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CLUSTER ANALYSIS OF PHYSICO-CHEMICAL PARAMETERS FROM THANE LAKES IN MAHARASHTRA

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ABSTRACT

In four study lakes namely Ambeghosale, Rewale, Makhamali and Upavan, analysis of physico-chemical parameters was done throughout the year. Statistical tools are extremely useful to prove large data. Hence, during the course of study statistical analysis was done for various physico-chemical parameters. The physico-chemical parameters of the lakes from Thane city were subjected to cluster analysis and dendrograms for the first time.

INTRODUCTION

Statistic or datum means one measured or counted fact or piece of information stated as a figure such as height of one person, birth of a baby, etc. (Mahajan 1991). During the present study apart from the simple graphical comparison, statistical methods were used to interpret the data. We used cluster analysis to classify the variables into groups. Cluster analysis appears to be handy tool in determining important factors that control various activities in polluted waters. The cluster analysis is represented by dendrogram. Dendrogram is a tree diagram, which represents the amalgamation (grouping) of variable into clusters.

Correlation coefficient has been used as a similarity measure in the present study. In the 1st 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 2nd cluster. This procedure continues until all variables are clustered and all clusters are joined into one single cluster. Cluster analysis was also reported by Mruthunjaya & Hosmani (2004) in Lingamudhi lake in Mysore. Rana & Bhat (2005) also represented cluster analysis with dendrogram to show relationships among cotton cultivators.

MATERIALS AND METHODS

The water samples from the lakes namely Ambeghosale, Rewale, Upavan and Makhamali were collected monthly. The physico-chemical analysis of water samples was performed as per the procedures described in the Standard Methods (APHA 1981) and Trivedy & Goel (1984) for following parameters: air temperature, water temperature, light penetration, total solids, dissolved solids, suspended solids, pH, conductivity, turbidity, salinity, dissolved oxygen, free carbon dioxide, phenolphthalein alkalinity, total alkalinity, total hardness, calcium hardness, calcium, magnesium, silicates, phosphates, nitrates and biochemical oxygen demand.

The one year data of the physico-chemical parameters were subjected to statistical analysis, for which, software Mintab 14 was used.

With this programme cluster analysis of physico-chemical parameters of all the four lakes was carried out and represented in a form of dendrograms. The PLS (Partial Least Square) groups were also drawn by using the same statistical software.

RESULTS AND DISCUSSION

Cluster analysis appears to be handy tool in determining important factors that control activity in polluted water. For the cluster analysis of physico-chemical parameters, 60% similarity level was taken into consideration as it depicts a better picture. For various lakes, cluster analysis was carried out and dendrograms obtained. The results of the cluster analysis of physico-chemical parameters conducted in the four lakes are shown in Figs. 1 to 4.

Lake Ambeghosale

Cluster

Cluster 1: AT, WT, DS, SALI, Ca HARD, Ca
Cluster2: LP
Cluster 3: TS, SS, COND, TURB, TALK, SIL, POSP
Cluster 4: pH, DO
Cluster 5: FCO_2, T HARD, Mg, BOD
Cluster 6: P ALK, NIT

Dendrogram shows that 6 clusters are formed of which cluster 1 and 3 are the largest clusters. Cluster 5 is of medium size and remaining are represented by only 1 or 2 physico-chemical parameters.

The larger is the size of a cluster more is the correlation among the parameters involved. Thus, in lake Ambeghosale other than 5 and 6 parameters remaining parameters show more than 60% similarity with each other.

Lake Rewale

Cluster

Cluster 1: AT, WT, DO, SS, THRD, Mg NIT
Cluster2: LP
Cluster 3: COND, TDS, TA, CaHR Ca ,PHOS, SALI
Cluster 4: pH, TURB, TS, PA, BOD
Cluster 5: CO_2
Cluster 6: SIL

In lake Rewale out of the 6 clusters, 3 clusters (i.e., cluster number 1, 3 and 4) are with 5 or more physicochemical parameters and remaining 3 clusters are of single parameters each. Light penetration, carbon dioxide and silicates do not depend on any physico-chemical parameter.

Lake Makhamali

Cluster

Cluster 1: AT, WT, pH, TURB, DO, TDS, THRD, Mg, SIL, SALI
Cluster2: LP, SS, PHOS, NIT
Cluster 3: COND, PA, TA
Cluster 4: CO_2, TS
Cluster 5: CaHR, Ca, BOD

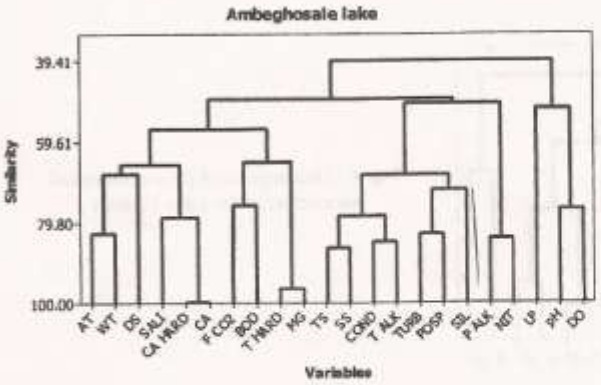

Fig. 1. Dendrogram of physicochemical parameters of the Lake Ambeghosale.

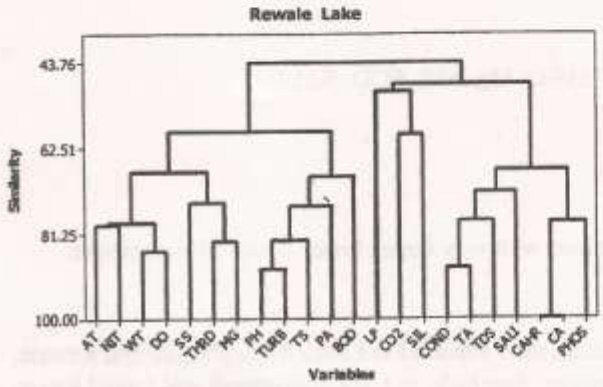

Fig. 2. Dendrogram of physicochemical parameters of the Lake Rewale.

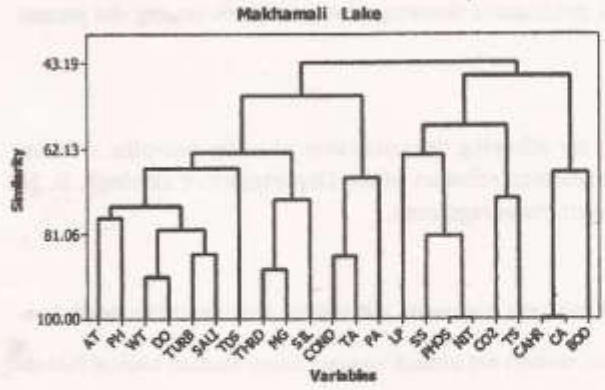

Fig. 3. Dendrogram of physicochemical parameters of the Lake Makhamali.

It is interesting to note that only 5 clusters were seen in the Lake Makhamali. Cluster 1 is very large with 10 parameters, cluster 2 with 4 parameters, clusters 3 and 5 with 3 parameters and cluster 4 with 2 parameters.

Out of 21 physico-chemical parameters 10 parameters were more correlated with each other.

Lake Upavan

Cluster

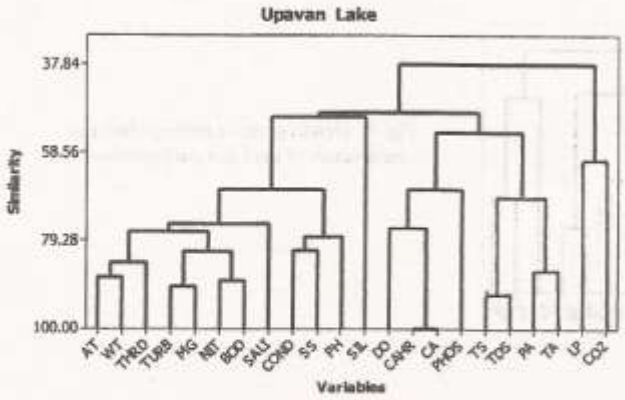

Fig. 4. Dendrogram of physicochemical parameters of the Lake Upavan.

Cluster 1: AT, WT, COND, pH, TURB, SS, HARD, Mg, NIT, BOD, SALI
Cluster2: LP, CO_2
Cluster 3: DO, CaHR, Ca, PHOS
Cluster 4: TS, TDS, PA, TA
Cluster 5: SIL

In Lake Upavan also 5 clusters were obtained with very large cluster 1 with 11 parameters.

CONCLUSION

In cluster analysis of all the four lakes, 6 clusters were reported in Lakes Ambeghosale and Rewale, while 5 clusters in Lakes Makhamali and Upavan. Similarly, in Lake Makhamali and Lake Upavan one of the clusters was very large with 10/11 parameters showing close relations among the parameters.

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REFERENCES

APHA 1980. Standard Methods for the Examination of Water and Wastewater, 15th edition. American Public Health Association, Washington DC, USA.

Mahajan B. K. 1991. Methods in Biostatistics (for medical students and research workers), Jaypee Brothers Medical Publishers (P) Ltd. pp. 332.

Mruthunjaya T.B. and Hosmani S.P. 2004. Application of cluster analysis to evaluate pollution in Lingambudhi lake in Mysore, Karnataka. Nature Environment and Pollution Technology, 3(4): 463-466.

Rana M. K. and Bhat K. V. 2005. RAPD markers for genetic diversity study among Indian cotton cultivars. Current Science, Vol. 88, No. 12.

Trivedy, R. K. and Goel, P. K. 1984. Chemical and Biological Methods for Water Pollution Studies. Environmental Publ., Karad, India.