 | 87 | 78 | ***1624*** |
| JUL. | 48 | 45 | 41 | 64 | 114 | 114 | 127 | 115 | 81 | 94 | 85 | 84 | 75 | 70 | 76 | 81 | ***1314*** |
| AUG. | 52 | 21 | 19 | 25 | 112 | 112 | 112 | 103 | 82 | 82 | 82 | 85 | 46 | 47 | 46 | 48 | ***1074*** |
| SEP. | 53 | 40 | 43 | 38 | 119 | 118 | 124 | 117 | 76 | 80 | 71 | 74 | 44 | 48 | 46 | 49 | ***1140*** |
| OCT. | 58 | 48 | 61 | 54 | 120 | 114 | 117 | 110 | 69 | 68 | 65 | 65 | 38 | 39 | 41 | 42 | ***1109*** |
| NOV. | 55 | 50 | 45 | 43 | 115 | 120 | 115 | 112 | 78 | 60 | 68 | 68 | 40 | 45 | 45 | 40 | ***1099*** |
| *Total* | ***757*** | ***681*** | ***687*** | ***692*** | ***998*** | ***1073*** | ***1078*** | ***1032*** | ***768*** | ***785*** | ***772*** | ***760*** | ***526*** | ***535*** | ***562*** | ***562*** | |

*Table 3: Monthly Variations in Zooplanktonic Density (2002-2003).*

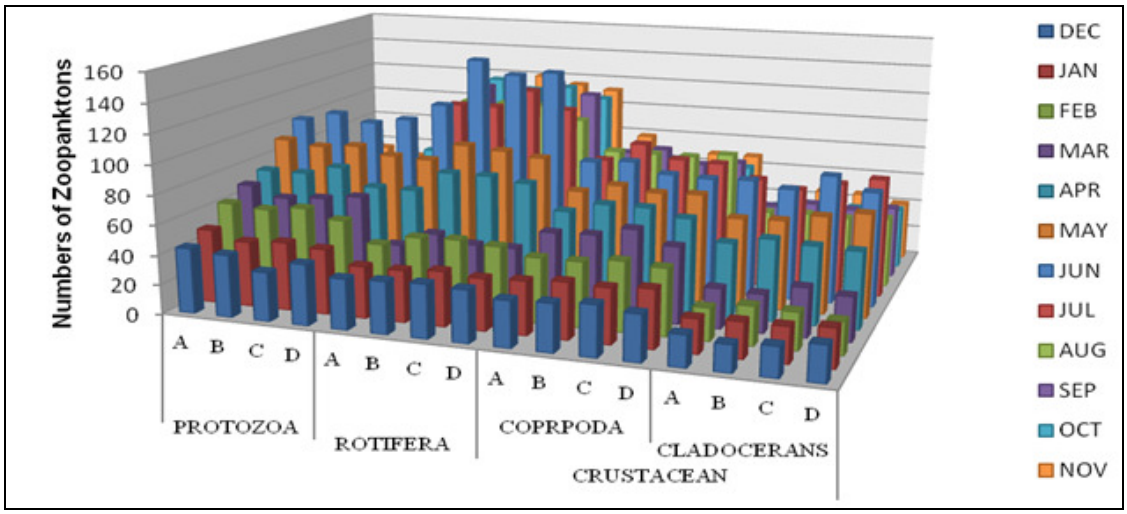


*Figure 3: Zooplanktonic Diversity at Different Sampling Sites*

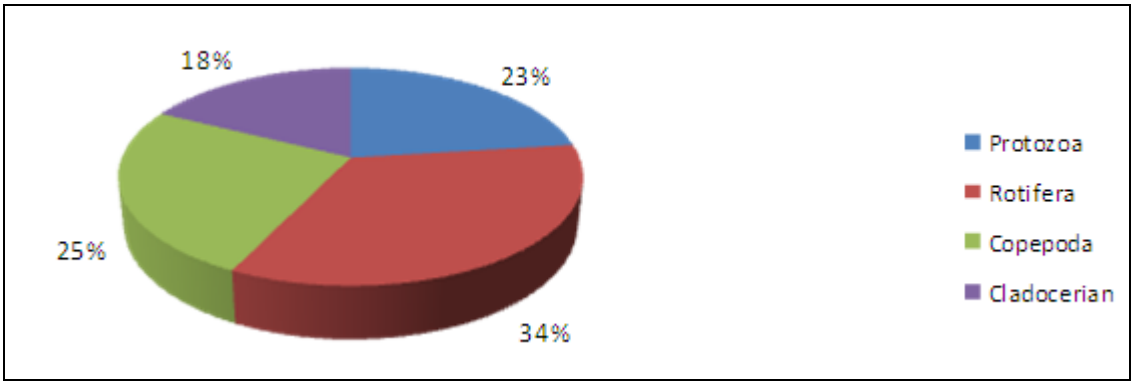


*Figure 4: Density of zooplanktons in Keerat sagar pond*

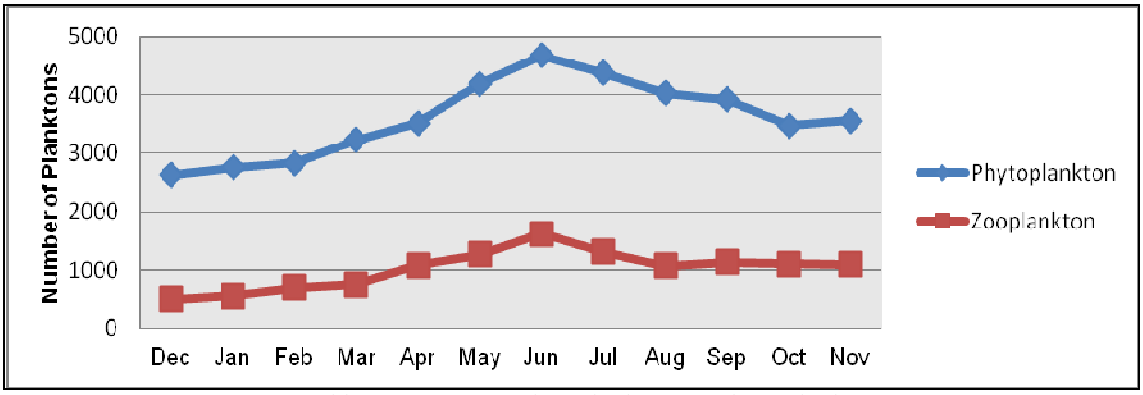


*Figure 5: Monthly Variations in Phytoplanktonic and Zooplanktonic Density*

**3. Result and Discussion**

After collection, summarization and analyzing the data, we concluded that thirty-three plankton species were recorded from study area, out of which sixteen species belongs to phytoplanktons and rest of seventeen species belongs to zooplanktons Table 1.

*3.1. Phytoplankton*

Phytoplanktonic population in various sites of Keerat Sagar pond indicated the order of dominancy among the group with regards to their density and diversity as chlorophyceae > baccillariophyceae > myxophyceae (Figure-2). Maximum density of phytoplanktons were found in the months of summer due to scarcity of water while minimum density was found in the months of winter and monsoon season due to low evaporation and inflow of water in the pond (Figure 5). Gupta *et.al.* (2005) also observed high number of phytoplanktonic population in summer season. Similarly, Escaravage *et al.* (1999) had also recorded the low density of plankton during rainy and winter season due to high influx of flood water and rain washings.

3.1.1. Chlorophyceae

During investigation the chlorophyceae varied from 315 org/L to 588 org/L. They were maximum in summer and minimum in winter period Table 2. The species were Cloestrum, Spirogyra, Zygnema, Ulothrix, Tetraspora, Protococcus, Actinastrum and Scnedamus. Zafer (1968), and Mehra (1986) also observed the maximum growth of chlorophyceae during warmer month of year. Sarwar and Zutshi (1988) also reported that the first maxima of chlorophyceae occurred during summer season.

3.1.2. Baccilariophyceae

Baccillariophyceae ranged from 99 org/L to 266 org/ L in the month of December, January and April respectively Table 2. The species were Navicula, Frustulia, Synedra and Diatoma Table 1.

3.1.3. Myxophyceae

This group was ranged from 190 org/l to 385 org/l in the month of December and June respectively Table -2. The species founded were Microcystis, Tetraspedia, Anabena and Oscillatoria Table 1. Our results were coinciding with Sharma and Pant (1979) who also reported the dominancy of myxophyceae during hot summer months.

*3.2. Zooplankton*

Zooplankton study is a necessity in fisheries, aquaculture and paleolimnological research. (Gay, 1992). Their communities were found in order to their dominancy at Keerat Sagar pond is rotifera > copepoda > protozoa >cladocerian (Figure 4). The maximum density of zooplankton was recorded in the months of summer while minimum density during the winter season (Figure 5). A similar trend of zooplankton communities was also observed by Muruganantham, P *et. al.* (2012), Shivalingam *et al.* (2013) and Dubey *et. al.* (2014). The positive relationship of zooplanktons with phytoplanktons was also observed by Prasad and Goswami (1991) he reported that higher the density of phytoplanktons, higher will be the number of zooplanktons (Figure 5). This similar result also supported by this investigation. On its conclusion it was observed that the seasonal fluctuations of planktonic diversity and density at Keerat Sagar pond varies from season to season within a year which was fit for healthy aquatic-diversity hence very useful and ideal for the purpose of fish and prawn farming. Beside it provides the good revenue to the government.

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