United States
Environmental Protection
Agency

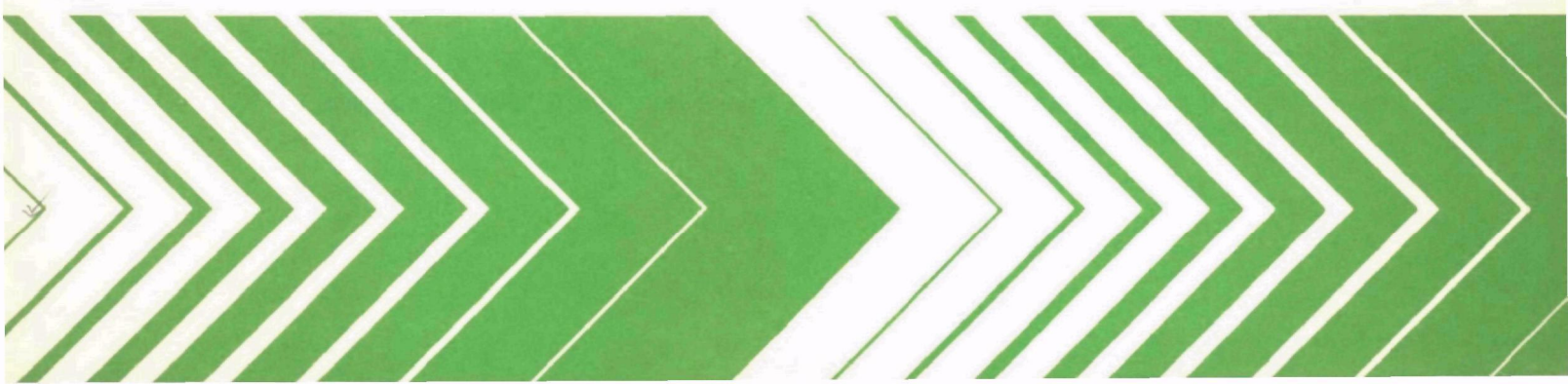
Environmental Monitoring
and Support Laboratory
P.O. Box 15027
Las Vegas NV 89114

EPA-600/3-79-119
December 1979

Research and Development

EPA

Distribution of Phytoplankton in Oregon Lakes



RESEARCH REPORTING SERIES

Research reports of the Office of Research and Development, U.S. Environmental Protection Agency, have been grouped into nine series. These nine broad categories were established to facilitate further development and application of environmental technology. Elimination of traditional grouping was consciously planned to foster technology transfer and maximum interface in related fields. The nine series are:

1. Environmental Health Effects Research
2. Environmental Protection Technology
3. Ecological Research
4. Environmental Monitoring
5. Socioeconomic Environmental Studies
6. Scientific and Technical Assessment Reports (STAR)
7. Interagency Energy—Environment Research and Development
8. "Special" Reports
9. Miscellaneous Reports

This report has been assigned to the ECOLOGICAL RESEARCH series. This series describes research on the effects of pollution on humans,plant and animal species, and materials. Problems are assessed for their long-and short-term influences. Investigations include formations, transport, and pathway studies to determine the fate of pollutants and their effects. This work provided the technical basis for setting standards to minimize undesirable changes in living organisms in the aquatic, terrestrial, and atmospheric environments.

This document is available to the public through the National Technical Information Service, Springfield, Virginia 22161

EPA-600/3-79-119
December 1979

DISTRIBUTION OF PHYTOPLANKTON IN OREGON LAKES

by

W. D. Taylor, L. R. Williams, S. C. Hern,
V. W. Lambou, F. A. Morris*, and M. K. Morris*

Water and Land Quality Branch
Monitoring Operations Division
Environmental Monitoring and Support Laboratory
Las Vegas, Nevada 89114

*Department of Biological Sciences
University of Nevada, Las Vegas
Las Vegas, Nevada 89154

ENVIRONMENTAL MONITORING AND SUPPORT LABORATORY
OFFICE OF RESEARCH AND DEVELOPMENT
U.S. ENVIRONMENTAL PROTECTION AGENCY
LAS VEGAS, NEVADA 89114

DISCLAIMER

This report has been reviewed by the Environmental Monitoring and Support Laboratory-Las Vegas, U.S. Environmental Protection Agency, and approved for publication. Mention of trade names or commercial products does not constitute endorsement or recommendation for use.

FOREWORD

Protection of the environment requires effective regulatory actions which are based on sound technical and scientific information. This information must include the quantitative description and linking of pollutant sources, transport mechanisms, interactions, and resulting effects on man and his environment. Because of the complexities involved, assessment of specific pollutants in the environment requires a total systems approach which transcends the media of air, water, and land. The Environmental Monitoring and Support Laboratory-Las Vegas contributes to the formation and enhancement of a sound monitoring data base for exposure assessment through programs designed to:

- develop and optimize systems and strategies for monitoring pollutants and their impact on the environment
- demonstrate new monitoring systems and technologies by applying them to fulfill special monitoring needs of the Agency's operating programs

This report presents the species and abundance of phytoplankton in the 8 lakes sampled by the National Eutrophication Survey in the State of Oregon, along with results from the calculation of several commonly used biological indices of water quality and community structure. These data can be used to biologically characterize the study lakes, and as baseline data for future investigations. This report was written for use by Federal, State, and local governmental agencies concerned with water quality analysis, monitoring, and/or regulation. Private industry and individuals similarly involved with the biological aspects of water quality will find the document useful. For further information contact the Water and Land Quality Branch, Monitoring Operations Division.

George B. Morgan
Director
Environmental Monitoring and Support Laboratory
Las Vegas

CONTENTS

INTRODUCTION

The collection and analysis of phytoplankton data were included in the National Eutrophication Survey in an effort to determine relationships between algal characteristics and trophic status of individual lakes.

During spring, summer, and fall of 1975, the Survey sampled 156 lakes in 11 States. Over 450 algal species and varieties were identified and enumerated from the 430 water samples examined.

This report presents the species and abundance of phytoplankton in the 8 lakes sampled in the State of Oregon (Table 1). The Nygaard's Trophic State (Nygaard 1949), Palmer's Organic Pollution (Palmer 1969), and species diversity and abundance indices are also included.

TABLE 1. LAKES SAMPLED IN THE STATE OF OREGON

STORET No.	Lake Name	County
4101	Brownlee Reservoir	Baker (Washington in Idaho)
4102	Diamond	Douglas
4103	Hells Canyon Reservoir	Wallowa, Baker (Adams in Idaho)
4104	Hills Creek Reservoir	Lane
4105	Owyhee	Malheur
4106	Oxbow Reservoir	Baker (Adams in Idaho)
4107	Suttle Lake	Jefferson
4108	Waldo Lake	Lane

MATERIALS AND METHODS

LAKE AND SITE SELECTION

Lakes and reservoirs included in the Survey were selected through discussions with State water pollution agency personnel and U.S. Environmental Protection Agency Regional Offices (U.S. Environmental Protection Agency 1975). Screening and selection strongly emphasized lakes with actual or potential accelerated eutrophication problems. As a result, the selection was limited to lakes:

(1) impacted by one or more municipal sewage treatment plant outfalls either directly into the lake or by discharge to an inlet tributary within approximately 40 kilometers of the lake;

(2) 40 hectares or larger in size; and

(3) with a mean hydraulic retention time of at least 30 days.

Specific selection criteria were waived for some lakes of particular State interest.

Sampling sites for a lake were selected based on available information on lake morphometry, potential major sources of nutrient input, and on-site judgment of the field limnologist (U.S. Environmental Protection Agency 1975). Primary sampling sites were chosen to reflect the deepest portion of each major basin in a test lake. Where many basins were present, selection was guided by nutrient source information on hand. At each sampling site, a depth-integrated phytoplankton sample was taken. Depth-integrated samples were uniform mixtures of water from the surface to a depth of 15 feet (4.6 meters) or from the surface to the lower limit of the photic zone representing 1 percent of the incident light, whichever was greater. If the depth at the sampling site was less than 15 feet (4.6 meters), the sample was taken from just off the bottom to the surface. Normally, a lake was sampled three times in 1 year, providing information on spring, summer, and fall conditions.

SAMPLE PREPARATION

To preserve the sample 4 milliliters (ml) of Acid-Lugol's solution (Prescott 1970) were added to each 130-ml sample from each site at the time of collection. The samples were shipped to the Environmental Monitoring and Support Laboratory, Las Vegas, Nevada, where equal volumes from each site

were mixed to form two 130-ml composite samples for a given lake. One composite sample was put into storage and the other was used for the examination.

Prior to examination, the composite samples were concentrated by the settling method. Solids were allowed to settle for at least 24 hours prior to siphoning off the supernate. The volume of the removed supernate and the volume of the remaining concentrate were measured and concentrations determined. A small (8-ml) library subsample of the concentrate was then taken. The remaining concentrate was gently agitated to resuspend the plankton and poured into a capped, graduated test tube. If a preliminary examination of a sample indicated the need for a more concentrated sample, the contents of the test tube were further concentrated by repeating the settling method. Final concentrations varied from 15 to 40 times the original.

Permanent slides were prepared from concentrated samples after analysis was complete. A ring of clear Karo® corn syrup with phenol (a few crystals of phenol were added to each 100 ml of syrup) was placed on a glass slide. A drop of superconcentrate from the bottom of the test tube was placed in the ring. This solution was thoroughly mixed and topped with a coverglass. After the syrup at the edges of the coverglass had hardened, the excess was scraped away and the mount was sealed with clear fingernail polish. Permanent diatom slides were prepared by drying sample material on a coverglass, heating in a muffle furnace at 400° C for 45 minutes, and mounting in Hyrax®. Finally, the mounts were sealed with clear fingernail polish.

Backup samples, library samples, permanent sample slides, and Hyrax®mounted diatom slides are being stored and maintained at the Environmental Monitoring and Support Laboratory-Las Vegas.

EXAMINATION

The phytoplankton samples were examined with the aid of binocular compound microscopes. A preliminary examination was performed to precisely identify and list all forms encountered. The length of this examination varied depending on the complexity of the sample. An attempt was made to find and identify all of the forms present in each sample. Often forms were observed which could not be identified to species or to genus. Abbreviated descriptions were used to keep a record of these forms (e.g., lunate cell, blue-green filament, Navicula #1). Diatom slides were examined using a standard light microscope. If greater resolution was essential to accurately identify the diatoms, a phase-contrast microscope was used.

After the species list was compiled, phytoplankton were enumerated using a Neubauer Counting Chamber with a 40X objective lens and a 10X ocular lens. All forms within each field were counted. The count was continued until a minimum of 100 fields had been viewed, or until the dominant form had been observed a minimum of 100 times.

®Registered trademark

QUALITY CONTROL

Project phycologists performed internal quality control intercomparisons regularly on 7 percent of the species identification and counts. Although an individual had primary responsibility for analyzing a sample, taxonomic problems were discussed among the phycologists.

Additional quality control checks were performed on the Survey samples by Dr. G. W. Prescott of the University of Montana at the rate of 5 percent. Quality control checks were made on 75 percent of these samples to verify species identifications while checks were made on the remaining 25 percent of the samples to verify genus counts. Presently, the agreement between quality control checks for species identification and genus enumerations is satisfactory.

RESULTS

A phytoplankton species list for the State is presented in Appendix A. Appendix B summarizes all of the phytoplankton data collected from the State by the Survey. The latter is organized by lake, and includes an alphabetical phytoplankton species list with concentrations for individual species given by sampling date. Results from the application of several indices are presented (Nygaard's Trophic State, Palmer's Organic Pollution, and species diversity and abundance). Each lake has been assigned a four-digit STORET number. (STORET (STOrage and RETrieval) is the U.S. Environmental Protection Agency's computer system which processes and maintains water quality data.) The first two digits of the STORET number identify the State; the last two digits identify the lake.

NYGAARD'S TROPHIC STATE INDICES

Five indices devised by Nygaard (1949) were proposed under the assumption that certain algal groups are indicative of levels of nutrient enrichment. These indices were calculated in order to aid in determining the surveyed lakes' trophic status. As a general rule, Cyanophyta, Euglenophyta, centric diatoms, and members of the Chlorococcales are found in waters that are eutrophic (rich in nutrients), while desmids and many pennate diatoms generally cannot tolerate high nutrient levels and so are found in oligotrophic waters (poor in nutrients).

In applying the indices to the Survey data, the number of taxa in each major group was determined from the species list for each sample. The ratios of these groups give numerical values which can be used as a biological index of water richness. The five indices and the ranges of values established for Danish lakes by Nygaard for each trophic state are presented in Table 2. The appropriate symbol, (E) eutrophic and (O) oligotrophic, follows each calculated value in the tables in Appendix B. A question mark (?) following a calculated value in these tables was entered when that value was within the range of both classifications.

PALMER'S ORGANIC POLLUTION INDICES

Palmer (1969) analyzed reports from 165 authors and developed algal pollution indices for use in rating water samples with high organic pollution. Two lists of organic-pollution-tolerant forms were prepared, one containing 20 genera, the other, 20 species (Tables 3 and 4). Each form was assigned a pollution index number ranging from 1 for moderately tolerant forms to 6 for

TABLE 2. NYGAARD'S TROPHIC STATE INDICES ADAPTED FROM HUTCHINSON (1967)

Index	Calculation	Oligotrophic	Eutrophic
Myxophycean	$\frac{\text{Myxophyceae}}{\text{Desmideae}}$	0.0-0.4	0.1-3.0
Chlorophycean	$\frac{\text{Chlorococcales}}{\text{Desmideae}}$	0.0-0.7	0.2-9.0
Diatom	$\frac{\text{Centric Diatoms}}{\text{Pennate Diatoms}}$	0.0-0.3	0.0-1.75
Euglenophyte	$\frac{\text{Euglenophyta}}{\text{Myxophyceae + Chlorococcales}}$	0.0-0.2	0.0-1.0
Compound	$\frac{\text{Myxophyceae + Chlorococcales + Centric Diatoms + Euglenophyta}}{\text{Desmideae}}$	0.0-1.0	1.2-25

TABLE 3. ALGAL GENUS POLLUTION INDEX (Palmer 1969)

Genus	Pollution Index
Anacystis	1
Ankistrodesmus	2
Chlamydomonas	4
Chlorella	3
Closterium	1
Cyclotella	1
Euglena	5
Gomphonema	1
Lepocinclis	1
Melosira	1
Micractinium	1
Navicula	3
Nitzschia	3
Oscillatoria	5
Pandorina	1
Phacus	2
Phormidium	1
Scenedesmus	4
Stigeoclonium	2
Synedra	2

TABLE 4. ALGAL SPECIES POLLUTION INDEX (Palmer 1969)

Species	Pollution Index
Ankistrodesmus falcatus	3
Arthrospira jenneri	2
Chlorella vulgaris	2
Cyclotella meneghiniana	2
Euglena gracilis	1
Euglena viridis	6
Gomphonema parvulum	1
Melosira varians	2
Navicula cryptocephala	1
Nitzschia acicularis	1
Nitzschia palea	5
Oscillatoria chlorina	2
Oscillatoria limosa	4
Oscillatoria princeps	1
Oscillatoria putrida	1
Oscillatoria tenuis	4
Pandorina morum	3
Scenedesmus quadricauda	4
Stigeoclonium tenue	3
Synedra ulna	3

extremely tolerant forms. Palmer based the index numbers on occurrence records and/or where emphasized by the authors as being especially tolerant of organic pollution.

In analyzing a water sample, any of the 20 genera or species of algae present in concentrations of 50 per milliliter or more are recorded. The pollution index numbers of the algae present are totaled, providing a genus score and a species score. Palmer determined that a score of 20 or more for either index can be taken as evidence of high organic pollution, while a score of 15 to 19 is taken as probable evidence of high organic pollution. Lower figures suggest that the organic pollution of the sample is not high, that the sample is not representative, or that some substance or factor interfering with algal persistence is present and active.

SPECIES DIVERSITY AND ABUNDANCE INDICES

"Information content" of biological samples is being used commonly by biologists as a measure of diversity. Diversity in this connection means the degree of uncertainty attached to the specific identity of any randomly selected individual. The greater the number of taxa and the more equal their proportions, the greater the uncertainty, and hence, the diversity (Pielou 1966). There are several methods of measuring diversity, e.g., the formulas given by Brillouin (1962) and Shannon and Weaver (1963). The method which is appropriate depends on the type of biological sample on hand.

Pielou (1966) classifies the types of biological samples and gives the measure of diversity appropriate for each type. The Survey phytoplankton samples are what she classifies as larger samples (collections in Pielou's terminology) from which random subsamples can be drawn. According to Pielou, the average diversity per individual (H) for these types of samples can be estimated from the Shannon-Wiener formula (Shannon and Weaver 1963):

$$H = -\sum_{i=1}^{S} P_i \log_x P_i$$

where P is the proportion of the ith taxon in the sample, which is calculated from n_i/N; n_i is the number of individuals per milliliter of the ith taxon; N is the total number of individuals per ml; and S is the total number of taxa. However, Basharin (1959) and Pielou (1966) have pointed out that H calculated from the subsample is a biased estimator of the sample H, and if this bias is to be accounted for, we must know the total number of taxa present in the sample since the magnitude of this bias depends on it.

Pielou (1966) suggests that if the number of taxa in the subsample falls only slightly short of the number in the larger sample, no appreciable error will result in considering S, estimated from the subsample, as being equal to the sample value. Even though considerable effort was made to find and identify all taxa, the Survey samples undoubtedly contain a fair number of rare phytoplankton taxa which were not encountered.

In the Shannon-Wiener formula, an increase in the number of taxa and/or an increase in the evenness of the distribution of individuals among taxa will increase the average diversity per individual from its minimal value of zero. Sager and Hasler (1969) found that the richness of taxa was of minor importance in determination of average diversity per individual for phytoplankton and they concluded that phytoplankton taxa in excess of the 10 to 15 most abundant ones have little effect on H. This was verified by our own calculations. Our counts are in number per milliliter and since logarithms to the base 2 were used in our calculations, H is expressed in units of bits per individual. When individuals of a taxon were so rare that they were not counted, a value of 1/130 per milliliter or 0.008 per milliliter was used in the calculations since at least one individual of the taxon must have been present in the collection.

A Survey sample for a given lake represents a composite of all phytoplankton collected at different sampling sites on the lake during a given sampling period. Since the number of samples (M) making up a composite is a function of both the complexity of the lake sampled and its size, it should affect the richness-of-taxa component of the diversity of our phytoplankton collections. The maximum diversity (MaxH) (i.e., when the individuals are distributed among the taxa as evenly as possible) was estimated from $\log_2 S$ (Pielou 1966), while the minimum diversity (MinH), was estimated from the formula:

$$\text{MinH} = -\frac{S-1}{N}\log_2\frac{1}{N} - \frac{N-(S-1)}{N}\log_2\frac{N-(S-1)}{N}$$

given by Zand (1976). The total diversity (D) was calculated from HN (Pielou 1966). Also given in Appendix B are L (the mean number of individuals per taxa per milliliter) and K (the number of individuals per milliliter of the most abundant taxon in the sample).

The evenness component of diversity (J) was estimated from H/MaxH (Pielou 1966). Relative evenness (RJ) was calculated from the formula:

$$\text{RJ} = \frac{\text{H-MinH}}{\text{MaxH-MinH}}$$

given by Zand (1976). Zand suggests that RJ be used as a substitute for both J and the redundancy expression given by Wilhm and Dorris (1968). As pointed out by Zand, the redundancy expression given by Wilhm and Dorris does not properly express what it is intended to show, i.e., the position of H in the range between MaxH and MinH. RJ may range from 0 to 1; being 1 for the most even samples and 0 for the least even samples.

Zand (1976) suggests that diversity indices be expressed in units of "sits", i.e., in logarithms to base S (where S is the total number of taxa in the sample) instead of in "bits", i.e., in logarithms to base 2. Zand points out that the diversity index in sits per individual is a normalized number ranging from 1 for the most evenly distributed samples to 0 for the least evenly distributed samples. Also, it can be used to compare different samples, independent of the number of taxa in each. The diversity in bits per

individual should not be used in direct comparisons involving various samples which have different numbers of taxa. Since MaxH equals log S, the expression in sits is equal to $\log_S S$, or 1. Therefore diversity in sits per individual is numerically equivalent to J, the evenness component for the Shannon-Wiener formula.

SPECIES OCCURRENCE AND ABUNDANCE

The alphabetic phytoplankton species list for each lake, presented in Appendix B, gives the concentrations of individual species by sampling date. Concentrations are in cells, colonies, or filaments (CEL, COL, FIL) per milliliter. An "X" after a species name indicates that the species identified in the preliminary examination was in such a low concentration that it did not appear in the count. A blank space indicates that the organism was not found in the sample collected on that date. Column S is used to designate the examiner's subjective opinion of the five dominant taxa in a sample, based upon relative size and concentration of the organism. The percent column (%C) presents, by abundance, the percentage composition of each taxon.

LITERATURE CITED

Basharin, G. P. 1959. On a statistical estimate for the entropy of a sequence of independent random variables, pp. 333-336. In: Theory of Probability and Its Applications (translation of "Teoriya Veroyatnosei i ee Premeneniya"). N. Artin (ed). 4. Society for Industrial and Applied Mathematics, Philadelphia.

Brillouin, L. 1962. Science and Information Theory (2nd ed.). Academic Press, New York. 351 pp.

Hutchinson, G. E. 1967. A Treatise on Limnology. II. Introduction to Lake Biology and the Limnoplankton. John Wiley and Sons, Inc., New York. 1,115 pp.

Nygaard, G. 1949. Hydrobiological studies of some Danish ponds and lakes. II. (K danske Vidensk. Selsk.) Biol. Sci. 7:293.

Palmer, C. M. 1969. A composite rating of algae tolerating organic pollution. J. Phycol. 5:78-82.

Pielou, E. C. 1966. The measurement of diversity in different types of biological collections. J. Theor. Biol. 13:131-144.

Prescott, G. W. 1970. How to Know the Freshwater Algae. William C. Brown Company, Dubuque. 348 pp.

Sager, P. E., and A. D. Hasler. 1969. Species diversity in lacustrine phytoplankton. I. The components of the index of diversity from Shannon's formula. Amer. Natur. 103(929):51-59.

Shannon, C. E., and W. Weaver. 1963. The Mathematical Theory of Communication. University of Illinois Press, Urbana. 117 pp.

U.S. Environmental Protection Agency. 1975. National Eutrophication Survey Methods 1973-1976. Working Paper No. 175. Environmental Monitoring and Support Laboratory, Las Vegas, Nevada, and Corvallis Environmental Research Laboratory, Corvallis, Oregon. 91 pp.

Wilhm, V. L., and T. C. Dorris. 1968. Biological parameters for water quality criteria. Bio-Science. 18:477.

Zand, S. M. 1976. Indexes associated with information theory in water quality. J. Water Pollut. Contr. Fed. 48(8):2026-2031.

APPENDIX A

PHYTOPLANKTON SPECIES LIST FOR THE STATE OF OREGON

Achnanthes exigua
Anabaena planctonica
Ankistrodesmus falcatus
Ankistrodesmus falcatus
v. *acicularis*
Ankistrodesmus falcatus
v. *mirabilis*
Aphanizomenon flos-aquae
Asterionella formosa
Ceratium hirundinella
Ceratium hirundinella
f. *piburgense*
Ceratium hirundinella
f. *scotticum*
Chlamydomonas
Closteridium
Closterium
Cocconeis
Coelastrum microporum
Coelosphaerium naegelianum
Cryptomonas erosa
Cryptomonas ovata
Cyclotella glomerata
Cymatopleura solea
Cymbella minuta
Dactylococcopsis irregularis
Diatoma vulgare
Dinobryon sociale
Epithemia sorex
Epithemia turgida
Euglena
Eunotia
Fragilaria capucina
v. *mesolepta*
Fragilaria crotonensis
Glenodinium gymnodinium
Glenodinium oculatum
Gomphonema acuminatum
Gomphonema olivaceum
Gomphonema parvulum
Gymnodinium fuscum
Melosira granulata
Melosira granulata
v. *angustissima*
Melosira italica
Melosira varians
Microcystis aeruginosa
Navicula cuspidata
Navicula tripunctata
Navicula tripunctata
v. *schizonemoides*
Nitzschia acicularis
Nitzschia apiculata
Nitzschia vermicularis
Oocystis
Pandorina morum
Pediastrum boryanum
Pediastrum duplex
v. *clathratum*
Peridinium inconspicuum
Peridinium umbonatum
Phormidium mucicola
Rhoicosphenia curvata
Scenedesmus acuminatus
Scenedesmus bijuga
Scenedesmus quadricauda
Schroederia setigera
Skeletonema potamos
Sphaerocystis schroeteri
Staurastrum
Stephanodiscus astraea
v. *minutula*
Stephanodiscus dubius
Stephanodiscus niagarae
Surirella ovata
Synedra ulna
Tabellaria fenestrata
Tetraedron minimum
Trachelomonas

APPENDIX B. SUMMARY OF PHYTOPLANKTON DATA

This appendix was generated by computer. Because it was only possible to use upper case letters in the printout, all scientific names are printed in upper case and are not italicized.

The alphabetic phytoplankton lists include taxa without species names (e.g., EUNOTIA, EUNOTIA #1, FLAGELLATE, FLAGELLATES, MICROCYSTIS INCERTA ?, CHLOROPHYTAN COCCOID CELLED COLONY). When species determinations were not possible, symbols or descriptive phrases were used to separate taxa for enumeration purposes. Each name on a list, however, represents a unique species different from any other name on the same list, unless otherwise noted, for counting purposes.

Numbers were used to separate unidentified species of the same genus. A generic name listed alone is also a unique species. A question mark (?) is placed immediately after the portion of a name which was assigned with uncertainty. Numbered, questioned, or otherwise designated taxa were established on a lake-by-lake basis; therefore NAVICULA #2 from lake A cannot be compared to NAVICULA #2 from lake B. Pluralized categories (e.g., FLAGELLATES, CENTRIC DIATOMS, SPP.) were used for counting purposes when taxa could not be properly differentiated on the counting chamber.

LAKE NAME: BROWNLEE RES.
STORET NUMBER: 4101

NYGAARD TROPHIC STATE INDICES

DATE	04 09 75	08 04 75	09 15 75
MYXOPHYCEAN	0/0 O	3.00 E	01/0 E
CHLOROPHYCEAN	02/0 E	1.00 E	0/0 O
EUGLENOPHYTE	0.50 E	0/04 ?	0/01 ?
DIATOM	0.17 ?	3.00 E	2.00 E
COMPOUND	05/0 E	7.00 E	03/0 E

PALMER'S ORGANIC POLLUTION INDICES

DATE	04 09 75	08 04 75	09 15 75
GENUS	04	01	01
SPECIES	00	00	00

SPECIES DIVERSITY AND ABUNDANCE INDICES

DATE		04 09 75	08 04 75	09 15 75
AVERAGE DIVERSITY	H	0.86	1.02	1.22
NUMBER OF TAXA	S	19.00	12.00	7.00
NUMBER OF SAMPLES COMPOSITED	M	5.00	5.00	5.00
MAXIMUM DIVERSITY	MAXH	4.25	3.58	2.81
MINIMUM DIVERSITY	MINH	0.02	0.08	0.03
TOTAL DIVERSITY	D	9568.36	1681.98	3766.14
TOTAL NUMBER OF INDIVIDUALS/ML	N	11126.00	1649.00	3087.00
EVENNESS COMPONENT	J	0.20	0.28	0.43
RELATIVE EVENNESS	RJ	0.20	0.27	0.43
MEAN NUMBER OF INDIVIDUALS/TAXA	L	585.58	137.42	441.00
NUMBER/ML OF MOST ABUNDANT TAXON	K	9749.00	1312.00	2254.00

LAKE NAME: BROWNLEE RES.
STORET NUMBER: 4101

CONTINUED

TAXA	FORM	04 09 75 IS	04 09 75 %C	04 09 75 ALGAL UNITS PER ML	08 04 75 IS	08 04 75 %C	08 04 75 ALGAL UNITS PER ML	09 15 75 IS	09 15 75 %C	09 15 75 ALGAL UNITS PER ML
ANKISTRODESMUS FALCATUS	CEL			X						
APHANIZOMENON FLOS-AQUAE	FIL						X	13	10,1	312
ASTERIONELLA FORMOSA	CEL	12	8,4	603						
CERATIUM HIRUNDINELLA F. PIBURGENSE	CEL						X			
CHROOMONAS ? ACUTA	CEL	1	0,3	34	14	9,1	150			X
COCCONEIS	CEL			X						
CRYPTOMONAS	CEL				13	2,2	37			
CYMATOPLEURA SOLEA	CEL	1	0,3	34						
DIATOMA VULGARE	CEL			X						
EUGLENA	CEL			X						
FRAGILARIA CROTONENSIS	CEL	1	0,6	67	11	79,6	1312			
GLENODINIUM GYMNODINIUM	CEL	1	0,3	34						
GOMPHONEMA #1	CEL			X						
GOMPHONEMA #2	CEL			X						
MELOSIRA GRANULATA	CEL	15	0,9	101	12	9,1	150	11	73,0	2254
MELOSIRA ITALICA	CEL							12	14,6	451
MICROCYSTIS AERUGINOSA	COL						X			
NAVICULA TRIPUNCTATA	CEL	14	1,5	168				15	1,1	35
NITZSCHIA VERMICULARIS	CEL			X						
PHORMIDIUM MUCICOLA	FIL						X			
SCENEDESMUS ACUMINATUS	COL	1	0,3	34						
SCHRODERIA SETIGERA	CEL							14	1,1	35
SCHROEDERIA SETIGERA	CEL						X			
SKELETONEMA POTAMOS	CEL						X			
STAURASTRUM	CEL						X			
STEPHANODISCUS	CEL						X			
STEPHANODISCUS ASTRAEA V. MINUTULA	CEL	11	87,6	9749						
SURIRELLA OVATA	CEL	13	2,1	235						
SYNEDRA ULNA	CEL			X						
TABELLARIA FENESTRATA	CEL	1	0,6	67						
ZOOSPORE	CEL									X
TOTAL				11126			1649			3087

LAKE NAME: DIAMOND
STORET NUMBER: 4102

NYGAARD TROPHIC STATE INDICES

DATE	07 16 75	10 31 75
MYXOPHYCEAN	01/0 E	1.00 E
CHLOROPHYCEAN	0/0 D	2.00 E
EUGLENOPHYTE	0/01 ?	0/03 ?
DIATOM	0.60 E	0.09 ?
COMPOUND	04/0 E	4.00 E

PALMER'S ORGANIC POLLUTION INDICES

DATE	07 16 75	10 31 75
GENUS	00	01
SPECIES	00	00

SPECIES DIVERSITY AND ABUNDANCE INDICES

DATE		07 16 75	10 31 75
AVERAGE DIVERSITY	H	0.22	1.71
NUMBER OF TAXA	S	10.00	20.00
NUMBER OF SAMPLES COMPOSITED	M	2.00	2.00
MAXIMUM DIVERSITY	MAXH	3.32	4.32
MINIMUM DIVERSITY	MINH	0.05	0.25
TOTAL DIVERSITY	D	478.50	1456.92
TOTAL NUMBER OF INDIVIDUALS/ML	N	2175.00	852.00
EVENNESS COMPONENT	J	0.07	0.40
RELATIVE EVENNESS	RJ	0.06	0.36
MEAN NUMBER OF INDIVIDUALS/TAXA	L	217.50	42.60
NUMBER/ML OF MOST ABUNDANT TAXON	K	2113.00	402.00

LAKE NAME: DIAMOND
STORET NUMBER: 4102

CONTINUED

TAXA	FORM	07 16 75			10 31 75		
		1S	%C	ALGAL UNITS PER ML	1S	%C	ALGAL UNITS PER ML
ACHNANTHES EXIGUA	CEL						X
ANABAENA	FIL	12	1.4	31	19	2.8	24
ASTERIONELLA FORMOSA	CEL	11	97.1	2113			
CHROOMONAS ?	CEL	13	1.4	31			
CHROOMONAS ? ACUTA	CEL					5.5	47
COCCONEIS	CEL						X
CRYPTOMONAS	CEL						X
CYCLOTELLA	CEL			X			
CYCLOTELLA GLOMERATA	CEL				12	38.8	331
CYMBELLA	CEL			X	13	2.8	24
EPITHEMIA	CEL				14	2.8	24
EPITHEMIA TURGIDA	CEL			X			
FRAGILARIA CAPUCINA V. MESOLEPTA	CEL						X
FRAGILARIA CROTONENSIS	CEL			X			X
GOMPHONEMA ACUMINATUM	CEL						X
MELOSIRA	CEL			X			
NAVICULA #1	CEL						X
NAVICULA #2	CEL						X
NAVICULA CUSPIDATA	CEL			X			
PANDORINA MORUM	COL						X
PENNATE DIATOM	CEL						X
RHOICOSPHENIA CURVATA	CEL						X
SCENEDESMUS QUADRICAUDA	COL						X
SCHROEDERIA SETIGERA	CEL						X
STAURASTRUM	CEL						X
STEPHANODISCUS NIAGARAE	CEL				11	47.2	402
STEPHANODISCUS	CEL			X			
TOTAL				2175			852

LAKE NAME: HELLS CANYON RES,
STORET NUMBER: 4103

NYGAARD TROPHIC STATE INDICES

DATE	04 08 75	08 04 75	09 15 75
MYXOPHYCEAN	0/0 O	01/0 E	1.00 E
CHLOROPHYCEAN	02/0 E	02/0 E	3.00 E
EUGLENOPHYTE	1.00 E	0/03 ?	0/04 ?
DIATOM	0.23 ?	1.50 E	0.50 E
COMPOUND	07/0 E	06/0 E	7.00 E

PALMER'S ORGANIC POLLUTION INDICES

DATE	04 08 75	08 04 75	09 15 75
GENUS	06	01	01
SPECIES	00	00	00

SPECIES DIVERSITY AND ABUNDANCE INDICES

DATE		04 08 75	08 04 75	09 15 75
AVERAGE DIVERSITY	H	0.90	1.54	1.40
NUMBER OF TAXA	S	24.00	9.00	19.00
NUMBER OF SAMPLES COMPOSITED	M	3.00	3.00	3.00
MAXIMUM DIVERSITY	MAXH	4.58	3.17	4.25
MINIMUM DIVERSITY	MINH	0.04	0.01	0.14
TOTAL DIVERSITY	D	7497.90	17845.52	2123.80
TOTAL NUMBER OF INDIVIDUALS/ML	N	8331.00	11588.00	1517.00
EVENNESS COMPONENT	J	0.20	0.49	0.33
RELATIVE EVENNESS	RJ	0.19	0.49	0.31
MEAN NUMBER OF INDIVIDUALS/TAXA	L	347.13	1287.56	79.84
NUMBER/ML OF MOST ABUNDANT TAXON	K	7332.00	6928.00	795.00

LAKE NAME: HELLS CANYON RES.
STORET NUMBER: 4103

CONTINUED

TAXA	FORM	04 08 75			08 04 75			09 15 75		
		IB	%C	ALGAL UNITS PER ML	IB	%C	ALGAL UNITS PER ML	IB	%C	ALGAL UNITS PER ML
ANABAENA	FIL									X
ANKISTRODESMUS FALCATUS	CEL		0,4	37						
APHANIZOMENON FLOS-AQUAE	FIL				14	1,1	122			
ASTERIONELLA FORMOSA	CEL	2	3,6	296	3	5,2	608			X
CERATIUM HIRUNDINELLA	CEL									X
CHROOMONAS ?	CEL							2	52,4	795
CLOSTERIDIUM	CEL									X
COCCONEIS	CEL			X						X
CRYPTOMONAS EROSA	CEL		0,9	74	5	1,4	162			X
CRYPTOMONAS OVATA	CEL							4	2,4	36
CYMBELLA #1	CEL			X						
CYMBELLA #2	CEL			X						
CYMBELLA MINUTA	CEL									X
DIATOMA VULGARE	CEL									X
DINOBRYON SOCIALE	CEL		0,4	37						
EUGLENA	CEL		0,9	74						
FRAGILARIA #1	CEL			X						
FRAGILARIA CROTONENSIS	CEL	3	1,3	111	1	59,8	6928			X
GOMPHONEMA OLIVACEUM	CEL			X						
MELOSIRA GRANULATA	CEL	5	1,8	148	2	28,7	3322	1	40,5	614
MELOSIRA VARIANS	CEL									X
NAVICULA #1	CEL			X						
NAVICULA #2	CEL			X						
NITZSCHIA #1	CEL			X						
NITZSCHIA ACICULARIS	CEL		0,4	37						
NITZSCHIA APICULATA	CEL			X						
PEDIASTRUM DUPLEX V. CLATHRATUM	COL									X
PERIDINIUM	CEL		0,4	37						
SCENEDESMUS	COL			X						
SCHROEDERIA SETIGERA	CEL						X			
SCHROEDERIA SETIGERA	CEL							5	2,4	36
SKELETONEMA POTAMOS	CEL					3,5	405			
SPHAEROCYSTIS SCHROETERI	COL						X			X
STAURASTRUM	CEL									X
STEPHANODISCUS	CEL					0,4	41	3	2,4	36
STEPHANODISCUS #1	CEL			X						
STEPHANODISCUS DUBIUS	CEL			X						
STEPHANODISCUS SPP.	CEL	1	80,0	7332						
SURIRELLA OVATA	CEL	4	1,3	111						
SYNEDRA	CEL									X
TRACHELOMONAS	CEL		0,4	37						
TOTAL				8331			11508			1517

LAKE NAME: HILLS CREEK RES.
STORET NUMBER: 4104

NYGAARD TROPHIC STATE INDICES

DATE	03 28 75	07 16 75	10 30 75
MYXOPHYCEAN	0/0 O	0/0 O	0/0 O
CHLOROPHYCEAN	0/0 O	01/0 E	0/0 O
EUGLENOPHYTE	0/0 ?	0/01 ?	0/0 ?
DIATOM	0/0 ?	0/03 ?	1.00 E
COMPOUND	0/0 O	01/0 E	02/0 E

PALMER'S ORGANIC POLLUTION INDICES

DATE	03 28 75	07 16 75	10 30 75
GENUS	00	00	05
SPECIES	00	00	00

SPECIES DIVERSITY AND ABUNDANCE INDICES

DATE		03 28 75	07 16 75	10 30 75
AVERAGE DIVERSITY	H	0.37	1.16	0.89
NUMBER OF TAXA	S	2.00	7.00	7.00
NUMBER OF SAMPLES COMPOSITED	M	2.00	2.00	2.00
MAXIMUM DIVERSITY	MAXH	1.00	2.81	2.81
MINIMUM DIVERSITY	MINH	0.04	0.04	0.02
TOTAL DIVERSITY	D	87.32	2459.20	4258.65
TOTAL NUMBER OF INDIVIDUALS/ML	N	236.00	2120.00	4785.00
EVENNESS COMPONENT	J	0.37	0.41	0.32
RELATIVE EVENNESS	RJ	0.35	0.41	0.32
MEAN NUMBER OF INDIVIDUALS/TAXA	L	118.00	302.86	683.57
NUMBER/ML OF MOST ABUNDANT TAXON	K	219.00	1569.00	4118.00

LAKE NAME: HILLS CREEK RES, CONTINUED
STORET NUMBER: 4104

TAXA	FORM	03 28 75 IS	03 28 75 %C	03 28 75 ALGAL UNITS PER ML	07 16 75 IS	07 16 75 %C	07 16 75 ALGAL UNITS PER ML	10 30 75 IS	10 30 75 %C	10 30 75 ALGAL UNITS PER ML
ANKISTRODESMUS FALCATUS	CEL						X			
ASTERIONELLA FORMOSA	CEL				13	10.0	212	12	4.7	223
CENTRIC DIATOM	CEL							5	2.3	111
CERATIUM HIRUNDINELLA I. SCOTTICUM	CEL						X			
CHLAMYDOMONAS	CEL							4	2.3	111
CHROOMONAS T ACUTA	CEL	1	2.8	219	1	2.0	42	1	1.5	74
CRYPTOMONAS	CEL	2	7.2	17	2	14.0	297			
FLAGELLATE	CEL									X
FRAGILARIA CROTONENSIS	CEL				1	74.0	1569	3	3.1	148
GOMPHONEMA	CEL						X			
MELOSIRA GRANULATA V. ANGUSTISSIMA	CEL							1	86.1	4118
TOTAL				236			2120			4785

LAKE NAME: OWYHEE
STORET NUMBER: 4105

NYGAARD TROPHIC STATE INDICES

DATE	04 08 75	08 01 75	09 16 75
MYXOPHYCEAN	01/0 E	04/0 E	01/0 E
CHLOROPHYCEAN	01/0 E	02/0 E	0/0 O
EUGLENOPHYTE	0.50 E	0.17 ?	0/01 ?
DIATOM	0.50 E	1.00 E	2.00 E
COMPOUND	05/0 E	09/0 E	03/0 E

PALMER'S ORGANIC POLLUTION INDICES

DATE	04 08 75	08 01 75	09 16 75
GENUS	06	05	00
SPECIES	00	00	00

SPECIES DIVERSITY AND ABUNDANCE INDICES

DATE		04 08 75	08 01 75	09 16 75
AVERAGE DIVERSITY	H	2.40	2.08	0.92
NUMBER OF TAXA	S	13.00	13.00	8.00
NUMBER OF SAMPLES COMPOSITED	M	4.00	4.00	4.00
MAXIMUM DIVERSITY	MAXH	3.70	3.70	3.00
MINIMUM DIVERSITY	MINH	0.20	0.18	0.12
TOTAL DIVERSITY	D	1569.60	1474.72	563.96
TOTAL NUMBER OF INDIVIDUALS/ML	N	654.00	709.00	613.00
EVENNESS COMPONENT	J	0.65	0.56	0.31
RELATIVE EVENNESS	RJ	0.63	0.54	0.28
MEAN NUMBER OF INDIVIDUALS/TAXA	L	50.31	54.54	76.63
NUMBER/ML OF MOST ABUNDANT TAXON	K	207.00	304.00	409.00

LAKE NAME: ONYHEE
STORET NUMBER: 4105

CONTINUED

TAXA	FORM	04 08 75			08 01 75			09 16 75		
		IS	%C	ALGAL UNITS PER ML	IS	%C	ALGAL UNITS PER ML	IS	%C	ALGAL UNITS PER ML
ANABAENA	FIL						X			
APHANIZOMENON FLOS-AQUAE	FIL				2	14.2	101	1	66.7	409
CERATIUM HIRUNDINELLA	CEL									X
CHLAMYDOMONAS	CEL	4	10.6	69						
CHROOMONAS ? ACUTA	CEL	3	31.7	207				2	33.3	204
COELOSPHAERIUM NAEGELIANUM	COL				1	42.9	304			
CRYPTOMONAS	CEL									X
CRYPTOMONAS EROSA	CEL	2	5.2	34	3	21.4	152			
CYCLOTELLA	CEL	2	31.7	207			X			
EUGLENA	CEL						X			
FRAGILARIA CROTONENSIS	CEL						X			
GLENODINIUM #1	CEL	1	5.2	34						
GLENODINIUM #2	CEL									X
GOMPHONEMA	CEL									X
GOMPHONEMA PARVULUM	CEL	1	5.2	34						
MELOSIRA GRANULATA	CEL									X
MELOSIRA GRANULATA V. ANGUSTISSIMA	CEL			X			X			
NAVICULA	CEL			X						
NITZSCHIA	CEL						X			
PENNATE DIATOM	CEL			X						
PERIDINIUM UMBONATUM	CEL						X			
PHORMIDIUM	FIL	5	10.6	69						
PHORMIDIUM MUCICOLA	FIL				4	14.2	101			
RHOICOSPHENIA CURVATA	CEL			X						
SCENEDESMUS BIJUGA	COL				1	7.2	51			
SCHROEDERIA SETIGERA	CEL			X			X			
STEPHANODISCUS	CEL									X
TRACHELOMONAS	CEL			X						
TOTAL				654			709			613

LAKE NAME: OXBOW RES.
STORET NUMBER: 4106

NYGAARD TROPHIC STATE INDICES

DATE	04 09 75	08 04 75	09 15 75
MYXOPHYCEAN	0/0 O	01/0 E	0/02 O
CHLOROPHYCEAN	03/0 E	0/0 O	2.00 E
EUGLENOPHYTE	0.33 E	0/01 ?	0/04 ?
DIATOM	0.37 E	0.50 E	0.67 E
COMPOUND	07/0 E	04/0 E	3.00 E

PALMER'S ORGANIC POLLUTION INDICES

DATE	04 09 75	08 04 75	09 15 75
GENUS	01	00	02
SPECIES	00	00	00

SPECIES DIVERSITY AND ABUNDANCE INDICES

DATE		04 09 75	08 04 75	09 15 75
AVERAGE DIVERSITY	H	0.69	0.36	0.62
NUMBER OF TAXA	S	17.00	11.00	12.00
NUMBER OF SAMPLES COMPOSITED	M	3.00	3.00	3.00
MAXIMUM DIVERSITY	MAXH	4.09	3.46	3.58
MINIMUM DIVERSITY	MINH	0.04	0.22	0.14
TOTAL DIVERSITY	D	4351.83	167.04	565.44
TOTAL NUMBER OF INDIVIDUALS/ML	N	6307.00	464.00	912.00
EVENNESS COMPONENT	J	0.17	0.10	0.17
RELATIVE EVENNESS	RJ	0.17	0.05	0.14
MEAN NUMBER OF INDIVIDUALS/TAXA	L	371.00	42.18	76.00
NUMBER/ML OF MOST ABUNDANT TAXON	K	5621.00	433.00	807.00

LAKE NAME: OXBOW RES,
STORET NUMBER: 4106

CONTINUED

TAXA	FORM	04 09 75			08 04 75			09 15 75		
		IS	%C	ALGAL UNITS PER ML	IS	%C	ALGAL UNITS PER ML	IS	%C	ALGAL UNITS PER ML
ANKISTRODESMUS FALCATUS V. ACICULARIS	CEL			X						
ANKISTRODESMUS FALCATUS V. MIRABILIS	CEL			X						
APHANIZOMENON FLOS-AQUAE	FIL						X			
ASTERIONELLA FORMOSA	CEL	2	4,8	300						
CHROOMONAS ?	CEL	5	0,7	43						
CLOSTERIUM	CEL									X
COCCONEIS	CEL			X						
CUELASTRUM MICROPORUM	COL									X
CRYPTOMONAS	CEL						X			
CRYPTOMONAS EROSA	CEL							3	3,8	35
CYCLOTELLA	CEL			X				2	7,7	70
EUGLENA	CEL		0,7	43						
FRAGILARIA	CEL						X			
FRAGILARIA CROTONENSIS	CEL			X	1	93,3	433			X
GLENODINIUM OCULATUM	CEL			X						
MELOSIRA GRANULATA	CEL						X	11	88,5	807
MELOSIRA ITALICA	CEL	3	4,1	257						
MELOSIRA VARIANS	CEL						X			
NAVICULA	CEL						X			X
NAVICULA TRIPUNCTATA V. SCHIZONEMOIDES	CEL			X						
NAVICULA TRIPUNCTATA V. SCHIZONEMOIDES	CEL						X			
NITZSCHIA	CEL			X						
NITZSCHIA VERMICULARIS	CEL			X						
OOCYSTIS	CEL									X
PEDIASTRUM BORGANUM	COL			X						
PEDIASTRUM DUPLEX V. CLATHRATUM	COL									X
RHOICOSPHENIA CURVATA	CEL						X			
SPHAEROCYSTIS SCHROETERI	COL									X
STAURASTRUM	CEL									X
STEPHANODISCUS	CEL	11	89,1	5621	2	6,7	31			
SURIRELLA	CEL	4	0,7	43			X			
SYNEDRA ULNA	CEL									X
TABELLARIA FENESTRATA	CEL			X						
TOTAL				6307			464			912

LAKE NAME: SUTTLE LAKE
STORET NUMBER: 4107

NYGAARD TROPHIC STATE INDICES

DATE	03 28 75	07 16 75	10 31 75
MYXOPHYCEAN	02/0 E	01/0 E	0/01 O
CHLOROPHYCEAN	0/0 O	0/0 O	3.00 E
EUGLENOPHYTE	0/02 ?	0/01 ?	0/03 ?
DIATOM	0.75 E	0.67 E	0.40 E
COMPOUND	05/0 E	03/0 E	5.00 E

PALMER'S ORGANIC POLLUTION INDICES

DATE	03 28 75	07 16 75	10 31 75
GENUS	01	00	00
SPECIES	00	00	00

SPECIES DIVERSITY AND ABUNDANCE INDICES

DATE		03 28 75	07 16 75	10 31 75
AVERAGE DIVERSITY	H	0.62	0.35	2.31
NUMBER OF TAXA	S	11.00	7.00	17.00
NUMBER OF SAMPLES COMPOSITED	M	1.00	1.00	1.00
MAXIMUM DIVERSITY	MAXH	3.46	2.81	4.09
MINIMUM DIVERSITY	MINH	0.08	0.05	0.11
TOTAL DIVERSITY	D	970.30	473.55	3917.76
TOTAL NUMBER OF INDIVIDUALS/ML	N	1565.00	1353.00	1696.00
EVENNESS COMPONENT	J	0.18	0.12	0.56
RELATIVE EVENNESS	RJ	0.16	0.11	0.56
MEAN NUMBER OF INDIVIDUALS/TAXA	L	142.27	193.29	99.76
NUMBER/ML OF MOST ABUNDANT TAXON	K	1374.00	1263.00	637.00

LAKE NAME: SUTTLE LAKE
STORET NUMBER: 4107

CONTINUED

TAXA	FORM	03 28 75 IS	03 28 75 %C	03 28 75 ALGAL UNITS PER ML	07 16 75 IS	07 16 75 %C	07 16 75 ALGAL UNITS PER ML	10 31 75 IS	10 31 75 %C	10 31 75 ALGAL UNITS PER ML
ANABAENA	FIL			X						
ANABAENA PLANCTONICA	FIL				11	93.3	1263			
ANABENA	FIL									X
ANABENA PLANCTONICA	FIL									X
ASTERIONELLA FORMOSA	CEL				2	6.7	90	5	2.1	35
CERATIUM HIRUNDINELLA	CEL						X			
CHLOROPHYTAN FILAMENT	FIL							1	2.1	35
CHROOMONAS ?	CEL							14	16.7	283
COCCONEIS	CEL							1	2.1	35
CRYPTOMONAS EROSA	CEL							3	6.2	106
CYMBELLA	CEL									X
DACTYLOCOCCOPSIS IRREGULARIS	CEL	3	9.8	153						
EPITHEMIA SOREX	CEL									X
EPITHEMIA TURGIDA	CEL			X						
FRAGILARIA	CEL			X						
FRAGILARIA CROTONENSIS	CEL						X	2	29.2	495
FRAGILARIA	CEL									X
GLENODINIUM OCULATUM	CEL			X						
GYMNODINIUM FUSCUM	CEL			X						
MELOSIRA GRANULATA	CEL	11	67.8	1374						
MELOSIRA ITALICA	CEL			X			X			X
OOCYSTIS	CEL									X
SPHAEROCYSTIS SCHROETERI	COL							1	2.1	35
STAURASTRUM	CEL									X
STEPHANODISCUS NIAGARAE	CEL			X			X	11	37.6	637
SYNEDRA	CEL	2	2.4	35			X			
SYNEDRA ULNA	CEL			X						
TETRAEDRON MINIMUM	CEL							1	2.1	35
TOTAL				1565			1353			1696

LAKE NAME: WALDO LAKE
STORET NUMBER: 4108

NYGAARD TROPHIC STATE INDICES

DATE	07 16 75	10 31 75
MYXOPHYCEAN	0/0 O	0/0 O
CHLOROPHYCEAN	0/0 O	0/0 O
EUGLENOPHYTE	0/0 ?	0/0 ?
DIATOM	0,20 ?	0,50 E
COMPOUND	01/0 E	01/0 E

PALMER'S ORGANIC POLLUTION INDICES

DATE	07 16 75	10 31 75
GENUS	00	00
SPECIES	00	00

SPECIES DIVERSITY AND ABUNDANCE INDICES

DATE		07 16 75	10 31 75
AVERAGE DIVERSITY	H	1,49	1,81
NUMBER OF TAXA	S	7,00	4,00
NUMBER OF SAMPLES COMPOSITED	M	2,00	2,00
MAXIMUM DIVERSITY	MAXH	2,81	2,00
MINIMUM DIVERSITY	MINH	1,78	0,59
TOTAL DIVERSITY	D	25,33	57,92
TOTAL NUMBER OF INDIVIDUALS/ML	N	17,00	32,00
EVENNESS COMPONENT	J	0,53	0,91
RELATIVE EVENNESS	RJ	-0,28	0,87
MEAN NUMBER OF INDIVIDUALS/TAXA	L	2,43	8,00
NUMBER/ML OF MOST ABUNDANT TAXON	K	9,00	12,00

LAKE NAME: WALDO LAKE
STORET NUMBER: 4108

CONTINUED

TAXA	FORM	07 16 75 IS	07 16 75 %C	07 16 75 ALGAL UNITS PER ML	10 31 75 IS	10 31 75 %C	10 31 75 ALGAL UNITS PER ML
ASTERIONELLA FORMOSA	CEL	11	52,9	9	11	37,5	12
CYMBELLA	CEL			X			
EUNOTIA	CEL			X			
GLENODINIUM OCULATUM	CEL				14	12,5	4
MELOSIRA ITALICA	CEL				12	37,5	12
NAVICULA CUSPIDATA	CEL			X			
PERIDINIUM INCONSPICUUM	CEL	12	23,5	4			
STEPHANODISCUS	CEL			X			
SYNEDRA	CEL	13	23,5	4	13	12,5	4
TOTAL				17			32

TECHNICAL REPORT DATA
(Please read Instructions on the reverse before completing)

1. REPORT NO.	2.	3. RECIPIENT'S ACCESSION NO.
EPA-600/3-79-119		

4. TITLE AND SUBTITLE	5. REPORT DATE
DISTRIBUTION OF PHYTOPLANKTON IN OREGON LAKES	December 1979
	6. PERFORMING ORGANIZATION CODE
7. AUTHOR(S) W.D. Taylor, L.R. Williams, S.C. Hern, V.W. Lambou, F.A. Morris, and M.K. Morris	8. PERFORMING ORGANIZATION REPORT NO.
9. PERFORMING ORGANIZATION NAME AND ADDRESS Environmental Monitoring and Support Laboratory Office of Research and Development U.S. Environmental Protection Agency Las Vegas, NV 89114	10. PROGRAM ELEMENT NO. 1BD884 11. CONTRACT/GRANT NO.
12. SPONSORING AGENCY NAME AND ADDRESS U.S. Environmental Protection Agency-Las Vegas, NV Office of Research and Development Environmental Monitoring and Support Laboratory Las Vegas, NV 89114	13. TYPE OF REPORT AND PERIOD COVERED 02-21-75 to 12-11-75 14. SPONSORING AGENCY CODE EPA/600/07
15. SUPPLEMENTARY NOTES	

16. ABSTRACT

This is a data report presenting the species and abundance of phytoplankton in the 8 lakes sampled by the National Eutrophication Survey in the State of Oregon. Results from the calculation of several water quality indices are also included (Nygaard's Trophic State Index, Palmer's Organic Pollution Index, and species diversity and abundance indices).

17. KEY WORDS AND DOCUMENT ANALYSIS

a. DESCRIPTORS	b. IDENTIFIERS/OPEN ENDED TERMS	c. COSATI Field/Group
*aquatic microbiology lakes *phytoplankton water quality	Oregon lake eutrophication Nygaard's trophic indices Palmer's organic pollution indices Species diversity and abundance	06 C, M 08 H 13 B

18. DISTRIBUTION STATEMENT	19. SECURITY CLASS *(This Report)*	21. NO. OF PAGES
RELEASE TO PUBLIC	UNCLASSIFIED	36
	20. SECURITY CLASS *(This page)*	22. PRICE
	UNCLASSIFIED	

EPA Form 2220-1 (Rev. 4-77) PREVIOUS EDITION IS OBSOLETE

☆ U.S. GOVERNMENT PRINTING OFFICE: 1979—683-282/2214