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**QUALITATIVE AND QUANTITATIVE AQUATIC ALGAL
DATA COMPILATION TO DETERMINE MACROTRENDS-II**

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Technical Completion Report Research Project G-1004-32

Arkansas Water Resources Research Center
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Fayetteville, Arkansas 72701



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ABSTRACT

QUALITATIVE AND QUANTITATIVE AQUATIC ALGAL DATA COMPILATION TO DETERMINE MACROTRENDS - II

A database of the algae of Arkansas has been established by the use of a relational database management system (dBase III). The system was chosen to be readily available for microcomputers using MS and PC-DOS. The database contains taxonomic fields from division through variety, synonymy, authors, starting date and definitive descriptive source. The data is cross-referenced by ecoregion, community and subcommunity.

The database contains nearly 1,500 taxonomic records in all division and classes of freshwater algae. These data are sortable by any of the included parameters. The data have been used to initiate the publication of the algal flora of Arkansas. The listing of the Cyanophyta/Cyanobacteria or blue-green algae is presently available.

Richard L. Meyer

Completion Report to the U. S. Department of the Interior, Geological Survey, Reston, VA, June 1986.

Keywords -- Algae/Taxonomy/Classification/Habitat/Lakes/Reservoirs/
Streams

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INTRODUCTION

In 1906 and 1909 West and West initiated the use of algae as associates with geological formations and the resultant lake and stream types. The use of algal indicators, particularly the desmids, remains a classic in the study of algal ecology. Pearsall (1932) contributed the chemical and limnological information which substantiated the use of these indicator organisms. Modern literature emphasizes the distribution of algae in association with specific lakes, reservoirs and streams. Particular emphasis has been given to nuisance taxa. Palmer (1969) summarized the application of algae as trophic indicators in his paper on pollution-tolerant taxa.

The prior research in Europe and northwestern Asia strongly suggests that the distribution of organisms is associated with the geological substrate (Hutchinson, 1967). In streams it is well established that the upstream conditions have a major impact as well as the in situ conditions in which the alga resides. Within a climatic zone the primary influencing parameters under natural conditions will be the substrate of the locale and drainage basin.

Arkansas is influenced by a generally temperate climate with strong seasonal variation. Summer water temperatures may attain temporary maxima of 42⁰ while winter air temperatures may be as low as -25⁰. Lakes and reservoirs typically have surface temperatures five to seven degrees cooler than the air temperature. Also, portions of reservoirs, lakes, ponds, and streams may be ice covered for one to four weeks. The diversity in stream temperature is associated

with the stream origin (spring or runoff) and slope.

Meyer (1985) has defined six "ecoregions" based upon the integration of chemical, physical and biological parameters associated with the geological substrata, generalized soil types, and typical surface vegetation. These include the oak-hickory forest in the Ozark Highlands and Boston Mountains, the alluvial Arkansas River Valley, the pine with scattered hardwoods covered Ouachita Mountains, the prairie-like Mississippi delta, the beech-maple forest along Crowley's Ridge, and the southern pine forest of the gulf coastal plain.

A. Purpose and Objectives

The diverse ecoregions of Arkansas have had sporadic sampling except for the northwest region of the Ozark Highlands and certain research sites. From these diverse sources of information greater than 1,200 taxa are known. Certain taxa are known to be widely distributed while others are restricted to a single site.

The objective of this research is to assemble the existing data into a cohesive body of information from which distributional and ecological questions can be addressed. The data base can then be correlated, sorted and displayed by ecoregion with associated organisms, community and subcommunity characteristics. These regionally sorted data can be used for environmental assessment and for the selection of best management practices.

The increase in sophistication of microprocessors and software has allowed the development of data summaries and bases. The first

phase of the research included the selection of appropriate hardware and software, the development of record format, and the entry of a trial taxonomic data set. The present phase expands the size of the taxonomic data and includes the development of several parallel data sets. The parallel data files include not only the source author and date but usually available references sources from which other researchers can identify the organism. Additional files contain the description of the ecoregion, community type and subcommunity in which the alga exists.

B. Related Research or Activities

A search of the literature and personal contacts with other phycologists indicates that the research program and protocol represents initial efforts into forming quickly retrievable and sortable statewide data based for microprocessors. Our protocol will permit the retrieval of all or portions of the information via modem with commonly available computer hardware and software. Other known data bases are hardware and program unique and not easily exported or imported.

METHOD AND PROCEDURES

The outline of the selection of the hardware and software has been presented by Meyer (1985). The hardware is based upon the IBM-type microcomputer so that numerous compatible machines can use the data base. The software selected was the Aston-Tate dBase III relational data base management system.

The data entry has expanded the initial taxonomic file to in-

clude additional records. Additional files for taxonomic reference by author and reference source have been established. Also, a habitat file has been initiated to record the characteristics of the locale in which the alga has been collected.

PRINCIPLE FINDINGS AND SIGNIFICANCE

The taxonomic file included within the data base has the algae classified to Class, Order, Genus, Species, and, where appropriate, variety and form. Family epithets are not given because of the dynamics of phylogenetic research in progress at the present time. The taxonomic levels assigned are based upon commonly available systematic literature and may differ from the most recent recommendations. A new file will be developed in the future which includes alternate higher taxonomic category assignments.

The present suite also includes two secondary files: an identification file and a habitat file. The identification file contains the generic and specific names, the author(s) name and original date of description. This file includes the references source(s) from which an illustration, a word description, and a key are available. The habitat file contains the generic and specific name plus information concerning the ecoregion, community, and subcommunity. Temporal and spatial information may be added to this file or a separate file developed in the future.

The software data base management program used allows sorting and merging the various files to produce customized reports for specific needs. To-date, a customized listing of the Cyanophyta/

Cyanobacteria has been published which includes the complete complement of taxonomic citation. This flora has been supplied to the Arkansas Academy of Science for distribution with its Arkansas Flora and Fauna series.

A copy of the "to date" data base is available from the author. Periodically updated copies will be deposited with the Arkansas Water Resources Research Center at the University of Arkansas.

CONCLUSIONS

The selection of the hardware and software compliment have been shown to be applicable in developing a data base for the taxonomy, identification, and distribution of the freshwater algae. The data base design permits the retrieval of complexes of information from several files so that customized output request can addressed. The management system allows for the development for new input files and the merging of these files or portion of these files with all or part of existing files.

At the present time the files contain information from greater than 1,200 taxa of algae from all regions of Arkansas. The associated information is presently being entered and verified. The data base is archived with the Phycology Laboratory at the University of Arkansas at Fayetteville.

LITERATURE CITED

- Hutchinson, G.E. 1967. "A Treatise on Limnology. Vol. II. Introduction to Lake Biology and Limnoplankton". J. Wiley and Sons. New York. 1115p.
- Meyer, R.L. 1985. "Qualitative and Quantitative Aquatic Algal Data Compilation to Determine Macrotrends". Arkansas Water Resources Research Center. Publication No. 114. 7p.
- Palmer, M.C. 1969. "A Composite Rating of Algae Tolerating Organic Pollution". J. Phycol. 5(1):78-82.
- Pearsall, W.H. 1932. "Phytoplankton of the English Lake District. II. The Composition of the Phytoplankton in Relation to Dissolved Substances". J. Ecol. 20:241-262.
- West, W. and G.S. West. 1906. "A Comparative Study of the Plankton of some Irish Lough. Proc. Roy. Ir. Acad., B, 32:77-116.
- West, W. and G.S. West. 1909. "The British Freshwater Phytoplankton, with Special Reference to the Desmid-plankton and the Distribution of British Desmids. Proc. R. Soc., (B) 81:164-206.