

CLUSTER ANALYSIS OF PHYTOPLANKTON FROM THE LAKES OF THANE, MAHARASHTRA

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ABSTRACT

The study of four lakes namely Ambeghosale, Rewale, Upavan and Makhamali from Thane city, Maharashtra was undertaken to investigate the phytoplankton population. Phytoplankton was subjected to cluster analysis. Different clusters are represented with the help of tree diagram of variables (dendrogram) and lake Rewale and lake Ambeghosale showed three clusters each, while lake Makhamali showed five clusters and lake Upavan showed six clusters. The results indicated that dependency of the phytoplankton is not controlled by presence or absence of macrophytes.

Key words : Lakes, Phytoplankton, Cluster analysis, Dendrogram.

INTRODUCTION

Statistical techniques are put to use in one form or another in almost all branches of modern science and in many other fields of human activity. Hernet (1982) quoted Solomon Fabricant, "The whole world now seems to hold that statistics can be useful in understanding, assessing and controlling the operations of society". Progress in our society can be measured by a variety of numerical indices. Statistics are used to describe, manipulate and interpret these numbers. During the present study apart from the simple graphical comparison, statistical methods are used to interpret the data.

Cluster analysis is used to classify the variables into groups. It appears to be handy tool in determining important factors that control activity in polluted waters. It is represented by dendrogram, which is a tree diagram, representing the amalgamation (grouping) of variables into clusters.

In this study correlation coefficient is used as a similarity measure. In the first step two variables, which are closest are joined. In the next step either a third variable joins the first two or two other variables are joined together in second cluster. This procedure continues until all variables are clustered and all clusters are joined into one single cluster. Cluster analysis was reported with the help of

dendrogram by Joyeux Jean Christophe (2004), who gave Phylogram-style cluster based on the results of twin span analysis on the mean monthly abundance of 53 ichthyoplankton taxa plus unidentified larvae (excluding eggs). Singh and Singh (2004), during their study showed dendrogram of laboratory populations of *Drosophila ananassae* based on clustering of genetic identity values. Ward-Campbell and Beamish (2005) also obtained dendrogram from a median-linkage cluster analysis on the prey-specific abundance values of prey items for *Channa limbata*, a predatory fish in Western Thailand. During the present study the phytoplankton were subjected to cluster analysis mainly to find out the co-relation with different phytoplankton found in different lakes.

MATERIALS AND METHODS

Water samples from the study lakes of Ambeghosale, Rewale, Upavan and Makhamali were collected monthly and the physico chemical analyses of water samples were performed as per the procedures described in the standard methods (APHA 1981) and Trivedi and Goel (1984). The samples were preserved in 4% Lugol's Iodine for further analyses.

One year data of the phytoplankton was subjected to statistical analysis, for which, software Mintab 14 was used. With this programme cluster analysis of phytoplankton of all the four selected lakes were carried out and are represented in a form of dendrograms.

RESULT AND DISCUSSION

Cluster analysis appears to be handy tool in determining important factors that control activities in polluted waters. For the cluster analysis of phytoplankton, 75% similarity level was taken into consideration as it depicts better picture.

Lake Ambeghosale : The cluster analysis (Fig. 1) shows that many species of phytoplankton are dependent on one another in lake Ambeghosale as 16 species have formed a single large cluster, while remaining two clusters are formed by only two species each. Thus only 3 clusters are formed in this lake.

The co-relation co-efficient measures, the extent or degree of relations between two sets of figures, since correlation co-efficient is used as similarity measure the parameter with more similarity are grouped in one cluster. Hence more number of clusters indicate more uncorrelated variables.

Lake Rewale : Fig. 2 indicates that out of 20 species, 18 species form 1st largest cluster with dependency on each other, while 2nd and 3rd cluster are of one single

species each indicating that *Kirchinerilla* sp. and *Cyclotella* sp. are independent species in lake Rewale.

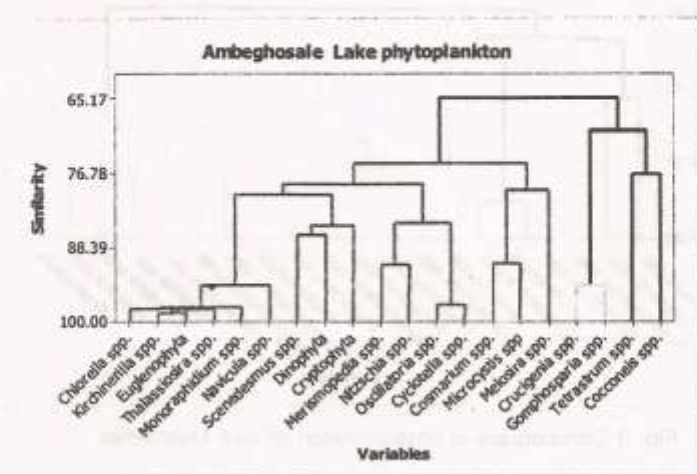


Fig. 1 Dendrogram of phytoplankton of lake Ambeghosale.

Cluster 1 : *Chlorella* sp., *Cosmarium* sp., *Kirchnerilla* sp., *Monoraphidium* sp., *Scenedesmus* sp., *Merismopedia* sp., *Microcystis* sp., *Oscillatoria* sp., *Cyclotella* sp., *Melosira* sp., *Navicula* sp., *Nitzschia* sp., *Thalassiosira* sp., *Euglenophyta*, *Cryptophyta*, *Dinophyta* Cluster 2 : *Crucigenia* sp., *Gomphosparia* sp., Cluster 3 : *Tetrastrum* sp., *Cocconeis* sp.,

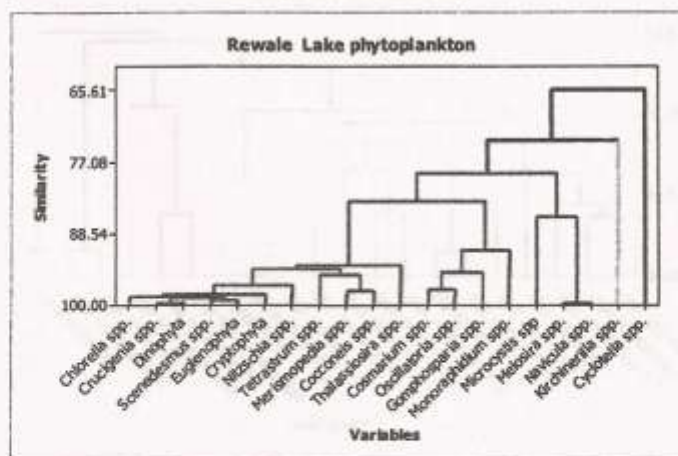


Fig. 2 Dendrogram of phytoplankton of lake Rewale.

Cluster 1 : *Chlorella* sp., *Cosmarium* sp., *Crucigenia* sp., *Monoraphidium* sp., *Scenedesmus* sp., *Tetrastrum* sp., *Gomphosparia* sp., *Merismopedia* sp., *Microcystis* sp., *Oscillatoria* sp., *Cocconeis* sp., *Melosira* sp., *Navicula* sp., *Nitzschia* spp., *Thalassiosira* sp., *Euglenophyta*, *Cryptophyta*, *Dinophyta* Cluster 2 : *Kirchnerilla* sp., Cluster 3 : *Cyclotella* sp.,

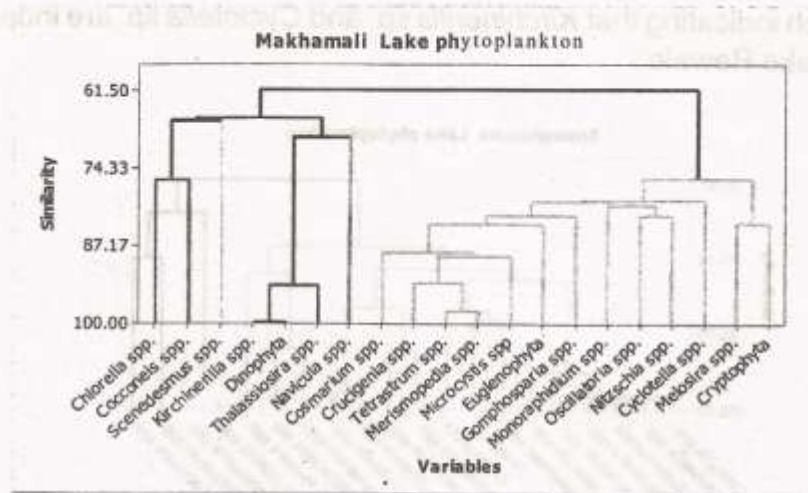


Fig. 3 Dendrogram of phytoplankton of lake Makhamali

Cluster 1 : *Chlorella* sp., *Cocconeis* sp., Cluster 2 : *Cosmarium* sp., *Crucigenia* sp., *Monoraphidium* sp., *Tetrastrum* sp., *Gomphosparia* sp., *Merismopedia* sp., *Microcystis* sp., *Oscillatoriella* sp., *Cyclotella* sp., *Melosira* sp., *Nitzschia* sp., *Euglenophyta*, *Cryptophyta*, Cluster 3 : *Kirchneriella* sp., *Dinophyta*, *Thalassiosira* sp., Cluster 4 : *Scenedesmus* sp., Cluster 5 : *Navicula* sp.,

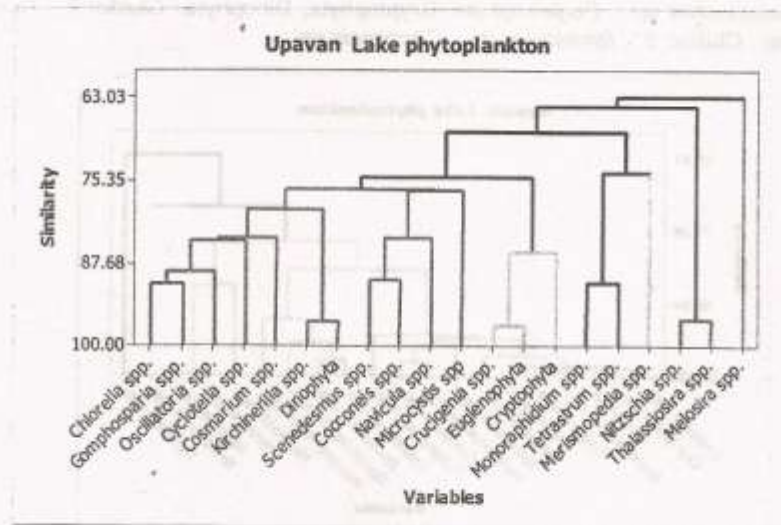


Fig. 4 Dendrogram of phytoplankton of lake Upavan.

Cluster 1 : *Chlorella* sp., *Cosmarium* sp., *Kirchneriella* sp., *Scenedesmus* sp., *Gomphosparia* sp., *Microcystis* sp., *Oscillatoriella* sp., *Cocconeis* sp., *Cyclotella* sp., *Navicula* sp., *Dinophyta* Cluster 2 : *Crucigenia* sp., *Euglenophyta*, *Cryptophyta*; Cluster 3 : *Monoraphidium* sp., *Tetrastrum* sp. Cluster 4 : *Merismopedia* sp., Cluster 5 : *Melosira* sp., Cluster 6 : *Nitzschia* sp., *Thalassiosira* sp.

During the present study three clusters each were found in lake Ambeghosale and Rewale while in lake Upavan, six clusters were seen and in lake Makhamali, five clusters were seen. Thus lake Upavan and lake Makhamali show more unrelated phytoplankton or the phytoplankton of these lakes have less similarity.

Lake Makhamali: In lake Makhamali, maximum numbers of cluster (i.e. 5) in comparison into macrophyte infested were seen, compared to other study lakes. In these clusters, cluster no. 2 is largest with 13 species, no. 3 with 3 species, no. 1 with 2 species and 4 and 5 clusters are of one species each. From the dendrogram (Fig. 3) it is noted that this lake contains many species which are independent and not showing similarity with each other.

Lake Upavan : During the present study in macrophyte non-infested lake Upavan maximum number of clusters (i.e. 6) were reported. From this cluster 1 posses maximum number of phytoplankton i.e. 11. While in remaining cluters 1, 2 or 3 phytotlakton were seen.

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