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# An Evaluation of plankton diversity and abundance of Meena River with reference to Pollution

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## ABSTRACT

Researches on fresh water bodies such as ponds, lakes, reservoirs, wetlands, rivers, streams have gained much significance in recent years due to their importance. These water bodies harbours broad array of aquatic organisms, in particular Plankton. They form a very significant part of fresh water community and contribute significantly to aquatic productivity. In Present studyPlankton diversity and abundance of Meenariver was assessed before and after pollution. Plankton diversity and abundance is widespread during different seasons, both at non-polluted and polluted sites. A total of 67 Species of phytoplanktons and 27 Species of zooplanktons were found. Myxophycean Species were found to be chief at both the stations. Euglenophyceae have revealed less No. of phytoplankton abundance in both the sites. The studies have exposed that Non-polluted water shows relatively larger abundance of Myxophyceae and zooplanktons as compared to the polluted water. It is concluded from this study that the plankton population of river Meena at Junnar, Pune district is highly influenced by the discharge from different small scale industrial effluents. The shift in the planktonic population structure and dominance of pollution tolerant forms at discharge zone indicated deterioration of water quality in this stretch of the river.

**Keywords:** Plankton, Diversity, Abundance, Pollution, Meena River.

## I. INTRODUCTION

Rivers are most significant systems of aquatic biodiversity and are among the most dynamic ecosystems on the earth because of the favourable environment that supports No. of flora and fauna. River ecosystem is one of the natural source which comes into the service of mankind in many parts of the ecosphere. They play an important role in the productivity as they are beset with varieties of flora and fauna including planktons. Suburbanization, expansion of irrigation and increasing trend ofindustrial development has contributed towards the demand for water. Surface water is the major source of irrigation in rural areas. Most of the fresh water bodies all over the world are getting polluted water, thus reducing the potability of the water [1].The concept of sustainable utilization by maintaining the natural properties of the wetland ecosystem becomes apractical reality only by a appropriate assessment of the relation between the parameters of water with the plankton,understanding its delicate functioning and by creating an cumulative awareness about its ecological value. Several interdependent and influencing abiotic factors along with high crucial productivity have made it a suitable niche formany aquatic forms.The biota of an aquatic system directly reflects condition present in the environment [2] and data produced in the past has been exploited for biological monitoring of the water pollution level. In this regard, scientists have considered the planktons as an index of water quality with respect to industrial,

municipal and domestic pollution [3,4].The present study was carried out on the surface planktons population in the aquatic ecosystem of Meena river water of Pune district in Maharashtra state (Fig.1). The industrial effluents form small scale industries in and around Pune contain numerouspollutants and have entered into the river Meena affecting the water quality. As a consequence, the plankton population of the Meena River has been affected in terms of abundance and diversity. The present investigation is aimed at evaluating the plankton index as the water quality criteria with reference to the fresh water river Meena polluted by small scale industries at Pune.

## II. MATERIALS AND METHODS:


**Figure 1.** Study Area: Junnar Tehsil, Maharashtra State, India

The Meena River is located in Junnar of Pune district and flows for distance of more than 30 kms before joining river Ghod river in Pune district. The investigation also examines the effect of village effluent, small scale industries pollutants and assesses the planktonic population in Meena river at Station I (non-polluted) and Station II (polluted). Phytoplankton's were collected using a conical net of bolting nylon of 0.069mm mesh width and mouthring diameter of 35 cm with the help of an outrigger canoe. The net was dragged for ten minutes for surface hauls and the volume of water filtered through it was examined by flow meter attached to it and the net was back washed between the two stations to avoid clogging of meshes. The filtered samples were stored and preserved in 4% formalin with a few drops of Lugol's iodine solution. For the quantitative study of phytoplankton, the settlement method described by Sukhanova [5] was used. Numerical plankton analysis was carried out using an invertedmicroscope. Planktons were identified and enumerated by using the methods described by Hosamani and Bharathi [6]. For qualitative analysis of zooplanktons was done according to the methods given by Edmondson [7], Needham and Needham [8], Pennak [9], and Tonap [10]. Zooplanktons were recognized by usingmonographs of Edmondson [11], Batish [12] and Althof [13].

## III. RESULTS AND DISCUSSION

Phytoplankton's been collected from the river water throughout the study period from non-polluted site (Station I) and polluted site (Station II). The results of phytoplankton's counts from each of the selected sites of Meena River are shown in Table 1 and Table 2.

**Table 1.** Distribution of phytoplankton in station I (Non Polluted Site)

| Month | Bacillariophyceae | | Desmidaceae | | Chlorococcales | | Myxophyceae | | Euglenophyceae | |
|---|---|---|---|---|---|---|---|---|---|---|
| | No of Individuals | No of Species | No. of Individuals | No. of Species | No. of Individuals | No. of Species | No of Individuals | No. of Species | No. of Individuals | No. of Species |
| Jan | 400 | 7 | 600 | 8 | 315 | 4 | 60 | 9 | 50 | 5 |
| Feb | 415 | 8 | 650 | 8 | 412 | 5 | 100 | 12 | 30 | 4 |
| Mar | 300 | 8 | 620 | 7 | 318 | 4 | 50 | 20 | Nil | 0 |
| Apr | 350 | 7 | 518 | 6 | 400 | 4 | 80 | 24 | 40 | 4 |
| Ma | 360 | 7 | 545 | 7 | 415 | 4 | 90 | 26 | 20 | 2 |
| Jun | 280 | 6 | 612 | 7 | 218 | 3 | 72 | 21 | 30 | 3 |
| July | 415 | 7 | 600 | 6 | 318 | 3 | 102 | 23 | 10 | 2 |
| Aug | 450 | 8 | 300 | 4 | 400 | 4 | 68 | 15 | 40 | 3 |

| | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| Sep | 389 | 9 | 680 | 7 | 215 | 2 | 94 | 17 | 20 | 2 |
| Oct | 400 | 11 | 610 | 6 | 118 | 1 | 180 | 11 | 10 | 1 |
| Nov | 250 | 6 | 590 | 5 | 180 | 2 | 104 | 13 | 18 | 1 |
| Dec | 180 | 4 | 580 | 5 | 190 | 2 | 84 | 9 | 15 | 2 |
| Total | **4279** | 7 Mean | **6705** | 6 Mean | **3818** | 3 Mean | **4084** | 17 Mean | **483** | 2 Mean |

A detailed microscopic examination of phytoplankton's revealed, the presence of maximum Species of Myxophyceae (19 Species in Station-I and 17Species in Station-II) followed by Bacillariophycean Species (6 Species in Station I and 7Species in Station-II). However, the least No. of Euglenophycean Species (3) and Chloroococcales Species (4) were recorded in Station-I and Station-II respectively. Desmidaceae showed highest No. of Individuals (6908) and euglenoid showed less No. of Individuals (286) in Station-I. Myxophyceae showed highest No. of Individuals and Chlorococcales showed less No. of Individuals in Station-II. pollutants are considered as one of the most important parameters in the aquatic environment which influences the growth, reproduction and metabolic activities of living beings. Distribution of pollutants is mainly based on the season tidal conditions and fresh water flow from land source [14]. In the present investigation a visible change in phytoplankton community with regard to the numerical abundance and Species composition was noticed among the stations studied. A total of 67phytoplanktons taxa were identified.

**Table 2.** Distribution of phytoplankton in station II (Polluted Site)

| Month | Bacillariophyceae | | Desmidaceae | | Chlorococcales | | Myxophyceae | | Euglenophyceae | |
|---|---|---|---|---|---|---|---|---|---|---|
| | **No. of Individuals** | **No. Of Species** | **No. of Individuals** | **No. Of Species** | **No. of Individuals** | **No. Of Species** | **No. of Individuals** | **No. Of Species** | **No. of Individuals** | **No. Of Species** |
| Jan | 150 | 6 | 200 | 8 | 70 | 4 | 350 | 9 | 112 | 4 |
| Feb | 80 | 4 | 80 | 5 | 28 | 4 | 300 | 13 | 114 | 4 |
| Mar | 70 | 4 | 60 | 6 | 35 | 3 | 428 | 18 | 154 | 3 |
| Apr | 112 | 5 | 50 | 4 | 48 | 4 | 412 | 26 | 106 | 2 |
| May | 106 | 6 | 30 | 6 | 106 | 3 | 218 | 24 | 180 | 4 |
| Jun | 250 | 6 | 116 | 7 | 250 | 3 | 289 | 19 | 189 | 4 |
| Jul | 260 | 7 | 106 | 5 | 66 | 2 | 291 | 20 | 192 | 3 |
| Aug | 270 | 7 | 180 | 4 | 177 | 4 | 358 | 22 | 106 | 4 |
| Sep | 116 | 8 | 90 | 6 | 98 | 2 | 415 | 22 | 88 | 3 |
| Oct | 180 | 9 | 70 | 5 | 89 | 1 | 454 | 20 | 95 | 4 |
| Nov | 110 | 4 | 60 | 5 | 69 | 2 | 402 | 18 | 108 | 4 |
| Dec | 90 | 4 | 48 | 4 | 50 | 1 | 359 | 18 | 160 | 2 |
| Total | **1794** | 6 Mean | **1090** | 5 Mean | **1086** | 3 Mean | **2276** | 19 Mean | **204** | 3 Mean |

Desmidaceae (8 Species with 6705Individuals) and Bacillariophyceae (11 Species with 4279Individuals) werefound to be leading in non-polluted site. Their population was found to be comparatively less in polluted site. Generic representation of the Euglenophyceae was lowermost throughout the study period, where as the algal population was dominated by Myxophyceae followed by Bacillariophyceae in polluted site. Maximum phytoplankton abundancewas observed throughout the month of February and while lowest No. was recorded in the month of December inStation I. From the analyzed data, it is observed that Speciessymmetry decreased withthe increasing size of algalpopulation. The abundance and

Species composition of phytoplankton wide-ranging strongly at the succeeding months andbetween the stations in the study area. Algal abundance was observed during summer and their No. declined inmonsoon, which was in accordance with Thomas and Prasad [15] who documented similar results in wetlands ofMysore. Abundance of Myxophyceae was observed in the polluted sites during all the seasons. The maximum abundance of Euglenophyceae was recorded in the month of June at polluted site while number of individual of Euglenoids was recorded in March at non-polluted site. Euglenophyceae and/or Chlorophyceae, however, occurred as atransition stage. Such transition stage constantly occurs when intermediate environments of light and rainfall exist [16].Such surroundings are favoring to Euglenophyceae and Chlorophyceae. A similar pattern of phytoplankton Speciessuccession has been previously noted in the lake [17].In the present study four types of Zooplanktons were identified and are shown in Table -3. Rotifera and Crustacea founded the most leading groups in both non-polluted and polluted stations.The most commonly perceived zooplankton Species in the both sites are Asplachna, Cyclops, Daphnia, Mesocyclops, Nauplius, Siphlonurus Species. Arcellasp. Lacane sp., Macrocyclopssp., Tipulasp., Anopheles larvae,andChironomuslarvae are exclusively observed only in polluted site while Carchesiumpolypium, Paramaeciumaurelia, Brachionuscaudatus, Epiphanesmacrourus, Diurella sp., Gastropushyptopus, Keratellaquadrata, Diaphanosoma sp. and Chaoborus sp. are observed in non-polluted site. Although zooplanktons occur under abroad range ofenvironmental conditions, yet numerousSpecies are limited by dissolved oxygen, temperature, salinity and other physico-chemical factors [18]. The supremacy of any Species in the polluted water for one season or more may beconsidered as indicator Species. The natural unpolluted environments are characterized by stable biologicalconditions and contain a great diversity of plants and animals life's with one Species dominating. The greatinstabilities in the quantitative and qualitative composition of the phytoplankton in the different stations over themonths were mostly due to numerous environmental factors, which are variable in different seasons and regions [19].pollutants present in small scale industrial waste water have been identified as the main cause for changing the trophic statusof water body from eutrophictooligotrophic.

**Table 3.** Distribution of zooplankton in non-polluted site (Station-I) and polluted site (Station- II)

| **Species** | **Non-polluted site (Station-I)** | **Polluted site (Station-II)** |
|---|---|---|
| **Protozoa:** | | |
| Amoeba Species | + | + |
| ArcellaSpecies | - | + |
| Carchesiumpolypium | + | - |
| Paramaeciumcaudatum | - | - |
| Paramaecium Aurelia | + | - |
| SphaerophysaSpecies | - | - |
| **Rotifera:** | | |
| AsplachnaSpecies | + | + |
| Brachionuscaudatus | + | - |
| Epiphanesmacrourus | + | - |
| DiurellaSpecies | + | - |
| Gastropushyptopus | + | - |
| Keratellaquadrata | + | - |
| LacaneSpecies | - | + |
| MicrocodonSpecies | + | - |
| **Crustacea:** | | |
| | | |
| Cyclops Species | + | + |
| Daphnia Species | + | + |
| DiaphanosomaSpecies | + | - |
| MacrocyclopsSpecies | - | + |
| MesocyclopsSpecies | + | + |
| Nupliuslarvae | + | + |
| NaupliusSpecies | + | + |
| Zoealarvae | + | + |
| **Insecta:** | | |
| | | |
| Anopheles larvae | + | + |
| Chironomuslarvae | - | + |
| ChaoborusSpecies | + | - |
| SiphlonurusSpecies | + | + |
| TipulaSpecies | - | + |

## IV. CONCLUSION

The present study provides vital details on plankton distribution and abundance of Meena River which may unravel the information on the energy turnover

of the river ecosystem. It will serve as a useful tool for further ecological assessment and monitoring of the river ecosystem. The results have shown the need of planktons as index of water quality.

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