

**Statistical Analysis and Production of Water Quality
Data Reports Using Microcomputers**

Annette L. Smith

This Report was Prepared under Contract to
Inland Waters and Lands, Conservation and Protection
Environment Canada

Scientific Authority: Stephen W. Sheehan

Inland Waters and Lands

Conservation and Protection

Environment Canada

Pacific and Yukon Region

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ABSTRACT

This report describes the use of Supercalc Version 1.12 software for the Osborne 1 microcomputer to produce Water Quality data reports. It includes Supercalc /EXECUTE programs for simple statistical procedures. The report also illustrates editing and printing of tabulated chemical and biological data using Wordstar software.

RESUME

Le présent rapport explique l'usage sur microordinateur Osborne du logiciel Supercalc Version 1.12 destiné à la rédaction des rapports de données de la Direction de la qualité des eaux. Sont inclus des programmes Supercalc /EXECUTE destinés à des calculs statistiques simples. De plus, le rapport explique l'usage du logiciel Wordstar destiné à la confection de tableaux de données chimiques et biologiques.

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INTRODUCTION

Supercalc Version 1.12 software for the Osborne 1 microcomputer can be used to produce Water Quality data reports. This software can be used to tabulate data and to perform data transformations and simple statistical procedures. Tabulated data may be edited to final report format and printed using the Osborne 1 and Wordstar software. Copies of the data may be saved in Supercalc files for further statistical analyses.

This document is intended to supplement the explanation of Supercalc given in the Osborne 1 User's Reference Guide. (Hogan and Innamico, 1981). It describes several programs (to be used with the EXECUTE function) which were written to analyze data for the Akamina-Kishinena and Columbia River Algal Assay reports (Smith et al., 1985; Tuominen et al., 1987). It also provides some suggestions for writing programs and formatting data for reports.

WRITING EFFICIENT PROGRAMS IN SUPERCALC

Any microcomputer has two major limitations when compared with a mainframe computer:

1. speed
2. memory capacity

While these limits cannot be removed, Supercalc programs can be written to minimize running time and maximize the amount of data which can be analyzed. Some suggestions for writing efficient Supercalc programs follow:

1. Begin the program with the GLOBAL, MANUAL (/gm) command.

Supercalc automatically recalculates all values each time a new entry is made. The /gm command suppresses recalculation at each step and speeds program running. ! must be entered at the end of the program (or after the last formula) to initiate calculation.

Depending upon the arrangement of the worksheet, it may be necessary to recalculate more than once to obtain correct values (see Osborne Users Reference Guide, pp 219-221). Programs are more efficient if designed so that only one recalculation is necessary (eg. DSTATS.XQT). However, in some cases, an output which requires additional recalculation may be desired (eg. ANOVA.XQT - the standard ANOVA table format requires three recalculations).

2. Multiplying a value by itself ($a1*a1$) is faster and uses less memory than squaring that value ($a1^2$).

Apparently Supercalc uses logarithms to calculate power functions. Thus, it can compute fractional powers (eg. $A1^{2.5}$). However, this process is less efficient than simple multiplication for calculating low, whole number powers.

3. When a sum is going to be used in repeated calculations, it is more efficient to store the sum in a cell and refer to that cell than to call for "sum" in each calculation. For example, when calculating proportions

```
=b1  
sum(a2:a90)  
=b2  
a2/b1  
/rb2, b3:b90, ayn
```

is faster than

```
=b2  
a2/sum(a2:a90)  
/rb2, b3:b90, aynn
```

4. Any program which uses logarithms runs slowly and uses a large block of memory. If log tranformations are desired, it may be more efficient to use Supercalc to calculate the logarithms, SAVE the log-transformed data as values, and reload that file for use in further calculations.

PROGRAMS

DSTATS.XQT

(Descriptive Statistics)

Purpose: Calculates descriptive statistics (mean, variance, standard deviation) for each row in a data matrix. Thus, summary statistics can be calculated and tabulated for many parameters simultaneously.

Limits: 47 parameters with up to 4 replicates.

Data Input: The first two rows are reserved for title and/or comments. Parameter labels are entered in column A, followed by observations in columns B to E.

Data Output: Mean and standard deviation are printed in columns F and G, which are labelled. Columns H through K contain calculations. The variance is printed in column L. ERROR is printed under "Mean" on lines where no data are entered (label or title lines) and under "Var." and "S.D." if there is only one observation for a given parameter.

DSTATS.XQT

```
/gm/fr1,tr  
=f1  
"Mean  
=k1  
"Var.  
=l1  
"S. D.  
=f3  
average(b3:e3)  
/rf3,f4:f49  
=g3  
b3*b3  
/rg3,h3:j3  
/rg3:j3,g4:g49  
=k3  
(sum(g3:j3)-(sum(b3:e3)*sum(b3:e3))/count(b3:e3))/(count(b3:e3)-1)  
=l3  
sqrt(k3)  
/rk3:l3,k4:k49  
!/mcl,g
```

INPUT

| | A | B | C | D | E |
|-----------------------------|-------|-------|-------|---|---|
| 1 Date: | | | | | |
| 2 Birchbank | | | | | |
| 3 Orthophosphate | 10.5 | 10.5 | 10 | | |
| 4 Nitrate + Nitrite | .066 | .067 | .065 | | |
| 5 Ammonia | .046 | .047 | .047 | | |
| 6 Total Dissolved Nitrogen | .18 | .185 | .18 | | |
| 7 Dissolved Zn | .07 | .04 | .28 | | |
| 8 Dissolved Cu | .002 | .001 | .003 | | |
| 9 Dissolved Fe | .002 | .002 | .001 | | |
| 10 Dissolved Mn | .01 | .03 | .05 | | |
| 11 Dissolved Cd | .0005 | .0005 | .0034 | | |
| 12 Dissolved Pb | .001 | .001 | .001 | | |
| 13 Dissolved Ni | .008 | .009 | .012 | | |
| 14 Waneta | | | | | |
| 15 Orthophosphate | 2.5 | 2.5 | 2.5 | | |
| 16 Nitrate + Nitrite | .072 | .072 | .073 | | |
| 17 Ammonia | .028 | .028 | .031 | | |
| 18 Total Dissolved Nitrogen | .163 | .163 | .168 | | |
| 19 Dissolved Zn | .04 | .04 | .04 | | |
| 20 Dissolved Cu | .006 | .005 | .01 | | |
| 21 Dissolved Fe | .002 | .002 | .002 | | |
| 22 Dissolved Mn | .01 | .01 | .01 | | |
| 23 Dissolved Cd | .001 | .0005 | .0005 | | |
| 24 Dissolved Pb | .005 | .004 | .003 | | |
| 25 Dissolved Ni | .001 | .001 | .001 | | |
| 26 Effluent | | | | | |
| 27 Orthophosphate | 27 | 28 | 28 | | |
| 28 Nitrate + Nitrite | .09 | .08 | .08 | | |
| 29 Ammonia | 46 | 42 | 46 | | |
| 30 Total Dissolved Nitrogen | 55 | 49 | 55 | | |
| 31 Dissolved Zn | 160 | 140 | 160 | | |
| 32 Dissolved Cu | .55 | .46 | .58 | | |
| 33 Dissolved Fe | 1.2 | 1.2 | 1.2 | | |
| 34 Dissolved Mn | 30 | 26 | 30 | | |
| 35 Dissolved Cd | .002 | .002 | .002 | | |
| 36 Dissolved Pb | .38 | .36 | .37 | | |
| 37 Dissolved Ni | .02 | .02 | .02 | | |
| 38 TED-70 | | | | | |
| 39 Orthophosphate | 48 | 58.5 | 57 | | |
| 40 Nitrate + Nitrite | .061 | | | | |
| 41 Ammonia | .042 | | | | |
| 42 Total Dissolved Nitrogen | .194 | | | | |
| 43 Dissolved Zn | .14 | .13 | | | |
| 44 Dissolved Cu | .003 | .003 | | | |
| 45 Dissolved Fe | .005 | .005 | | | |
| 46 Dissolved Mn | .02 | .02 | | | |
| 47 Dissolved Cd | .0006 | .0006 | | | |
| 48 Dissolved Pb | .003 | .003 | | | |
| 49 Dissolved Ni | .005 | .006 | | | |

GSTATS.XQT

(Descriptive Statistics, log-transformed)

- Purpose: Calculates the geometric mean and geometric factor (geometric standard deviation) for each row in a data matrix.
- Limits: 47 parameters with up to 4 replicates.
- Data Input: Identical to input for DSTATS.XQT.
- Data Output: Geometric mean and geometric factor appear in columns F and G, respectively. Columns H through P contain calculations.
- Note: ERROR is sometimes printed instead of 1.000 for the geometric factor when all replicates are the same. If the output is being used in a data report, editing will be required.

GSTATS.XQT

```
/gm/fr1,tr  
/fr2,tr  
=p1  
"Geom.  
=p2  
"Mean  
=q2  
"G. F.  
=j2  
"n  
=f3  
if(b3=0,0,ln(b3))  
/rf3,f4:f49  
/rf3:f49,g3:i3  
=j3  
count(b3:e3)  
=k3  
sum(f3:i3)/j3  
/rj3:k3,j4:j49  
=l3  
f3*f3  
/rl3,m3:o3  
/rl3:o3,14:149  
=p3  
exp(k3)  
=q3  
exp(sqrt((sum(l3:o3)-(sum(f3:i3)*sum(f3:i3))/j3)/(j3-1)))  
/rp3:q3,p4:p49  
!/mcp,f  
/mcq,g
```


DSTATS2.XQT

(Descriptive Statistics)

Purpose: Calculates mean, variance, standard deviation, geometric mean, and geometric factor (geometric standard deviation).

Limits: One parameter with up to 54 replicates.

Data Input: Rows 1 and 2 are reserved for title and/or labels. Data are entered in column A, beginning at row 3. Note that if zeros occur in the data, they will be ignored in the calculation of the geometric mean and geometric factor. Thus, these values will be incorrect.

Data Output: Output appears in rows 57-68. Values are labelled. Columns B-D contain calculations.

DSTATS2.XQT

```
/gb/gm/fr1,tr  
=b1  
"A Squared  
=c1  
"ln  
=d1  
"C Squared  
=a57  
"N  
=a58  
count(a3:a56)  
=a59  
"Mean  
=a60  
average(a3:a56)  
=b3  
a3*a3  
/rb3,b4:b56  
=a61  
"Var.  
=a62  
(sum(b3:b56)-(sum(a3:a56)*sum(a3:a56))/a58)/(a58-1)  
=a63  
"S. D.  
=a64  
sqrt(a62)  
=c3  
if(a3=0,0,ln(a3))  
/rc3,c4:c56  
=c60  
sum(c3:c56)/a58  
=d3  
c3*c3  
/rd3,d4:d56  
=a65  
"G. Mean  
=a66  
exp(c60)  
=a67  
"G. F.  
=a68  
exp(sqrt((sum(d3:d56)-(sum(c3:c56)*sum(c3:c56))/a58)/(a58-1)))  
!
```

| INPUT | |
|-------|--------|
| | A |
| 1 | August |
| 2 | |
| 3 | 116033 |
| 4 | 6270 |
| 5 | 7515 |
| 6 | 4920 |
| 7 | 305354 |
| 8 | 188912 |
| 9 | 107897 |
| 10 | 23310 |
| 11 | 24902 |
| 12 | 82582 |
| 13 | 7011 |
| 14 | 9271 |
| 15 | 16135 |
| 16 | 25073 |
| 17 | 8153 |
| 18 | 10782 |
| 19 | 13280 |
| 20 | 5307 |
| 21 | 39094 |
| 22 | 34484 |
| 23 | 39708 |
| 24 | 69648 |
| 25 | 15838 |
| 26 | 18620 |
| 27 | 223919 |
| 28 | 146421 |
| 29 | 276586 |
| 30 | 89248 |
| 31 | 53625 |
| 32 | 34958 |
| 33 | 141048 |
| 34 | 90840 |
| 35 | 138212 |
| 36 | 182433 |
| 37 | 41400 |
| 38 | 37897 |
| 39 | 44730 |
| 40 | 21653 |
| 41 | 8378 |
| 42 | 16130 |
| 43 | 8070 |
| 44 | 8190 |
| 45 | 3881 |
| 46 | 11769 |
| 47 | 22858 |
| 48 | 15221 |
| 49 | 12236 |
| 50 | 6475 |
| 51 | 71030 |
| 52 | 48573 |
| 53 | 6870 |
| 54 | 43351 |
| 55 | 18924 |
| 56 | 26523 |

| | A | | B | | C | | D | |
|----|----------|--|----|--|----------|--|---|--|
| 57 | N | | | | | | | |
| 58 | | | 54 | | | | | |
| 59 | Mean | | | | | | | |
| 60 | 56139.78 | | | | 10.26753 | | | |
| 61 | Var. | | | | | | | |
| 62 | 4.9311e9 | | | | | | | |
| 63 | S. D. | | | | | | | |
| 64 | 70221.72 | | | | | | | |
| 65 | G. Mean | | | | | | | |
| 66 | 28782.67 | | | | | | | |
| 67 | G. F. | | | | | | | |
| 68 | 3.236045 | | | | | | | |

ANOVA.XQT

(1-way Analysis of Variance)

Purpose: Performs a single classification analysis of variance using equal or unequal sample sizes (Sokal and Rohlf, 1969, p. 208-209).

Limits: Six groups with up to 55 replicates per group.

Data Input: Group 1 data are entered in column A, beginning at row 1. Group 2 data are entered in column B, etc. Lines may be inserted for titles AFTER the program has run.

Data Output: The ANOVA table is printed in rows 60-63. Computations appear in columns H-M.

Option: Group means may be obtained by moving the cursor to cell b64 and entering the following:

b56/b57

/rb64,c64:g64

!

ANOVA.XQT

```
/gm
=g1
a1*a1
/rg1,g2:g55
/rg1:g55,h1:l1
=a56
sum(a1:a55)
/ra56,b56:156
=a57
count(a1:a55)
/ra57,b57:f57
=a58
(sum(a56:f56)*sum(a56:f56))/sum(a57:f57)
=a59
if(a57=0,0,(a56*a56)/a57)
/ra59,b59:f59
=b61
sum(a59:f59)-a58
=b63
sum(g56:156)-a58
=b62
b63-b61
=a61
count(a1:f1)-1
=a63
sum(a57:f57)-1
=a62
a63-a61
=c61
b61/a61
=c62
b62/a62
=d61
c61/c62
/ica
/fca,10
=a61
"Treatment
=a62
>Error
=a63
>Total
=b60
"df
=c60
"SS
=d60
"MS
=e60
```

"F
/fg,tr
/fca,tl
/gb
!
!
!

| | A | B | C | D | E | F |
|----|----|----|----|----|---|---|
| 1 | 14 | 25 | 16 | 16 | | |
| 2 | 15 | 26 | 12 | 16 | | |
| 3 | 10 | 19 | 11 | 10 | | |
| 4 | 11 | 8 | 15 | 17 | | |
| 5 | 12 | 19 | 11 | 16 | | |
| 6 | 15 | 23 | 13 | 23 | | |
| 7 | 17 | 12 | 10 | 20 | | |
| 8 | 13 | 9 | 9 | 8 | | |
| 9 | 13 | 16 | 6 | 16 | | |
| 10 | 9 | 18 | 5 | 15 | | |
| 11 | 14 | 22 | 12 | 9 | | |
| 12 | 17 | 8 | 7 | 7 | | |
| 13 | | 16 | 8 | 16 | | |
| 14 | | 12 | 11 | 20 | | |
| 15 | | 12 | 11 | 9 | | |
| 16 | | 10 | 10 | 8 | | |
| 17 | | | | 9 | | |
| 18 | | | | 14 | | |
| 19 | | | | 9 | | |
| 20 | | | | 10 | | |
| 21 | | | | 12 | | |
| 22 | | | | 14 | | |
| 23 | | | | 11 | | |
| 24 | | | | 12 | | |
| 25 | | | | 9 | | |
| 26 | | | | 14 | | |
| 27 | | | | 15 | | |
| 28 | | | | 11 | | |
| 29 | | | | 12 | | |
| 30 | | | | 17 | | |
| 31 | | | | 20 | | |
| 32 | | | | 16 | | |
| 33 | | | | 16 | | |
| 34 | | | | 18 | | |
| 35 | | | | 11 | | |
| 36 | | | | 12 | | |
| 37 | | | | 7 | | |
| 38 | | | | 13 | | |
| 39 | | | | 10 | | |
| 40 | | | | 11 | | |
| 41 | | | | 13 | | |
| 42 | | | | 15 | | |
| 43 | | | | 18 | | |
| 44 | | | | 11 | | |
| 45 | | | | 12 | | |
| 46 | | | | 15 | | |
| 47 | | | | 4 | | |
| 48 | | | | 6 | | |
| 49 | | | | 10 | | |
| 50 | | | | 12 | | |
| 51 | | | | 10 | | |
| 52 | | | | 12 | | |
| 53 | | | | 10 | | |
| 54 | | | | 15 | | |

| | H | I | J | K | L | M |
|----|------|------|------|------|---|---|
| 1 | 196 | 625 | 256 | 256 | 0 | 0 |
| 2 | 225 | 676 | 144 | 256 | 0 | 0 |
| 3 | 100 | 361 | 121 | 100 | 0 | 0 |
| 4 | 121 | 64 | 225 | 289 | 0 | 0 |
| 5 | 144 | 361 | 121 | 256 | 0 | 0 |
| 6 | 225 | 529 | 169 | 529 | 0 | 0 |
| 7 | 289 | 144 | 100 | 400 | 0 | 0 |
| 8 | 169 | 81 | 81 | 64 | 0 | 0 |
| 9 | 169 | 256 | 36 | 256 | 0 | 0 |
| 10 | 81 | 324 | 25 | 225 | 0 | 0 |
| 11 | 196 | 484 | 144 | 81 | 0 | 0 |
| 12 | 289 | 64 | 49 | 49 | 0 | 0 |
| 13 | 0 | 256 | 64 | 256 | 0 | 0 |
| 14 | 0 | 144 | 121 | 400 | 0 | 0 |
| 15 | 0 | 144 | 121 | 81 | 0 | 0 |
| 16 | 0 | 100 | 100 | 64 | 0 | 0 |
| 17 | 0 | 0 | 0 | 81 | 0 | 0 |
| 18 | 0 | 0 | 0 | 196 | 0 | 0 |
| 19 | 0 | 0 | 0 | 81 | 0 | 0 |
| 20 | 0 | 0 | 0 | 100 | 0 | 0 |
| 21 | 0 | 0 | 0 | 144 | 0 | 0 |
| 22 | 0 | 0 | 0 | 196 | 0 | 0 |
| 23 | 0 | 0 | 0 | 121 | 0 | 0 |
| 24 | 0 | 0 | 0 | 144 | 0 | 0 |
| 25 | 0 | 0 | 0 | 81 | 0 | 0 |
| 26 | 0 | 0 | 0 | 196 | 0 | 0 |
| 27 | 0 | 0 | 0 | 225 | 0 | 0 |
| 28 | 0 | 0 | 0 | 121 | 0 | 0 |
| 29 | 0 | 0 | 0 | 144 | 0 | 0 |
| 30 | 0 | 0 | 0 | 289 | 0 | 0 |
| 31 | 0 | 0 | 0 | 400 | 0 | 0 |
| 32 | 0 | 0 | 0 | 256 | 0 | 0 |
| 33 | 0 | 0 | 0 | 256 | 0 | 0 |
| 34 | 0 | 0 | 0 | 324 | 0 | 0 |
| 35 | 0 | 0 | 0 | 121 | 0 | 0 |
| 36 | 0 | 0 | 0 | 144 | 0 | 0 |
| 37 | 0 | 0 | 0 | 49 | 0 | 0 |
| 38 | 0 | 0 | 0 | 169 | 0 | 0 |
| 39 | 0 | 0 | 0 | 100 | 0 | 0 |
| 40 | 0 | 0 | 0 | 121 | 0 | 0 |
| 41 | 0 | 0 | 0 | 169 | 0 | 0 |
| 42 | 0 | 0 | 0 | 225 | 0 | 0 |
| 43 | 0 | 0 | 0 | 324 | 0 | 0 |
| 44 | 0 | 0 | 0 | 121 | 0 | 0 |
| 45 | 0 | 0 | 0 | 144 | 0 | 0 |
| 46 | 0 | 0 | 0 | 225 | 0 | 0 |
| 47 | 0 | 0 | 0 | 16 | 0 | 0 |
| 48 | 0 | 0 | 0 | 36 | 0 | 0 |
| 49 | 0 | 0 | 0 | 100 | 0 | 0 |
| 50 | 0 | 0 | 0 | 144 | 0 | 0 |
| 51 | 0 | 0 | 0 | 100 | 0 | 0 |
| 52 | 0 | 0 | 0 | 144 | 0 | 0 |
| 53 | 0 | 0 | 0 | 100 | 0 | 0 |
| 54 | 0 | 0 | 0 | 225 | 0 | 0 |
| 55 | 0 | 0 | 0 | 0 | 0 | 0 |
| 56 | 2204 | 4613 | 1877 | 9694 | 0 | 0 |

| | A | B | C | D | E | F | G |
|----|-----------|---------|---------|---------|---------|---|---|
| 55 | | | | | | | |
| 56 | | 160 | 255 | 167 | 692 | 0 | 0 |
| 57 | | 12 | 16 | 16 | 54 | 0 | 0 |
| 58 | | 16562 | | | | | |
| 59 | | 2133.33 | 4064.06 | 1743.06 | 8867.85 | 0 | 0 |
| 60 | | df | SS | MS | F | | |
| 61 | Treatment | 3 | 246.310 | 82.1034 | 4.88559 | | |
| 62 | Error | 94 | 1579.69 | 16.8052 | | | |
| 63 | Total | 97 | 1826 | | | | |

REGRESS.XQT

(Regression and Correlation)

Purpose: Calculates regression statistics, including estimation of the slope (b) and Y-intercept (a) in the linear regression model

$$Y = a + bX$$

(See Sokal and Rohlf, 1969, p. 419).

Uses analysis of variance to test the null hypothesis

$$b = 0 \text{ (Snedecor and Cochran, 1967)}$$

Calculates the Pearson product-moment correlation coefficient (r) for two variables (Sokal and Rohlf, p. 509).

[CAUTION: Regression and correlation may not be appropriate statistics to use on the same data set.

(See discussion in Sokal and Rohlf, p. 495-498).

Because of the similarity of the computational steps for both analyses, they are included in the same program for convenience.]

Limits: Handles up to 55 pairs of observations.

Data Input: Observations on the independent variable (if applicable) are entered in column A, beginning at row 1. Observations on the dependent variable are entered in column B.

Data Output: The slope, intercept, and ANOVA for the regression appear in rows 61-66.

"F" (row 66) is the F-statistic for testing the null hypothesis $b=0$. It has $1, N-2$ degrees of freedom, where N is the number of pairs of observations.

The correlation coefficient, r , appears in row 67. Columns D-F contain calculations.

REGRESS.XQT

```
/gm=c1
a1*a1
/rc1,c2:c55
/rc1,d1:d55
=e1
a1*b1
/re1,e2:e55
=a57
sum(a1:a55)
/ra57,b57:e57
=a58
count(a1:a55)
=a59
c57-((a57*a57)/a58)
/ra59,b59,ayyyn
=e59
e57-((a57*b57)/a58)
=a60
e59/a59
=a61
(b57/a58)-(a60*(a57/a58))
=a62
(e59*e59)/a59
=a63
b59-a62
=a64
a63/(a58-2)
=a65
a62/a64
=a66
e59/(sqrt(a59*b59))
!/ica
=a58
"n
=a60
"b
=a61
"a
=a62
"SSR
=a63
"SSE
=a64
"MSE
=a65
"F
=a66
"r
/ir1
/fr1,tr
=b1
"x
=c1
"y
/gb
```

INPUT

| | A | B |
|----|-------|----|
| 1 | 209 | 16 |
| 2 | 105.2 | 16 |
| 3 | 88.6 | 10 |
| 4 | 191.4 | 17 |
| 5 | 251 | 16 |
| 6 | 98.8 | 23 |
| 7 | 156.8 | 20 |
| 8 | 84.8 | 8 |
| 9 | 135 | 16 |
| 10 | 270.8 | 15 |
| 11 | 247.2 | 9 |
| 12 | 209 | 7 |
| 13 | 134.2 | 16 |
| 14 | 119 | 20 |
| 15 | 144.6 | 9 |
| 16 | 128.4 | 8 |
| 17 | 133.4 | 9 |
| 18 | 185 | 14 |
| 19 | 386.4 | 9 |
| 20 | 164.4 | 10 |
| 21 | 335.4 | 12 |
| 22 | 148.8 | 14 |
| 23 | 141.4 | 11 |
| 24 | 113.2 | 12 |
| 25 | 432.8 | 9 |
| 26 | 182.2 | 14 |
| 27 | 115.2 | 15 |
| 28 | 105.4 | 11 |
| 29 | 77.4 | 12 |
| 30 | 43.2 | 17 |
| 31 | 122.4 | 20 |
| 32 | 163.8 | 16 |
| 33 | 121.8 | 16 |
| 34 | 216.8 | 18 |
| 35 | 62.6 | 11 |
| 36 | 72.8 | 12 |
| 37 | 120.8 | 7 |
| 38 | 152.8 | 13 |
| 39 | 64.8 | 10 |
| 40 | 40.2 | 11 |
| 41 | 89.2 | 13 |
| 42 | 64.2 | 15 |
| 43 | 150.4 | 18 |
| 44 | 72.8 | 11 |
| 45 | 84.6 | 12 |
| 46 | 100.8 | 15 |
| 47 | 91.2 | 4 |
| 48 | 41.6 | 6 |
| 49 | 243.6 | 10 |
| 50 | 541 | 12 |
| 51 | 192 | 10 |
| 52 | 144.2 | 12 |
| 53 | 199 | 10 |
| 54 | 111.6 | 15 |
| 55 | | |

| | A | B | C | D | E | F |
|----|-----|----------|----------|----------|------|----------|
| 57 | | | | | | |
| 58 | | 8403 | 692 | 1803953. | 9694 | 106385 |
| 59 | n | 54 | | | | |
| 60 | | 496353.0 | 826.1481 | | | -1297.89 |
| 61 | b | -.002615 | | | | |
| 62 | a | 13.22171 | | | | |
| 63 | SSR | 3.393785 | | | | |
| 64 | SSE | 822.7544 | | | | |
| 65 | MSE | 15.82220 | | | | |
| 66 | F | .2144952 | | | | |
| 67 | r | -.064093 | | | | |

DIVERS.XQT

(Species Diversity)

Purpose: Converts raw cell counts (of periphyton or phytoplankton) to number of cells per unit area or volume.

Calculates percent abundance of each species in the sample.

Calculates the Shannon-Wiener diversity index (H') (Shannon and Weaver, 1949) and eveness (J) (Pielou, 1975) according to the formulas

$$H' = \sum_{i=1}^s p_i \log_2 p_i$$

and

$$J = H'/\log_2 s$$

where

p_i = proportion of the total sample belonging to the i th species

s = total number of species

This program is intended to be used sequentially to analyze many related samples and to provide output which can be incorporated into a data report. It may be used with a permanent species list (see below).

Limits: Handles one sample with up to 146 species.

Data Input: Rows 1-4 are reserved for title and/or headings. The multiplication factor for converting raw cell counts to cells per unit area (or volume) is entered in cell b5. The species list is entered in column a, beginning at row 7. (Cell a6 can contain a taxonomic heading).

A permanent species list may be stored in a separate file and loaded onto the worksheet in column A. Raw cell counts are entered in column B. Counts of zero are not entered.

Data Output: Cell counts per unit area (or volume) appear in column B. Percentage abundances are listed in column C. Total cell count (cells per unit area summed over all species), diversity, and evenness are recorded in rows 152-157. Column d contains calculations. The input data have been moved to column e.

DIVERS.XQT

```
/gm=d153
count(b7:b150)
=c5
sum(b7:b150)
=c7
b5*b7
/rc7,c8:c150,any
=c152
sum(c7:c150)
=d7
b7*100/c5
/rd7,d8:d150,ayn
=e7
if(d7=0,0,(d7/100)*ln(d7/100))
/re7,e8:e150
=d155
(-1/0.693147)*sum(e7:e150)
=d157
d155/((1/0.693147)*ln(d153))
!/mcb,e
=b4
"Cell Count
=c4
"% Abundance
=d4
"P*lnP
=a152
"Total Count
=a153
"Number of Species
=a155
"Shannon-Wiener Index
=a157
"Eveness
```

| | | A | B | C | D | INPUT |
|----|--|---|---|---|---|-------|
| 1 | Date: August 28, 1979 | | | | | |
| 2 | Station: Kishinena Creek | | | | | |
| 3 | Species | | | | | |
| 4 | M. F. | | | | | |
| 5 | Coscinodiscales | | | | | |
| 6 | <i>Cyclotella glomerata</i> | | | | | |
| 7 | <i>Cyclotella ocellata</i> | | | | | |
| 8 | <i>Melosira granulata</i> | | | | | |
| 9 | <i>Melosira varians</i> | | | | | |
| 10 | <i>Fragilariales</i> | | | | | |
| 11 | <i>Ceratoneis arcus</i> | 4 | | | | |
| 12 | <i>Ceratoneis arcus</i> var. <i>amphioxys</i> | | | | | |
| 13 | <i>Diatoma elongatum</i> var. <i>tenuis</i> | 4 | | | | |
| 14 | <i>Diatoma hemale</i> | 2 | | | | |
| 15 | <i>Diatoma hemale</i> var. <i>quadratum</i> | | | | | |
| 16 | <i>Diatoma vulgare</i> | | | | | |
| 17 | <i>Fragilaria capucina</i> | | | | | |
| 18 | <i>Fragilaria construens</i> | | | | | |
| 19 | <i>Fragilaria construens</i> var. <i>binodis</i> | | | | | |
| 20 | <i>Fragilaria construens</i> var. <i>venter</i> | | | | | |
| 21 | <i>Fragilaria crotensis</i> | | | | | |
| 22 | <i>Fragilaria leptostauron</i> | 2 | | | | |
| 23 | <i>Fragilaria vaucheriae</i> | | | | | |
| 24 | <i>Meridion circulare</i> | | | | | |
| 25 | <i>Synedra acus</i> | 6 | | | | |
| 26 | <i>Synedra acus</i> var. <i>angustissima</i> | | | | | |
| 27 | <i>Synedra ulna</i> | | | | | |
| 28 | <i>Synedra ulna</i> var. <i>oxyrhynchus</i> | | | | | |
| 29 | <i>Tabellaria fenestrata</i> | | | | | |
| 30 | <i>Tabellaria flocculosa</i> | 2 | | | | |
| 31 | <i>Achnanthales</i> | | | | | |
| 32 | <i>Achnanthes flexella</i> | | | | | |
| 33 | <i>Achnanthes lanceolata</i> | | | | | |
| 34 | <i>Achnanthes microcephala</i> | | | | | |
| 35 | <i>Achnanthes minutissima</i> | | | | | |
| 36 | <i>Achnanthes sp.</i> | | | | | |
| 37 | <i>Cocconeis placentula</i> | | | | | |
| 38 | <i>Rhoicosphenia curvata</i> | 5 | | | | |
| 39 | <i>Naviculales</i> | | | | | |
| 40 | <i>Amphipleura coffeaeformis</i> | | | | | |
| 41 | <i>Amphora ovalis</i> | | | | | |
| 42 | <i>Amphora ovalis</i> | | | | | |
| 43 | <i>Amphora sp.</i> | | | | | |
| 44 | <i>Anomoeneis exilis</i> | | | | | |
| 45 | <i>Cymbella affinis</i> | | | | | |
| 46 | <i>Cymbella caespitosa</i> | | | | | |
| 47 | <i>Cymbella cistula</i> | 8 | | | | |
| 48 | <i>Cymbella mexicana</i> | | | | | |
| 49 | <i>Cymbella mexicana</i> | | | | | |

| | A | B | C | D | |
|----|--------------------------------|---|---|---|---|
| 50 | <i>Cymbella prostrata</i> | | | | |
| 51 | <i>Cymbella sinuata</i> | | | | 2 |
| 52 | <i>Cymbella turgida</i> | | | | |
| 53 | <i>Cymbella ventricosa</i> | | | | 2 |
| 54 | <i>Cymbella</i> sp. | | | | |
| 55 | <i>Diploneis decipiens</i> | | | | |
| 56 | <i>Frustulia rhomboides</i> | | | | |
| 57 | <i>Gomphonema geminatum</i> | | | | |
| 58 | <i>Gomphonema herculaeum</i> | | | | |
| 59 | <i>Gomphonema intricatum</i> | | | | |
| 60 | <i>Gomphonema lanceolatum</i> | | | | |
| 61 | <i>Gomphonema olivaceum</i> | | | | |
| 62 | <i>Gomphonema parvulum</i> | | | | |
| 63 | <i>Gomphonema</i> sp. | | | | |
| 64 | <i>Gyrosigma sciotense</i> | | | | |
| 65 | <i>Navicula arvensis</i> | | | | |
| 66 | <i>Navicula bicephala</i> | | | | |
| 67 | <i>Navicula pelliculosa</i> | | | | |
| 68 | <i>Navicula radiosa</i> | | | | |
| 69 | <i>Navicula salinarum</i> var. | | | | |
| 70 | <i>Navicula scutelloides</i> | | | | |
| 71 | <i>Navicula tripunctata</i> | | | | |
| 72 | <i>Navicula viridula</i> | | | | |
| 73 | <i>Navicula</i> sp.B | | | | |
| 74 | <i>Navicula</i> sp. | | | | |
| 75 | <i>Neidium</i> sp. | | | | |
| 76 | <i>Pinnularia</i> sp. | | | | |
| 77 | <i>Stauroneis anceps</i> | | | | |
| 78 | <i>Stauroneis</i> sp. | | | | |
| 79 | Surrellines | | | | |
| 80 | <i>Denticula elegans</i> | | | | |
| 81 | <i>Epithemia sorex</i> | | | | |
| 82 | <i>Epithemia turgida</i> | | | | |
| 83 | <i>Nitzschia acicularis</i> | | | | |
| 84 | <i>Nitzschia dissipata</i> | | | | |
| 85 | <i>Nitzschia frustulum</i> | | | | |
| 86 | <i>Nitzschia hantzschiana</i> | | | | |
| 87 | <i>Nitzschia linearis</i> | | | | |
| 88 | <i>Nitzschia palea</i> | | | | |
| 89 | <i>Nitzschia</i> sp. | | | | |
| 90 | <i>Surirella angustata</i> | | | | 2 |

| | | A | B | C | D | E | OUTPUT |
|----|------------------------------------|-------------------------------|-------------------------|-------|-------------------------|---|--------|
| 1 | Date: August 28, 1979 | | | | | | |
| 2 | Station: Kishinena Creek | | | | | | |
| 3 | | | | | | | |
| 4 | Species | | | | | | |
| 5 | M. F. | | | | | | |
| 6 | Coscinodiscates | | | | | | |
| 7 | Cyclotella glomerata | | | | | | |
| 8 | Cyclotella ocellata | | | | | | |
| 9 | Melosira granulata | | | | | | |
| 10 | Melosira varians | | | | | | |
| 11 | Fragilariales | | | | | | |
| 12 | Ceratoneis arcus | | | | | | |
| 13 | Ceratoneis arcus var. amphioxys | | | | | | |
| 14 | Diatoma elongatum var. tenuis | | | | | | |
| 15 | Diatoma hiemale | | | | | | |
| 16 | Diatoma hiemale var. quadratum | | | | | | |
| 17 | Diatoma vulgare | | | | | | |
| 18 | Fragilaria capucina | | | | | | |
| 19 | Fragilaria construens | | | | | | |
| 20 | Fragilaria construens var. binodis | | | | | | |
| 21 | Fragilaria construens var. venter | | | | | | |
| 22 | Fragilaria crotonensis | | | | | | |
| 23 | Fragilaria leptostauron | | | | | | |
| 24 | Fragilaria vaucheriae | | | | | | |
| 25 | Meridion circulaire | | | | | | |
| 26 | Synedra acus | | | | | | |
| 27 | Synedra acus var. angustissima | | | | | | |
| 28 | Synedra ulna | | | | | | |
| 29 | Synedra ulna var. oxyrhynchus | | | | | | |
| 30 | Tabellaria fenestrata | | | | | | |
| 31 | Tabellaria flocculosa | | | | | | |
| 32 | Achmanthesales | | | | | | |
| 33 | Achmanthes flexella | | | | | | |
| 34 | Achmanthes lanceolata | | | | | | |
| 35 | Achmanthes microcephala | | | | | | |
| 36 | Achmanthes minutissima | | | | | | |
| 37 | Achmanthes sp. | | | | | | |
| 38 | Coccoceraspis placentula | | | | | | |
| 39 | Rhoicosphenia curvata | | | | | | |
| 40 | Naviculales | | | | | | |
| 41 | Amphipleura pellucida | | | | | | |
| 42 | Amphora coffeaeformis | | | | | | |
| 43 | Amphora ovalis | | | | | | |
| 44 | Amphora sp. | | | | | | |
| 45 | Anomoeneis exilis | | | | | | |
| 46 | Cymbella affinis | | | | | | |
| 47 | Cymbella caespitosa | | | | | | |
| 48 | Cymbella cistula | | | | | | |
| 49 | Cymbella mexicana | | | | | | |
| 50 | Cymbella prostrata | | | | | | |
| | | Rock RR9 Cell Count 297 | Rock RR9 % Abundance | P•lnP | Original Count 127.6 | Rock RR9 P•lnP Original Count 127.6 | |

| | A | B | C | D | E | |
|-----|--|---------|-------------|-------------|-------------|---|
| 51 | <i>Cymbella sinuata</i> | 255.2 | .6734006734 | -.033673973 | 0 | 2 |
| 52 | <i>Cymbella turgida</i> | 0 | 0 | 0 | 0 | |
| 53 | <i>Cymbella ventricosa</i> | 255.2 | .6734006734 | -.033673973 | 0 | 2 |
| 54 | <i>Cymbella</i> sp. | 0 | 0 | 0 | 0 | |
| 55 | <i>Diplostomis decipiens</i> | 0 | 0 | 0 | 0 | |
| 56 | <i>Frustulia rhombooides</i> | 0 | 0 | 0 | 0 | |
| 57 | <i>Gomphonema geminatum</i> | 0 | 0 | 0 | 0 | |
| 58 | <i>Gomphonema herculeanum</i> | 0 | 0 | 0 | 0 | |
| 59 | <i>Gomphonema intricatum</i> | 0 | 0 | 0 | 0 | |
| 60 | <i>Gomphonema lanceolatum</i> | 0 | 0 | 0 | 0 | |
| 61 | <i>Gomphonema olivaceum</i> | 0 | 0 | 0 | 0 | |
| 62 | <i>Gomphonema parvulum</i> | 0 | 0 | 0 | 0 | |
| 63 | <i>Gomphonema</i> sp. | 0 | 0 | 0 | 0 | |
| 64 | <i>Gyrosigma sciotense</i> | 0 | 0 | 0 | 0 | |
| 65 | <i>Navicula arvensis</i> | 0 | 0 | 0 | 0 | |
| 66 | <i>Navicula bicephala</i> | 0 | 0 | 0 | 0 | |
| 67 | <i>Navicula pelliculosa</i> | 0 | 0 | 0 | 0 | |
| 68 | <i>Navicula radiosa</i> | 0 | 0 | 0 | 0 | |
| 69 | <i>Navicula salinarum</i> var. <i>intermedia</i> | 0 | 0 | 0 | 0 | |
| 70 | <i>Navicula scutelloides</i> | 0 | 0 | 0 | 0 | |
| 71 | <i>Navicula tripunctata</i> | 0 | 0 | 0 | 0 | |
| 72 | <i>Navicula viridula</i> | 0 | 0 | 0 | 0 | |
| 73 | <i>Navicula</i> sp.B | 0 | 0 | 0 | 0 | |
| 74 | <i>Navicula</i> sp. | 0 | 0 | 0 | 0 | |
| 75 | <i>Neidium</i> sp. | 0 | 0 | 0 | 0 | |
| 76 | <i>Pinnularia</i> sp. | 0 | 0 | 0 | 0 | |
| 77 | <i>Stauroneis anceps</i> | 0 | 0 | 0 | 0 | |
| 78 | <i>Stauroneis</i> sp. | 0 | 0 | 0 | 0 | |
| 79 | <i>Surirellines</i> | 0 | 0 | 0 | 0 | |
| 80 | <i>Denticula elegans</i> | 0 | 0 | 0 | 0 | |
| 81 | <i>Epithemia sorex</i> | 0 | 0 | 0 | 0 | |
| 82 | <i>Epithemia turgida</i> | 0 | 0 | 0 | 0 | |
| 83 | <i>Nitzschia acicularis</i> | 0 | 0 | 0 | 0 | |
| 84 | <i>Nitzschia dissipata</i> | 0 | 0 | 0 | 0 | |
| 85 | <i>Nitzschia frustulum</i> | 0 | 0 | 0 | 0 | |
| 86 | <i>Nitzschia hantzschiana</i> | 0 | 0 | 0 | 0 | |
| 87 | <i>Nitzschia linearis</i> | 0 | 0 | 0 | 0 | |
| 88 | <i>Nitzschia palea</i> | 0 | 0 | 0 | 0 | |
| 89 | <i>Nitzschia</i> sp. | 0 | 0 | 0 | 0 | |
| 90 | <i>Surirella angustata</i> | 0 | 0 | 0 | 0 | |
| 91 | | 0 | 0 | 0 | 0 | |
| 148 | | 0 | 0 | 0 | 0 | |
| 149 | | 0 | 0 | 0 | 0 | |
| 150 | | 0 | 0 | 0 | 0 | |
| 151 | Total Count | 37897.2 | 12 | | | |
| 152 | Number of Species | | | | | |
| 153 | Shannon-Wiener Index | | | | 1.760775451 | |
| 154 | | | | | | |
| 155 | Eveness | | | | .4911557631 | |

PSC.XQT

(Percentage Similarity of Communities)

Purpose: Calculates percentage similarity of communities (Whittaker, 1952). This index is

$$PSC = 100 - .5 \sum_{i=1}^K |a_i - b_i|$$

where a_i and b_i are the percentage abundances of the i th species in sample A and sample B., respectively, and K is the total number of species in sample A plus sample B.

Limits: Compares four samples with up to 92* species.

* Note that this program is written to use the output from DIVERSE.XQT, except that it was written for a list of only 92 species (rather than 146) because of memory limitation. Even the 92 species list may overload the memory of the Osborne 1 if one sample contains few zero values. When PSC.XQT is run using the input data shown in example 1, the program works. The input data shown in example 2 overloads the memory and the program is aborted. However, PSC.XQT can be run successfully on the example 2 data if the lines which contain taxonomic headings and the lines where species values are absent are dropped.

Data Input: Rows 1-6 are reserved for the title and/or headings. The species list is entered in column A beginning at line 7. (In the example, line 6 is a taxonomic heading). Percent abundances for each species in samples 1-4 are entered in columns B-E, respectively.

Data Output: The calculations of |a-b| appear in columns F-K. The column headings represent the comparisons being made - i.e., "b-c" is the comparison of the community represented by column B with the community represented by column C.

```
/gm
=f3
"b-c
=g3
"b-d
=h3
"b-e
=i3
"c-d
=j3
"c-e
=k3
"d-e
=f7
abs(b7-c7)
=g7
abs(b7-d7)
=h7
abs(b7-e7)
=i7
abs(c7-d7)
=j7
abs(c7-e7)
=k7
abs(d7-e7)
/rf7:k7,f8:f98
=b99
"% Similarity
=c100
"C
=d100
"D
=e100
"E
=b101
"B
=b102
"C
=b103
"D
/fr100,tr
=c101
100-(.5*sum(f7:f98))
/rc101,d101:e101
=d102
100-(.5*sum(i7:i98))
/rd102,e102
=e103
100-(.5*sum(k7:k98))
!
```


| | A | B | C | D | E |
|----|--|-----|-----|------|------|
| 1 | .00 | .00 | .04 | .00 | .00 |
| 50 | <i>Cymbella prostrata</i> | .76 | .78 | 1.40 | 3.41 |
| 51 | <i>Cymbella sinuata</i> | .00 | .00 | .00 | .00 |
| 52 | <i>Cymbella turgida</i> | .00 | .00 | 1.26 | 2.29 |
| 53 | <i>Cymbella ventricosa</i> | .00 | .00 | .00 | .00 |
| 54 | <i>Cymbella</i> sp. | .00 | .00 | .00 | .00 |
| 55 | <i>Diploneis decipiens</i> | .00 | .00 | .00 | .00 |
| 56 | <i>Frustulia rhomboides</i> | .00 | .00 | .00 | .00 |
| 57 | <i>Gomphonema geminatum</i> | .00 | .00 | .00 | .00 |
| 58 | <i>Gomphonema herculeanum</i> | .00 | .00 | .00 | .00 |
| 59 | <i>Gomphonema intricatum</i> | .00 | .00 | .20 | .28 |
| 60 | <i>Gomphonema lanceolatum</i> | .00 | .00 | .00 | .00 |
| 61 | <i>Gomphonema olivaceum</i> | .00 | .00 | .00 | .00 |
| 62 | <i>Gomphonema parvulum</i> | .00 | .35 | .28 | |
| 63 | <i>Gomphonema</i> sp. | .00 | .00 | .00 | .00 |
| 64 | <i>Gyrosigma sciotense</i> | .00 | .00 | .00 | .00 |
| 65 | <i>Navicula arvensis</i> | .00 | .00 | .00 | .00 |
| 66 | <i>Navicula bicephala</i> | .00 | .00 | .00 | .00 |
| 67 | <i>Navicula pelliculosa</i> | .00 | .00 | .00 | .00 |
| 68 | <i>Navicula radiosa</i> | .00 | .00 | .00 | .00 |
| 69 | <i>Navicula salinarum</i> var. <i>intermedia</i> | .00 | .02 | .00 | .00 |
| 70 | <i>Navicula scutelloides</i> | .00 | .04 | .19 | .00 |
| 71 | <i>Navicula tripunctata</i> | .00 | .00 | .00 | .00 |
| 72 | <i>Navicula viridula</i> | .00 | .01 | .00 | .00 |
| 73 | <i>Navicula</i> sp. B | .00 | .00 | .00 | .00 |
| 74 | <i>Navicula</i> sp. | .07 | .25 | .52 | .87 |
| 75 | <i>Neidium</i> sp. | .00 | .14 | .00 | .00 |
| 76 | <i>Pinnularia</i> sp. | .00 | .00 | .00 | .00 |
| 77 | <i>Stauroneis anceps</i> | .00 | .00 | .00 | .00 |
| 78 | <i>Stauroneis</i> sp. | .07 | .01 | .00 | .00 |
| 79 | <i>Surirellines</i> | .00 | .00 | .00 | .00 |
| 80 | <i>Denticula elegans</i> | .00 | .00 | .00 | .00 |
| 81 | <i>Epithemia sorex</i> | .00 | .00 | .00 | .00 |
| 82 | <i>Epithemia turgida</i> | .00 | .00 | .00 | .00 |
| 83 | <i>Nitzschia acicularis</i> | .00 | .00 | .00 | .00 |
| 84 | <i>Nitzschia dissipata</i> | .00 | .42 | .44 | .37 |
| 85 | <i>Nitzschia frustulum</i> | .00 | .00 | .00 | .00 |
| 86 | <i>Nitzschia hantzschiana</i> | .00 | .01 | .00 | .00 |
| 87 | <i>Nitzschia linearis</i> | .00 | .70 | .40 | 1.13 |
| 88 | <i>Nitzschia palea</i> | .00 | .00 | .19 | .00 |
| 89 | <i>Nitzschia</i> sp. | .00 | .00 | .00 | .00 |
| 90 | <i>Surirella angustata</i> | .00 | .00 | .00 | .00 |

| | F | G | H | I | J | K |
|----|-------|-------|-------|-------|-------|------|
| 53 | 1.26 | 1.63 | 2.29 | .37 | 1.03 | .66 |
| 54 | .00 | .00 | .00 | .00 | .00 | .00 |
| 55 | .00 | .00 | .00 | .00 | .00 | .00 |
| 56 | .00 | .00 | .00 | .00 | .00 | .00 |
| 57 | .00 | .00 | .00 | .00 | .00 | .00 |
| 58 | .00 | .00 | .00 | .00 | .00 | .00 |
| 59 | .20 | .00 | .28 | .20 | .08 | .28 |
| 60 | .00 | .00 | .00 | .00 | .00 | .00 |
| 61 | 76.83 | 44.54 | 53.78 | 32.29 | 23.05 | 9.24 |
| 62 | .35 | .00 | .28 | .35 | .07 | .28 |
| 63 | .00 | .00 | .00 | .00 | .00 | .00 |
| 64 | .00 | .00 | .00 | .00 | .00 | .00 |
| 65 | .00 | .00 | .00 | .00 | .00 | .00 |
| 66 | .00 | .00 | .00 | .00 | .00 | .00 |
| 67 | .00 | .00 | .00 | .00 | .00 | .00 |
| 68 | .00 | .00 | .00 | .00 | .00 | .00 |
| 69 | .02 | .00 | .00 | .02 | .02 | .00 |
| 70 | .04 | .19 | .00 | .14 | .04 | .19 |
| 71 | .00 | .00 | .00 | .00 | .00 | .00 |
| 72 | .01 | .00 | .00 | .01 | .01 | .00 |
| 73 | .00 | .00 | .00 | .00 | .00 | .00 |
| 74 | 2.28 | 2.46 | .80 | .18 | 1.48 | 1.65 |
| 75 | .14 | .00 | .00 | .14 | .14 | .00 |
| 76 | .00 | .00 | .00 | .00 | .00 | .00 |
| 77 | .00 | .00 | .00 | .00 | .00 | .00 |
| 78 | .06 | .07 | .07 | .01 | .01 | .00 |
| 79 | .00 | .00 | .00 | .00 | .00 | .00 |
| 80 | .00 | .00 | .00 | .00 | .00 | .00 |
| 81 | .00 | .00 | .00 | .00 | .00 | .00 |
| 82 | .00 | .00 | .00 | .00 | .00 | .00 |
| 83 | .00 | .00 | .00 | .00 | .00 | .00 |
| 84 | .42 | .00 | .00 | .42 | .42 | .00 |
| 85 | .44 | .37 | .00 | .07 | .44 | .37 |
| 86 | .00 | .00 | .00 | .00 | .00 | .00 |
| 87 | .01 | .00 | .00 | .01 | .01 | .00 |
| 88 | .70 | .40 | 1.13 | .29 | .44 | .73 |
| 89 | .00 | .19 | .00 | .19 | .00 | .19 |
| 90 | .00 | .00 | .00 | .00 | .00 | .00 |

| | B | C | D | E |
|-------------------|-------|-------|-------|---|
| 99 % Similarity | | | | |
| 100 | C | D | E | |
| 101 B | 20.84 | 54.09 | 44.31 | |
| 102 C | | 48.35 | 50.97 | |
| 103 D | | | 72.46 | |

| | A | B | C | D | E |
|---|-------|-------|-----|------|-----|
| 50 <i>Cymbella prostrata</i> | 1.00 | .00 | .00 | .00 | .00 |
| 51 <i>Cymbella sinuata</i> | 1.72 | 1.23 | .72 | .91 | .00 |
| 52 <i>Cymbella turgida</i> | .00 | .09 | .00 | .00 | .00 |
| 53 <i>Cymbella ventricosa</i> | .80 | .74 | .95 | .53 | .00 |
| 54 <i>Cymbella</i> sp. | .00 | .09 | .00 | .00 | .00 |
| 55 <i>Diploneis decipiens</i> | .00 | .00 | .00 | .00 | .00 |
| 56 <i>Frustulia rhomboides</i> | .00 | .00 | .00 | .00 | .00 |
| 57 <i>Gomphonema geminatum</i> | .00 | .00 | .00 | .00 | .00 |
| 58 <i>Gomphonema harculeanum</i> | .00 | .00 | .00 | .03 | .00 |
| 59 <i>Gomphonema intricatum</i> | .00 | .00 | .00 | .26 | .00 |
| 60 <i>Gomphonema lanceolatum</i> | .00 | .00 | .00 | .00 | .00 |
| 61 <i>Gomphonema olivaceum</i> | 16.61 | 21.55 | .27 | .55 | .00 |
| 62 <i>Gomphonema parvulum</i> | .00 | .00 | .00 | .00 | .00 |
| 63 <i>Gomphonema</i> sp. | .00 | .00 | .00 | .00 | .00 |
| 64 <i>Gyrosigma sciotense</i> | .00 | .00 | .00 | .00 | .00 |
| 65 <i>Navicula arvensis</i> | .00 | .00 | .00 | .00 | .00 |
| 66 <i>Navicula bicephala</i> | .00 | .00 | .00 | .00 | .00 |
| 67 <i>Navicula pelliculosa</i> | .00 | .43 | .00 | .00 | .00 |
| 68 <i>Navicula radiosa</i> | .00 | .00 | .20 | .00 | .00 |
| 69 <i>Navicula salinarum</i> var. <i>intermedia</i> | .84 | .00 | .00 | .00 | .00 |
| 70 <i>Navicula scutelloides</i> | .00 | .00 | .00 | .00 | .00 |
| 71 <i>Navicula tripunctata</i> | .00 | .00 | .00 | .33 | .00 |
| 72 <i>Navicula viridula</i> | .00 | .00 | .00 | .00 | .00 |
| 73 <i>Navicula</i> sp. B | .00 | .00 | .00 | .00 | .00 |
| 74 <i>Navicula</i> sp. | .18 | .01 | .20 | .49 | .00 |
| 75 <i>Neidium</i> sp. | .00 | .04 | .00 | .00 | .00 |
| 76 <i>Pinnularia</i> sp. | .00 | .08 | .00 | .00 | .00 |
| 77 <i>Stauroneis anceps</i> | .00 | .00 | .00 | .00 | .00 |
| 78 <i>Stauroneis</i> sp. | .00 | .00 | .00 | .00 | .00 |
| 79 <i>Surirellinees</i> | .00 | .00 | .00 | .00 | .00 |
| 80 <i>Denticula elegans</i> | .05 | .00 | .00 | .00 | .00 |
| 81 <i>Epithemia sorex</i> | .00 | .00 | .20 | .03 | .00 |
| 82 <i>Epithemia turgida</i> | .00 | .00 | .00 | .16 | .00 |
| 83 <i>Nitzschia acicularis</i> | .00 | .00 | .01 | .33 | .13 |
| 84 <i>Nitzschia dissipata</i> | .00 | .00 | .01 | .00 | .00 |
| 85 <i>Nitzschia frustulum</i> | .00 | .00 | .86 | .26 | .00 |
| 86 <i>Nitzschia hantzschiana</i> | .00 | .00 | .00 | .04 | .00 |
| 87 <i>Nitzschia linearis</i> | .00 | .00 | .62 | 3.53 | .00 |
| 88 <i>Nitzschia palea</i> | .00 | .00 | .62 | .21 | .00 |
| 89 <i>Nitzschia</i> sp. | .00 | .00 | .00 | .00 | .00 |
| 90 <i>Surirella angustata</i> | .00 | .00 | .00 | .00 | .00 |

MODIFICATIONS OF PROGRAMS

Modifications of programs to fit specific data sets may be desired. For example, the Columbia River phytoplankton samples contained several filamentous species whose abundances were recorded as μm of filament rather than cell counts. We wished to tabulate concentrations of these species but not to include them in the total cell counts, percent abundances, or diversity calculations. Thus, the program DIVERSC.XQT was written.

DIVERSC.XQT is a modification of the general species diversity program, DIVERS.XQT. The filamentous species are entered on rows 118, 126, and 127. The last species entry allowed is on row 136.

DIVERSC.XQT

```
/gm
=a138
"Number of Species
=d138
count(b7:b136)
=c7
b5*b7
/rc7,c8:c136,any
=a137
"Total Count
=a140
"Shannon-Wiener Index
=c137
sum(c7:c136)-c118-c126-c127
=d7
c7*100/c137
/rd7,d8:d136,ayn
=d118
"-
/rd118,d126:d127
=e7
if(d7=0,0,(d7/100)*ln(d7/100))
/re7,e8:e136
=d140
(-1/0.693147)*sum(e7:e136)
/mcb,g
!
!
```

| | | INPUT | | | | |
|----|------------------------------------|-------|-------|---|----|-------|
| 1 | Date: August 19, 1982 | | | | A | |
| 2 | Station: Birchbank | | | | B | C |
| 3 | | S | Count | | D | E |
| 4 | Species | 1 | S | 1 | % | ln(P) |
| 5 | M. F. | 3 | 59 | 3 | 59 | |
| 6 | Chrysophyta | | | | | |
| 7 | Class Bacillariophyceae | | | | | |
| 8 | Achnanthes clevei | | | | | |
| 9 | Achnanthes flexella | | | | | |
| 10 | Achnanthes lanceolata | | | | | |
| 11 | Achnanthes minutissima | | | 1 | | |
| 12 | Achnanthes sp. | | | | | |
| 13 | Amphipleura pellucida | | | | | |
| 14 | Asterionella formosa | | | | | |
| 15 | Ceratoneis arcus | | | | | |
| 16 | Ceratoneis arcus var. amphioxys | | | | | |
| 17 | Cocconeis pediculus | | | | | |
| 18 | Cocconeis placentula | | | | | |
| 19 | Cyclotella bodanica | | | | | |
| 20 | Cyclotella comta | | | | | |
| 21 | Cyclotella glomerata | | | | | |
| 22 | Cyclotella kuetzingiana | | | | | |
| 23 | Cyclotella ocellata | | | | | |
| 24 | Cyclotella stelligera | | | | | |
| 25 | Cyclotella sp. | 200 | | | | |
| 26 | Cymbella affinis | | | | | |
| 27 | Cymbella caespitosa | | | | | |
| 28 | Cymbella cistula | | | | | |
| 29 | Cymbella prostrata | | | | | |
| 30 | Cymbella turgida | | | | | |
| 31 | Cymbella ventricosa | | | 1 | | |
| 32 | Cymbella sp. | | | | | |
| 33 | Denticula elegans | | | | | |
| 34 | Diatoma elongatum | | | | | |
| 35 | Diatoma hemale | | | | | |
| 36 | Diatoma hemale var. quadratum | | | | | |
| 37 | Diatoma vulgare | | | | | |
| 38 | Diploneis decipiens | | | | | |
| 39 | Epithemia sorex | | | | | |
| 40 | Epithemia turgida | | | | | |
| 41 | Eunotia pectinalis | | | | | |
| 42 | Fragilaria capucina | | | | | |
| 43 | Fragilaria construens | | | | | |
| 44 | Fragilaria construens var. binodis | | | | | |
| 45 | Fragilaria construens var. venter | | | | | |
| 46 | Fragilaria crotonensis | | | | | |
| 47 | Fragilaria leptostauron | | | | | 16 |
| 48 | Fragilaria vaucheriae | | | | | |
| 49 | Gomphonema herculeanum | | | | | |

| | A | B C D E |
|-----|--------------------------------------|------------------|
| 50 | Gomphonema intricatum | |
| 51 | Gomphonema olivaceum | |
| 52 | Gomphonema parvulum | |
| 53 | Gomphonema sp. | |
| 54 | Gyrosigma sciotense | |
| 55 | Melosira granulata | |
| 56 | Melosira granulata var. angustissima | |
| 57 | Melosira herzogii | |
| 58 | Melosira italica | |
| 59 | Melosira varians | 3 |
| 60 | Meridion circulare | |
| 61 | Navicula bicephala | |
| 62 | Navicula cryptocephala | |
| 63 | Navicula pelluculosa | |
| 64 | Navicula pupula | |
| 65 | Navicula radiosa | |
| 66 | Navicula salinarum | |
| 67 | Navicula salinarum var. intermedia | |
| 68 | Navicula tripunctata | |
| 69 | Navicula sp. | |
| 70 | Neidium sp. | |
| 71 | Nitzschia acicularis | |
| 72 | Nitzschia actinasteroides | |
| 73 | Nitzschia dissipata | |
| 74 | Nitzschia filiformis | |
| 75 | Nitzschia linearis | |
| 76 | Nitzschia palea | |
| 77 | Nitzschia sigma | |
| 78 | Nitzschia sp. | |
| 79 | Rhizosolenia eriensis | 6 |
| 80 | Rhizosolenia sp. | |
| 81 | Rhopalodia gibba | |
| 82 | Rhopalodia gibberula | |
| 83 | Stauroneis anceps | |
| 84 | Stephanodiscus astraea | |
| 85 | Stephanodiscus sp. | |
| 86 | Synedra acus var. radians | |
| 87 | Synedra angustata | |
| 88 | Synedra ulna | |
| 89 | Synedra ulna var. oxyrhynchus | |
| 90 | Synedra sp. | |
| 91 | Tabellaria fenestrata | |
| 92 | Tabellaria flocculosa | |
| 93 | Non-Diatom Chrysophyta | |
| 94 | Chromulina-like | |
| 95 | Dinobryon bavaricum | |
| 96 | Dinobryon sertularia | |
| 97 | Malloomonas pseudocoronata | 3 |
| 98 | Malloomonas sp. | |
| 99 | Ochromonas sp. | |
| 100 | Chlorophyta | 10 |

| | A | B | C | D | E |
|-----|---------------------------------|---|---|---|----|
| 101 | <i>Ankistrodesmus falcatus</i> | | | | 2 |
| 102 | <i>Carteria</i> sp. | | | | |
| 103 | <i>Chlamydomonas</i> sp. | | | | |
| 104 | <i>Cosmarium</i> sp. | | | | |
| 105 | <i>Cosmarium</i> sp. A | | | | |
| 106 | <i>Crucigenia</i> sp. | | | | |
| 107 | <i>Elakatothrix gelatinosa</i> | | | | |
| 108 | <i>Elakatothrix</i> sp. | | | | |
| 109 | <i>Franceia</i> sp. | | | | |
| 110 | <i>Gemmacystis neglecta</i> | | | | |
| 111 | <i>Gemmacystis</i> sp. | | | | |
| 112 | <i>Gonium</i> sp. | | | | |
| 113 | <i>Lagerheimia</i> sp. | | | | |
| 114 | <i>Scenedesmus quadrifolius</i> | | | | 16 |
| 115 | <i>Scenedesmus</i> sp. | | | | |
| 116 | <i>Selenastrum</i> sp. | | | | |
| 117 | <i>Staurastrum</i> sp. | | | | |
| 118 | <i>Stigeoclonium</i> sp. | | | | |
| 119 | <i>Cryptophyta</i> | | | | |
| 120 | <i>Chroomonas acuta</i> | | | | |
| 121 | <i>Chroomonas</i> sp. | | | | |
| 122 | <i>Cryptomonas borealis</i> | | | | |
| 123 | <i>Cryptomonas</i> sp. | | | | |
| 124 | <i>Cyanophyta</i> | | | | |
| 125 | <i>Chroococcus</i> sp. | | | | |
| 126 | <i>Oscillatoria planctonica</i> | | | | |
| 127 | <i>Oscillatoria</i> sp. | | | | |
| 128 | Unidentified colony | | | | |
| 129 | <i>Pyrrhophyta</i> | | | | |
| 130 | <i>Ceratium hirundinella</i> | | | | |
| 131 | <i>Peridiniopsis</i> sp. | | | | |
| 132 | <i>Peridinium</i> sp. | | | | |
| 133 | <i>Peridinium</i> sp. A | | | | |
| 134 | Miscellaneous | | | | |
| 135 | Unidentified unicellular alga | | | | |

| | A | B | C | D | E | F | G |
|-----|--------------------------------------|----|------|-------|----|---|---|
| 50 | Gomphorema intricatum | 0 | 0 | 0 | 0 | 0 | |
| 51 | Gomphorema olivaceum | 0 | 0 | 0 | 0 | 0 | |
| 52 | Gomphorema parvulum | 0 | 0 | 0 | 0 | 0 | |
| 53 | Gomphorema sp. | 0 | 0 | 0 | 0 | 0 | |
| 54 | Gyrosigma scioltense | 0 | 0 | 0 | 0 | 0 | |
| 55 | Melosira granulata | 0 | 0 | 0 | 0 | 0 | |
| 56 | Melosira granulata var. angustissima | 0 | 0 | 0 | 0 | 0 | |
| 57 | Melosira herzogii | 0 | 0 | 0 | 0 | 0 | |
| 58 | Melosira italica | 0 | 0 | 0 | 0 | 0 | |
| 59 | Melosira varians | 0 | 0 | 0 | 0 | 0 | |
| 60 | Meridion circulare | 0 | 0 | 0 | 0 | 0 | |
| 61 | Navicula bicephala | 0 | 0 | 0 | 0 | 0 | |
| 62 | Navicula cryptocephala | 0 | 0 | 0 | 0 | 0 | |
| 63 | Navicula pelliculosa | 0 | 0 | 0 | 0 | 0 | |
| 64 | Navicula pupula | 0 | 0 | 0 | 0 | 0 | |
| 65 | Navicula radiosus | 0 | 0 | 0 | 0 | 0 | |
| 66 | Navicula salinarum | 0 | 0 | 0 | 0 | 0 | |
| 67 | Navicula salinarum var. intermedia | 0 | 0 | 0 | 0 | 0 | |
| 68 | Navicula triplacata | 0 | 0 | 0 | 0 | 0 | |
| 69 | Navicula sp. | 0 | 0 | 0 | 0 | 0 | |
| 70 | Neidium sp. | 0 | 0 | 0 | 0 | 0 | |
| 71 | Nitzschia acicularis | 0 | 0 | 0 | 0 | 0 | |
| 72 | Nitzschia actinasteroides | 0 | 0 | 0 | 0 | 0 | |
| 73 | Nitzschia dissipata | 0 | 0 | 0 | 0 | 0 | |
| 74 | Nitzschia filiformis | 0 | 0 | 0 | 0 | 0 | |
| 75 | Nitzschia linearis | 0 | 0 | 0 | 0 | 0 | |
| 76 | Nitzschia palea | 0 | 0 | 0 | 0 | 0 | |
| 77 | Nitzschia sigma | 0 | 0 | 0 | 0 | 0 | |
| 78 | Nitzschia sp. | 0 | 0 | 0 | 0 | 0 | |
| 79 | Rhizosolenia eriensis | 22 | 1.90 | -.075 | 6 | 0 | |
| 80 | Rhizosolenia sp. | 0 | 0 | 0 | 0 | 0 | |
| 81 | Rhopalodia gibba | 0 | 0 | 0 | 0 | 0 | |
| 82 | Rhopalodia gibberula | 0 | 0 | 0 | 0 | 0 | |
| 83 | Stauroneis anceps | 0 | 0 | 0 | 0 | 0 | |
| 84 | Stephanodiscus astraea | 0 | 0 | 0 | 0 | 0 | |
| 85 | Stephanodiscus sp. | 0 | 0 | 0 | 0 | 0 | |
| 86 | Synedra acus var. radians | 0 | 0 | 0 | 0 | 0 | |
| 87 | Synedra angustata | 0 | 0 | 0 | 0 | 0 | |
| 88 | Synedra ulna | 0 | 0 | 0 | 0 | 0 | |
| 89 | Synedra ulna var. oxyrhynchus | 0 | 0 | 0 | 0 | 0 | |
| 90 | Synedra sp. | 0 | 0 | 0 | 0 | 0 | |
| 91 | Tabellaria fenestrata | 0 | 0 | 0 | 0 | 0 | |
| 92 | Tabellaria flocculosa | 0 | 0 | 0 | 0 | 0 | |
| 93 | Non-Diatom Chrysophyta | 0 | 0 | 0 | 0 | 0 | |
| 94 | Chromulina-like | 0 | 0 | 0 | 0 | 0 | |
| 95 | Dinobryon bavaricum | 0 | 0 | 0 | 0 | 0 | |
| 96 | Dinobryon sertularia | 39 | 3.49 | -.117 | 11 | 0 | |
| 97 | Malloomonas pseudocoronaata | 0 | 0 | 0 | 0 | 0 | |
| 98 | Malloomonas sp. | 11 | .95 | -.044 | 3 | 0 | |
| 99 | Ochromonas sp. | 36 | .17 | -.110 | 10 | 0 | |
| 100 | Chlorophyta | 0 | .00 | 0 | 0 | 0 | |

| | A | B | C | D | E | F | G | 2 |
|-----|-------------------------------|---|------|-------|-------|---|---|------|
| 101 | Ankistrodesmus falcatus | | .63 | -.032 | | | | |
| 102 | Carteria sp. | | 0 | .00 | 0 | | | |
| 103 | Chlamydomonas sp. | | 0 | .00 | 0 | | | |
| 104 | Cosmarium sp. | | 0 | .00 | 0 | | | |
| 105 | Cosmarium sp. A | | 7 | .63 | -.032 | | | 2 |
| 106 | Crucigenia sp. | | 0 | .00 | 0 | | | |
| 107 | Elakatothrix gelatinosa | | 0 | .00 | 0 | | | |
| 108 | Elakatothrix sp. | | 0 | .00 | 0 | | | |
| 109 | Franceia sp. | | 0 | .00 | 0 | | | |
| 110 | Gemmifystis neglecta | | 0 | .00 | 0 | | | |
| 111 | Gemmifystis sp. | | 0 | .00 | 0 | | | |
| 112 | Gonium sp. | | 0 | .00 | 0 | | | |
| 113 | Lagerheimia sp. | | 0 | .00 | 0 | | | |
| 114 | Scenedesmus quadrifcauda | | 57 | 5.08 | -.151 | | | 16 |
| 115 | Scenedesmus sp. | | 0 | .00 | 0 | | | |
| 116 | Selenastrum sp. | | 0 | .00 | 0 | | | |
| 117 | Staurastrum sp. | | 0 | .00 | 0 | | | |
| 118 | Stigeoclonium sp. | | 0 | .00 | 0 | | | |
| 119 | Cryptophyta | | 0 | .00 | 0 | | | |
| 120 | Chroomonas acuta | | 0 | .00 | 0 | | | |
| 121 | Chroomonas sp. | | 108 | 9.52 | -.224 | | | 30 |
| 122 | Cryptomonas borealis | | 0 | .00 | 0 | | | |
| 123 | Cryptomonas sp. | | 25 | 2.22 | -.085 | | | 7 |
| 124 | Cyanophyta | | 0 | .00 | 0 | | | |
| 125 | Chroococcus sp. | | 0 | .00 | 0 | | | |
| 126 | Oscillatoria planctonica | | 0 | .00 | 0 | | | |
| 127 | Oscillatoria sp. | | 0 | .00 | 0 | | | |
| 128 | Unidentified colony | | 0 | .00 | 0 | | | |
| 129 | Pyrrhophyta | | 0 | .00 | 0 | | | |
| 130 | Ceratium hirundinella | | 0 | .00 | 0 | | | |
| 131 | Peridinopsis sp. | | 0 | .00 | 0 | | | |
| 132 | Peridinium sp. | | 0 | .00 | 0 | | | |
| 133 | Peridinium sp. A | | 0 | .00 | 0 | | | |
| 134 | Miscellaneous | | 0 | .00 | 0 | | | |
| 135 | Unidentified unicellular alga | | 0 | .00 | 0 | | | |
| 136 | | | 0 | .00 | 0 | | | |
| 137 | Total Count | | 1131 | 15.00 | | | | |
| 138 | Number of Species | | | | | | | |
| 139 | | | | | | | | |
| 140 | Shannon-Wiener Index | | | | | | | 2.13 |

CREATING DATA REPORTS FROM SUPERCALC OUTPUT

Some Supercalc programs (DIVERS.XQT, DSTATS.XQT, GSTATS.XQT) have been designed to produce output which can be used in data reports. The output usually needs some modification (eg., blanking zeros that appear on header rows, inserting spaces between groups of data). If the same modifications are to be made to several data sets, it may be more efficient to write a program containing blanking, inserting, and formatting commands. Example 1: FIX.XQT illustrates a program to convert the output from DSTATS.XQT (see p. 7-8, columns A-G only) to a report format.

Limitation: Supercalc Version 1.12 allows you to specify that values be printed as integers or with 2 decimal places. The only way to get 3 or more decimal places is to use general formatting and set the column width to force the desired number of decimal places. In Example 1, setting the column width to 6 (/fg6) provides space for four numbers plus a decimal place. Justifying the columns to the left (/fgl) aligns the decimal points and insures that four numbers will follow the decimal point IF (1) the value is <1 and (2) the fourth decimal place is not a 0 (i.e., .0200 will be rounded to .02). It is not possible to get 3 decimal places in one row and 4 decimal places in another row of the same column.

EXAMPLE 1: FIX.XQT

```
/fca,t1  
/fr1,tr  
/fea1,t1  
/fca,25  
/fg6  
/fg1  
/bf14:g14  
/bf26:g26  
/bf38:g38  
/icg  
/fcg,2  
/ir2  
/ir4  
/ir16  
/ir18  
/ir30  
/ir32  
/ir44  
/ir46  
/gb
```

"FIXED" OUTPUT

| Date: | | | | Mean | S. D. |
|--------------------------|-------|-------|-------|-------|-------|
| Birchbank | | | | | |
| Orthophosphate | 10.5 | 10.5 | 10 | 10.33 | .2887 |
| Nitrate + Nitrite | .066 | .067 | .065 | .066 | .001 |
| Ammonia | .046 | .047 | .047 | .0467 | .0006 |
| Total Dissolved Nitrogen | .18 | .185 | .18 | .1817 | .0029 |
| Dissolved Zn | .07 | .04 | .28 | .13 | .1308 |
| Dissolved Cu | .002 | .001 | .003 | .002 | .001 |
| Dissolved Fe | .002 | .002 | .001 | .0017 | .0006 |
| Dissolved Mn | .01 | .03 | .05 | .03 | .02 |
| Dissolved Cd | .0005 | .0005 | .0034 | .0015 | .0017 |
| Dissolved Pb | .001 | .001 | .001 | .001 | 0 |
| Dissolved Ni | .008 | .009 | .012 | .0097 | .0021 |
| Waneta | | | | | |
| Orthophosphate | 2.5 | 2.5 | 2.5 | 2.5 | 0 |
| Nitrate + Nitrite | .072 | .072 | .073 | .0723 | .0006 |
| Ammonia | .028 | .028 | .031 | .029 | .0017 |
| Total Dissolved Nitrogen | .163 | .163 | .168 | .1647 | .0029 |
| Dissolved Zn | .04 | .04 | .04 | .04 | 0 |
| Dissolved Cu | .006 | .005 | .01 | .007 | .0026 |
| Dissolved Fe | .002 | .002 | .002 | .002 | 0 |
| Dissolved Mn | .01 | .01 | .01 | .01 | 0 |
| Dissolved Cd | .001 | .0005 | .0005 | .0007 | .0003 |
| Dissolved Pb | .005 | .004 | .003 | .004 | .001 |
| Dissolved Ni | .001 | .001 | .001 | .001 | 0 |
| Effluent | | | | | |
| Orthophosphate | 27 | 28 | 28 | 27.67 | .5774 |
| Nitrate + Nitrite | .09 | .08 | .08 | .0833 | .0058 |
| Ammonia | 46 | 42 | 46 | 44.67 | 2.309 |
| Total Dissolved Nitrogen | 55 | 49 | 55 | 53 | 3.464 |
| Dissolved Zn | 160 | 140 | 160 | 153.3 | 11.55 |
| Dissolved Cu | .55 | .46 | .58 | .53 | .0624 |
| Dissolved Fe | 1.2 | 1.2 | 1.2 | 1.2 | 0 |
| Dissolved Mn | 30 | 26 | 30 | 28.67 | 2.309 |
| Dissolved Cd | .002 | .002 | .002 | .002 | 0 |
| Dissolved Pb | .38 | .36 | .37 | .37 | .01 |
| Dissolved Ni | .02 | .02 | .02 | .02 | 0 |
| TED-70 | | | | | |
| Orthophosphate | 48 | 58.5 | 57 | 54.5 | 5.679 |
| Nitrate + Nitrite | .061 | | | .061 | 0 |
| Ammonia | .042 | | | .042 | 0 |
| Total Dissolved Nitrogen | .194 | | | .194 | 0 |
| Dissolved Zn | .14 | .13 | | .135 | .0071 |
| Dissolved Cu | .003 | .003 | | .003 | 0 |
| Dissolved Fe | .005 | .005 | | .005 | 0 |
| Dissolved Mn | .02 | .02 | | .02 | 0 |
| Dissolved Cd | .0006 | .0006 | | .0006 | 0 |
| Dissolved Pb | .003 | .003 | | .003 | 0 |
| Dissolved Ni | .005 | .006 | | .0055 | .0007 |

Thus, the mean for Total Dissolved Nitrogen is reported to 4 decimals when only 3 significant figures should be shown.

The only way to correct this problem is to use Wordstar to edit the table. The "fixed output" is transferred to a Wordstar file using the command

/OD(display) a1:(last column and row), D(isk)b:filename.prn

[Note that Wordstar files cannot be accessed by Supercalc. If you wish to use the data for any additional calculations, you must make a separate Supercalc file by employing the SAVE (/S) command.]

When the output has been saved in a file whose name ends in .prn, it is ready to be edited using the Wordstar software. A problem may be encountered because some tables produced by Supercalc have longer lines than the default line length of Wordstar. Editing a long line may cause Wordstar to reformat that line to fit within the default margins. This problem can be avoided by changing the margins before you edit:

Place the cursor in longest line. Type ^OF. This command resets the margins to correspond with the beginning and end of that line of data.

Alterations to the bodies of tables are easier if you turn off the INSERT mode by typing ^V before you edit.

You may wish to merge the output from several data sets to produce one table. For example, DIVERSE.XQT analyzes only one sample, while a table in a data report may incorporate diatom cell counts or percent abundances from several replicate samples (see Smith et al., 1985). Before portions of files can be merged, the output must be saved as VALUES using the command

/S b:filename,V

This step is essential because the original output contains formulas, making values in one column dependent upon values in other columns (eg. percent abundances depend on cell counts). Deleting columns causes all values to be recalculated, even when the /gm command has been given. Note that ERROR is converted to 0 when files are saved as VALUES.

The desired portions of the saved output files are loaded onto the worksheet in the appropriate columns and formatted to produce the table. If the files to be merged for each table are given the same set of names,

all of these commands may be written into a program, as illustrated in Example 2. Note that files with identical names must be stored on different diskettes. In Example 2, the DIVERSC.XQT output for the three Birchbank samples for August, 1982, would be saved on a diskette labelled "August" under the names b1out, b2out, and b3out. The Birchbank data for September, 1982, would be stored on a different diskette (labelled "September") in three files named b1out, b2out, and b3out.

EXAMPLE 2: BMERGE.XQT

```
/lb:b1out,pa1:b133,a1  
/lb:b2out,pb1:b133,c1  
/lb:b3out,pb1:b133,d1  
/gb  
/fgi  
/fca,40  
/fg10  
/fca,t1  
/fgtr
```

OUTPUT

Date: August 19, 1982
 Station: Birchbank

| Species | Count S 1 | Count S 2 | Count S 3 |
|------------------------------------|--------------|--------------|--------------|
| Chrysophyta | | | |
| Class Bacillariophyceae | | | |
| Achnanthes clevei | 0 | 0 | 0 |
| Achnanthes flexella | 0 | 0 | 0 |
| Achnanthes lanceolata | 0 | 0 | 0 |
| Achnanthes minutissima | 4 | 8 | 18 |
| Achnanthes sp. | 0 | 0 | 0 |
| Amphipleura pellucida | 0 | 0 | 0 |
| Asterionella formosa | 25 | 11 | 39 |
| Ceratoneis arcus | 0 | 0 | 0 |
| Ceratoneis arcus var. amphioxys | 0 | 0 | 0 |
| Coccconeis pediculus | 0 | 0 | 0 |
| Coccconeis placentula | 0 | 0 | 0 |
| Cyclotella bodanica | 0 | 5 | 4 |
| Cyclotella comta | 0 | 0 | 0 |
| Cyclotella glomerata | 0 | 0 | 0 |
| Cyclotella kuetzingiana | 0 | 0 | 0 |
| Cyclotella ocellata | 0 | 0 | 0 |
| Cyclotella stelligera | 0 | 0 | 0 |
| Cyclotella sp. | 718 | 559 | 890 |
| Cymbella affinis | 0 | 0 | 0 |
| Cymbella caespitosa | 0 | 0 | 0 |
| Cymbella cistula | 0 | 0 | 0 |
| Cymbella prostrata | 0 | 0 | 0 |
| Cymbella turgida | 0 | 0 | 0 |
| Cymbella ventricosa | 4 | 5 | 0 |
| Cymbella sp. | 0 | 0 | 0 |
| Denticula elegans | 0 | 0 | 0 |
| Diatoma elongatum | 0 | 0 | 0 |
| Diatoma hiemale | 0 | 0 | 0 |
| Diatoma hiemale var. quadratum | 0 | 0 | 0 |
| Diatoma vulgare | 0 | 0 | 0 |
| Diploneis decipiens | 0 | 0 | 0 |
| Epithemia sorex | 0 | 0 | 0 |
| Epithemia turgida | 0 | 0 | 0 |
| Eunotia pectinalis | 0 | 0 | 0 |
| Fragilaria capucina | 0 | 0 | 0 |
| Fragilaria construens | 0 | 0 | 18 |
| Fragilaria construens var. binodis | 0 | 27 | 0 |
| Fragilaria construens var. venter | 0 | 0 | 0 |
| Fragilaria crotensis | 57 | 57 | 72 |
| Fragilaria leptostauron | 0 | 0 | 0 |
| Fragilaria vaucheriae | 0 | 0 | 0 |
| Gomphonema herculeanum | 0 | 0 | 0 |

| | | | |
|--|----|----|----|
| <i>Gomphonema intricatum</i> | 0 | 0 | 0 |
| <i>Gomphonema olivaceum</i> | 0 | 0 | 4 |
| <i>Gomphonema parvulum</i> | 0 | 0 | 0 |
| <i>Gomphonema</i> sp. | 0 | 0 | 0 |
| <i>Gyrosigma sciotense</i> | 0 | 0 | 0 |
| <i>Melosira granulata</i> | 0 | 0 | 0 |
| <i>Melosira granulata</i> var. <i>angustissima</i> | 0 | 0 | 0 |
| <i>Melosira herzogii</i> | 0 | 0 | 0 |
| <i>Melosira italica</i> | 0 | 0 | 0 |
| <i>Melosira varians</i> | 11 | 0 | 7 |
| <i>Meridion circulare</i> | 0 | 0 | 0 |
| <i>Navicula bicephala</i> | 0 | 0 | 0 |
| <i>Navicula cryptocephala</i> | 0 | 0 | 0 |
| <i>Navicula pelliculosa</i> | 0 | 0 | 0 |
| <i>Navicula pupula</i> | 0 | 0 | 0 |
| <i>Navicula radiosha</i> | 0 | 0 | 4 |
| <i>Navicula salinarum</i> | 0 | 0 | 0 |
| <i>Navicula salinarum</i> var. <i>intermedia</i> | 0 | 0 | 0 |
| <i>Navicula tripunctata</i> | 0 | 0 | 0 |
| <i>Navicula</i> sp. | 0 | 8 | 0 |
| <i>Neidium</i> sp. | 0 | 0 | 0 |
| <i>Nitzschia acicularis</i> | 0 | 0 | 0 |
| <i>Nitzschia actinasteroides</i> | 0 | 0 | 0 |
| <i>Nitzschia dissipata</i> | 0 | 0 | 0 |
| <i>Nitzschia filiformis</i> | 0 | 0 | 0 |
| <i>Nitzschia linearis</i> | 0 | 0 | 0 |
| <i>Nitzschia palea</i> | 0 | 8 | 0 |
| <i>Nitzschia sigma</i> | 0 | 0 | 0 |
| <i>Nitzschia</i> sp. | 0 | 0 | 0 |
| <i>Rhizosolenia eriensis</i> | 22 | 0 | 18 |
| <i>Rhizosolenia</i> sp. | 0 | 0 | 0 |
| <i>Rhopalodia gibba</i> | 0 | 0 | 0 |
| <i>Rhopalodia gibberula</i> | 0 | 0 | 0 |
| <i>Stauroneis anceps</i> | 0 | 0 | 0 |
| <i>Stephanodiscus astraea</i> | 0 | 0 | 0 |
| <i>Stephanodiscus</i> sp. | 0 | 0 | 0 |
| <i>Synedra acus</i> var. <i>radians</i> | 0 | 0 | 0 |
| <i>Synedra angustata</i> | 0 | 0 | 0 |
| <i>Synedra ulna</i> | 0 | 0 | 4 |
| <i>Synedra ulna</i> var. <i>oxyrhynchus</i> | 0 | 0 | 0 |
| <i>Synedra</i> sp. | 0 | 0 | 0 |
| <i>Tabellaria fenestrata</i> | 0 | 14 | 11 |
| <i>Tabellaria flocculosa</i> | 0 | 0 | 0 |
| Non-Diatom Chrysophyta | | | |
| <i>Chromulina</i> -like | 0 | 0 | 0 |
| <i>Dinobryon bavaricum</i> | 0 | 0 | 0 |
| <i>Dinobryon sertularia</i> | 39 | 35 | 39 |
| <i>Mallomonas pseudocoronata</i> | 0 | 0 | 0 |
| <i>Mallomonas</i> sp. | 11 | 0 | 0 |
| <i>Ochromonas</i> sp. | 36 | 32 | 32 |
| Chlorophyta | | | |
| <i>Ankistrodesmus falcatus</i> | 7 | 3 | 25 |

| | | | |
|-------------------------------|------|-----|------|
| Carteria sp. | 0 | 0 | 0 |
| Chlamydomonas sp. | 0 | 0 | 7 |
| Cosmarium sp. | 7 | 0 | 0 |
| Crucigenia sp. | 0 | 0 | 0 |
| Elakatothrix gelatinosa | 0 | 0 | 0 |
| Elakatothrix sp. | 0 | 0 | 0 |
| Franceia sp. | 0 | 0 | 0 |
| Gemellicystis neglecta | 0 | 0 | 0 |
| Gemellicystis sp. | 0 | 0 | 0 |
| Gonium sp. | 0 | 0 | 0 |
| Lagerheimia sp. | 0 | 0 | 0 |
| Scenedesmus quadricauda | 57 | 8 | 0 |
| Scenedesmus sp. | 0 | 0 | 0 |
| Selenastrum sp. | 0 | 0 | 0 |
| Staurastrum sp. | 0 | 0 | 0 |
| Stigeoclonium sp. | 0 | 0 | 0 |
| Cryptophyta | | | |
| Chroomonas sp. | 108 | 62 | 90 |
| Cryptomonas sp. | 25 | 14 | 32 |
| Cyanophyta | | | |
| Chroococcus sp. | 0 | 11 | 0 |
| Oscillatoria plantonica | 0 | 0 | 0 |
| Oscillatoria sp. | 0 | 0 | 0 |
| Unidentified colony | 0 | 0 | 0 |
| Pyrrhophyta | | | |
| Ceratium hirundinella | 0 | 0 | 0 |
| Peridiniopsis sp. | 0 | 0 | 0 |
| Peridinium sp. | 0 | 3 | 7 |
| Miscellaneous | | | |
| Unidentified unicellular alga | 0 | 0 | 0 |
| Total Count | 1131 | 869 | 1321 |

Scientific names of species present a special challenge in data reports because they must be underlined or italicized. Underlining and italics print are impossible in Supercalc but underlining can be done using Wordstar. The underlining command requires a CONTROL character (^) which cannot be entered in Supercalc. Instead, a symbol which will not appear anywhere else in the text must be substituted for the control character to mark the beginning and ending of underlining.

In Example 3: WS.XQT, a modified species list is stored in the file plws. In this list, \$ is substituted for the control character. Because trial and error proved that rows which had no underlining or two sets of underlining did not align properly, two other symbols, # and @, have been inserted to correct the problem. Their use will be explained below.

WS.XQT also includes some formatting (cf FIX.XQT), and adds two Wordstar commands, .op (omit page numbers) and .pa (begin a new page).

[Note that WS.XQT and BMERGE.XQT could have been written as one program. This was not done because it was useful to save the replicate cell counts in a single Supercalc file for further analysis.]

To produce the final table with an underlined species list, the output from WS.XQT is transferred to a Wordstar file and edited with the following sequence of commands:

^QA

find ? \$ replace?^PS options?ng

(This tells Wordstar to replace all occurrences of \$ with ^PS without asking.)

^QA

find?#replace? |SPACE| |SPACE| |SPACE| options?ng

^QA

find?@ |SPACE| replace? |RETURN| options?ng

WARNING: The replacement of every \$ with ^PS is SLOW.

The species list is now ready for printing. The final form produced with the Wordstar P(rint) command is as illustrated. You will see that the print quality of the underlined species list is inferior to the print quality of the other examples in this report. The species list was printed with the Lanpar Facit printer using the Osborne I and Wordstar. The other examples were printed with a laser printer controlled by the mainframe computer at Simon Fraser University (SFU).

The next section (page 74) describes the transfer of data from the Osborne I to other computer systems, including the mainframe at SFU. With the present Water Quality computer system, it is necessary to go through both transfer sequences described. That is, files must be transferred from the Osborne to the IBM-PC-XT and then from the PC to SFU.

CAUTION: Wordstar format commands do not work on Simon Fraser's MTS operating system. Problems with margins and page breaks may be encountered when Wordstar documents are printed by the SFU laser printer. In addition, the Wordstar underlining commands will not work. If underlining is desired, the TEXTFORM word processing package must be used.

A program similar to WS.XQT can be written to prepare tables containing underlined species lists for use with TEXTFORM. Since the number of lines per page printed by TEXTFORM and Wordstar differ, headings on the second and subsequent pages will need to be repositioned. As TEXTFORM uses different commands for "start underlining" and "stop underlining", a different character will have to be substituted for the second \$ bracketting each species, eg.

\$Achnanthes clevei?

After the file has been transferred to SFU, use the MTS editor to insert TEXTFORM underlining commands:

a@a/f '\$'' @nv

a@a/f '? '<f> @nv

To produce correct alignment of columns, change # and @ as described previously (page 65).

Insert a line before the first line of the table and enter

<inputmode=preformatted>

and renumber to ensure that this command line becomes line 1 of the file. The file is now ready to be formatted using TEXTFORM.

EXAMPLE 3: WS.XQT

```
/lplws,pa4:a133,a4
/fca,41
/bb3:d4
=c3
"      Replicates
/fec3,t1
/ir54
/ir55
/ir56
/ir57
/ir58
/ca1:d5,a54
=b54
"(Continued)
/feb54,t1
/ir105
/ir106
/ir107
/ir108
/ir109
/ir110
=a105
".pa
/ca54:d58,a106
/ir1
=a1
".op
/ir8
/ir10
/ir101
/ir103
/ir117
/ir135
/ir137
/ir145
/ir147
/ir151
/ir153
/ir140
/ir142
```

OUTPUT

.op
Date: August 19, 1982
Station: Birchbank

Replicates

Species

| | | | Replicates |
|---|-----|-----|------------|
| Chrysophyta | | | |
| Class Bacillariophyceae | | | |
| \$Achnanthes clevei\$ | 0 | 0 | 0 |
| \$Achnanthes flexella\$ | 0 | 0 | 0 |
| \$Achnanthes lanceolata\$ | 0 | 0 | 0 |
| \$Achnanthes minutissima\$ | 4 | 8 | 18 |
| \$Achnanthes\$ sp. | 0 | 0 | 0 |
| \$Amphipleura pellucida\$ | 0 | 0 | 0 |
| \$Asterionella formosa\$ | 25 | 11 | 39 |
| \$Ceratoneis arcus\$ | 0 | 0 | 0 |
| \$Ceratoneis arcus\$ var. \$amphioxys\$# | 0 | 0 | 0 |
| \$Cocconeis pediculus\$ | 0 | 0 | 0 |
| \$Cocconeis placentula\$ | 0 | 0 | 0 |
| \$Cyclotella bodanica\$ | 0 | 5 | 4 |
| \$Cyclotella comta\$ | 0 | 0 | 0 |
| \$Cyclotella glomerata\$ | 0 | 0 | 0 |
| \$Cyclotella kuetzingiana\$ | 0 | 0 | 0 |
| \$Cyclotella ocellata\$ | 0 | 0 | 0 |
| \$Cyclotella stelligera\$ | 0 | 0 | 0 |
| \$Cyclotella\$ sp. | 718 | 559 | 890 |
| \$Cymbella affinis\$ | 0 | 0 | 0 |
| \$Cymbella caespitosa\$ | 0 | 0 | 0 |
| \$Cymbella cistula\$ | 0 | 0 | 0 |
| \$Cymbella prostrata\$ | 0 | 0 | 0 |
| \$Cymbella turgida\$ | 0 | 0 | 0 |
| \$Cymbella ventricosa\$ | 4 | 5 | 0 |
| \$Cymbella\$ sp. | 0 | 0 | 0 |
| \$Denticula elegans\$ | 0 | 0 | 0 |
| \$Diatoma elongatum\$ | 0 | 0 | 0 |
| \$Diatoma hiemale\$ | 0 | 0 | 0 |
| \$Diatoma hiemale\$ var. \$quadratum\$# | 0 | 0 | 0 |
| \$Diatoma vulgare\$ | 0 | 0 | 0 |
| \$Diploneis decipiens\$ | 0 | 0 | 0 |
| \$Epithemia sorex\$ | 0 | 0 | 0 |
| \$Epithemia turgida\$ | 0 | 0 | 0 |
| \$Eunotia pectinalis\$ | 0 | 0 | 0 |
| \$Fragilaria capucina\$ | 0 | 0 | 0 |
| \$Fragilaria construens\$ | 0 | 0 | 18 |
| \$Fragilaria construens\$ var. \$binodis\$# | 0 | 27 | 0 |
| \$Fragilaria construens\$ var. \$venter\$# | 0 | 0 | 0 |
| \$Fragilaria crotensis\$ | 57 | 57 | 72 |
| \$Fragilaria leptostauron\$ | 0 | 0 | 0 |
| \$Fragilaria vaucheriae\$ | 0 | 0 | 0 |
| \$Gomphonema herculeanum\$ | 0 | 0 | 0 |
| \$Gomphonema intricatum\$ | 0 | 0 | 0 |
| \$Gomphonema olivaceum\$ | 0 | 0 | 4 |
| \$Gomphonema parvulum\$ | 0 | 0 | 0 |
| \$Gomphonema\$ sp. | 0 | 0 | 0 |

Date: August 19, 1982
 Station: Birchbank

(Continued)

| Species | | Replicates | |
|---|----|------------|----|
| \$Gyrosigma sciotense\$ | 0 | 0 | 0 |
| \$Melosira granulata\$ | 0 | 0 | 0 |
| \$Melosira granulata\$ var. \$angustissima\$# | 0 | 0 | 0 |
| \$Melosira herzogii\$ | 0 | 0 | 0 |
| \$Melosira italica\$ | 0 | 0 | 0 |
| \$Melosira varians\$ | 11 | 0 | 7 |
| \$Meridion circulare\$ | 0 | 0 | 0 |
| \$Navicula bicephala\$ | 0 | 0 | 0 |
| \$Navicula cryptocephala\$ | 0 | 0 | 0 |
| \$Navicula pelliculosa\$ | 0 | 0 | 0 |
| \$Navicula pupula\$ | 0 | 0 | 0 |
| \$Navicula radios\$ | 0 | 0 | 4 |
| \$Navicula salinarum\$ | 0 | 0 | 0 |
| \$Navicula salinarum\$ var. \$intermedia\$# | 0 | 0 | 0 |
| \$Navicula tripunctata\$ | 0 | 0 | 0 |
| \$Navicula\$ sp. | 0 | 8 | 0 |
| \$Neidium\$ sp. | 0 | 0 | 0 |
| \$Nitzschia acicularis\$ | 0 | 0 | 0 |
| \$Nitzschia actinasteroides\$ | 0 | 0 | 0 |
| \$Nitzschia dissipata\$ | 0 | 0 | 0 |
| \$Nitzschia filiformis\$ | 0 | 0 | 0 |
| \$Nitzschia linearis\$ | 0 | 0 | 0 |
| \$Nitzschia palea\$ | 0 | 8 | 0 |
| \$Nitzschia sigma\$ | 0 | 0 | 0 |
| \$Nitzschia\$ sp. | 0 | 0 | 0 |
| \$Rhizosolenia eriensis\$ | 22 | 0 | 18 |
| \$Rhizosolenia\$ sp. | 0 | 0 | 0 |
| \$Rhopalodia gibba\$ | 0 | 0 | 0 |
| \$Rhopalodia gibberula\$ | 0 | 0 | 0 |
| \$Stauroneis anceps\$ | 0 | 0 | 0 |
| \$Stephanodiscus astraea\$ | 0 | 0 | 0 |
| \$Stephanodiscus\$ sp. | 0 | 0 | 0 |
| \$Synedra acus\$ var. \$radians\$# | 0 | 0 | 0 |
| \$Synedra angustata\$ | 0 | 0 | 0 |
| \$Synedra ulna\$ | 0 | 0 | 4 |
| \$Synedra ulna\$ var. \$oxyrhynchus\$# | 0 | 0 | 0 |
| \$Synedra\$ sp. | 0 | 0 | 0 |
| \$Tabellaria fenestrata\$ | 0 | 14 | 11 |
| \$Tabellaria flocculosa\$ | 0 | 0 | 0 |
| Non-Diatom Chrysophyta | | | |
| \$Chromulina\$-like | 0 | 0 | 0 |
| \$Dinobryon bavaricum\$ | 0 | 0 | 0 |
| \$Dinobryon sertularia\$ | 39 | 35 | 39 |
| \$Mallomonas pseudocoronata\$ | 0 | 0 | 0 |
| \$Mallomonas\$ sp. | 11 | 0 | 0 |
| \$Ochromonas\$ sp. | 36 | 32 | 32 |
| .pa | | | |

Date: August 19, 1982
 Station: Birchbank

(Continued)

| Species | | Replicates | |
|--------------------------------|------|------------|------|
| Chlorophyta | | | |
| \$Ankistrodesmus falcatus\$ | 7 | 3 | 25 |
| \$Carteria\$ sp. | 0 | 0 | 0 |
| \$Chlamydomonas\$ sp. | 0 | 0 | 7 |
| \$Cosmarium\$ sp. | 7 | 0 | 0 |
| \$Crucigenia\$ sp. | 0 | 0 | 0 |
| \$Elakatothrix gelatinosa\$ | 0 | 0 | 0 |
| \$Elakatothrix\$ sp. | 0 | 0 | 0 |
| \$Franceia\$ sp. | 0 | 0 | 0 |
| \$Gemellicystis neglecta\$ | 0 | 0 | 0 |
| \$Gemellicystis\$ sp. | 0 | 0 | 0 |
| \$Gonium\$ sp. | 0 | 0 | 0 |
| \$Lagerheimia\$ sp. | 0 | 0 | 0 |
| \$Scenedesmus quadricauda\$ | 57 | 8 | 0 |
| \$Scenedesmus\$ sp. | 0 | 0 | 0 |
| \$Selenastrum\$ sp. | 0 | 0 | 0 |
| \$Staurastrum\$ sp. | 0 | 0 | 0 |
| \$Stigeoclonium\$ sp.* | 0 | 0 | 0 |
| Cryptophyta | | | |
| \$Chroomonas\$ sp. | 108 | 62 | 90 |
| \$Cryptomonas\$ sp. | 25 | 14 | 32 |
| Cyanophyta | | | |
| \$Chroococcus\$ sp. | 0 | 11 | 0 |
| \$Oscillatoria plantonica\$* | 0 | 0 | 0 |
| \$Oscillatoria\$ sp.* | 0 | 0 | 0 |
| Unidentified colony@ | 0 | 0 | 0 |
| Pyrrhophyta | | | |
| \$Ceratium hirundinella\$ | 0 | 0 | 0 |
| \$Peridiniopsis\$ sp. | 0 | 0 | 0 |
| \$Peridinium\$ sp. | 0 | 3 | 7 |
| Miscellaneous | | | |
| Unidentified unicellular alga@ | 0 | 0 | 0 |
| Total Count@ | 1131 | 869 | 1321 |

Date: August 19, 1982

Station: Birchbank

Replicates

Species

Chrysophyta

Class Bacillariophyceae

| | | | |
|--|-----|-----|-----|
| <i>Achnanthes olevei</i> | 0 | 0 | 0 |
| <i>Achnanthes flexella</i> | 0 | 0 | 0 |
| <i>Achnanthes lanceolata</i> | 0 | 0 | 0 |
| <i>Achnanthes minutissima</i> | 4 | 8 | 18 |
| <i>Achnanthes</i> sp. | 0 | 0 | 0 |
| <i>Amphipleura pellucida</i> | 0 | 0 | 0 |
| <i>Asterionella formosa</i> | 25 | 11 | 39 |
| <i>Ceratoneis arcus</i> | 0 | 0 | 0 |
| <i>Ceratoneis arcus</i> var. <i>amphioxys</i> | 0 | 0 | 0 |
| <i>Cocconeis pediculus</i> | 0 | 0 | 0 |
| <i>Cocconeis placentula</i> | 0 | 0 | 0 |
| <i>Cyclotella bodanica</i> | 0 | 5 | 4 |
| <i>Cyclotella comta</i> | 0 | 0 | 0 |
| <i>Cyclotella glomerata</i> | 0 | 0 | 0 |
| <i>Cyclotella kuetzingiana</i> | 0 | 0 | 0 |
| <i>Cyclotella ocellata</i> | 0 | 0 | 0 |
| <i>Cyclotella stelligera</i> | 0 | 0 | 0 |
| <i>Cyclotella</i> sp. | 718 | 559 | 890 |
| <i>Cymbella affinis</i> | 0 | 0 | 0 |
| <i>Cymbella caespitosa</i> | 0 | 0 | 0 |
| <i>Cymbella cistula</i> | 0 | 0 | 0 |
| <i>Cymbella prostrata</i> | 0 | 0 | 0 |
| <i>Cymbella turgida</i> | 0 | 0 | 0 |
| <i>Cymbella ventricosa</i> | 4 | 5 | 0 |
| <i>Cymbella</i> sp. | 0 | 0 | 0 |
| <i>Denticula elegans</i> | 0 | 0 | 0 |
| <i>Diatoma elongatum</i> | 0 | 0 | 0 |
| <i>Diatoma hiemale</i> | 0 | 0 | 0 |
| <i>Diatoma hiemale</i> var. <i>quadratum</i> | 0 | 0 | 0 |
| <i>Diatoma vulgare</i> | 0 | 0 | 0 |
| <i>Diploneis decipiens</i> | 0 | 0 | 0 |
| <i>Epithemia sorex</i> | 0 | 0 | 0 |
| <i>Epithemia turgida</i> | 0 | 0 | 0 |
| <i>Eunotia pectinalis</i> | 0 | 0 | 0 |
| <i>Fragilaria capucina</i> | 0 | 0 | 0 |
| <i>Fragilaria construens</i> | 0 | 0 | 18 |
| <i>Fragilaria construens</i> var. <i>binodis</i> | 0 | 27 | 0 |
| <i>Fragilaria construens</i> var. <i>venter</i> | 0 | 0 | 0 |
| <i>Fragilaria crotonensis</i> | 57 | 57 | 72 |
| <i>Fragilaria leptostauron</i> | 0 | 0 | 0 |
| <i>Fragilaria vaucheriae</i> | 0 | 0 | 0 |
| <i>Gomphonema herculeanum</i> | 0 | 0 | 0 |
| <i>Gomphonema intricatum</i> | 0 | 0 | 0 |
| <i>Gomphonema olivaceum</i> | 0 | 0 | 4 |
| <i>Gomphonema parvulum</i> | 0 | 0 | 0 |
| <i>Gomphonema</i> sp. | 0 | 0 | 0 |

Date: August 19, 1982

Station: Birchbank

(Continued)

| Species | | Replicates |
|--|----|------------|
| <u>Gyrosigma sciotense</u> | 0 | 0 |
| <u>Melosira granulata</u> | 0 | 0 |
| <u>Melosira granulata</u> var. <u>angustissima</u> | 0 | 0 |
| <u>Melosira herzogii</u> | 0 | 0 |
| <u>Melosira italica</u> | 0 | 0 |
| <u>Melosira varians</u> | 11 | 7 |
| <u>Meridion circulare</u> | 0 | 0 |
| <u>Navicula bicephala</u> | 0 | 0 |
| <u>Navicula cryptocephala</u> | 0 | 0 |
| <u>Navicula pelliculosa</u> | 0 | 0 |
| <u>Navicula pupula</u> | 0 | 0 |
| <u>Navicula radiosa</u> | 0 | 4 |
| <u>Navicula salinarum</u> | 0 | 0 |
| <u>Navicula salinarum</u> var. <u>intermedia</u> | 0 | 0 |
| <u>Navicula tripunctata</u> | 0 | 0 |
| <u>Navicula</u> sp. | 0 | 8 |
| <u>Neidium</u> sp. | 0 | 0 |
| <u>Nitzschia acicularis</u> | 0 | 0 |
| <u>Nitzschia actinasteroides</u> | 0 | 0 |
| <u>Nitzschia dissipata</u> | 0 | 0 |
| <u>Nitzschia filiformis</u> | 0 | 0 |
| <u>Nitzschia linearis</u> | 0 | 0 |
| <u>Nitzschia palea</u> | 0 | 8 |
| <u>Nitzschia sigma</u> | 0 | 0 |
| <u>Nitzschia</u> sp. | 0 | 0 |
| <u>Rhizosolenia eriensis</u> | 22 | 18 |
| <u>Rhizosolenia</u> sp. | 0 | 0 |
| <u>Rhopalodia gibba</u> | 0 | 0 |
| <u>Rhopalodia gibberula</u> | 0 | 0 |
| <u>Stauroneis anceps</u> | 0 | 0 |
| <u>Stephanodiscus astraeae</u> | 0 | 0 |
| <u>Stephanodiscus</u> sp. | 0 | 0 |
| <u>Synedra acus</u> var. <u>radians</u> | 0 | 0 |
| <u>Synedra arqustata</u> | 0 | 0 |
| <u>Synedra ulna</u> | 0 | 4 |
| <u>Synedra ulna</u> var. <u>oxyrhynchus</u> | 0 | 0 |
| <u>Synedra</u> sp. | 0 | 0 |
| <u>Tabellaria fenestrata</u> | 0 | 14 |
| <u>Tabellaria flocculosa</u> | 0 | 0 |
| Non-Diatom Chrysophyta | | |
| <u>Chromulina-like</u> | 0 | 0 |
| <u>Dinobryon bavaricum</u> | 0 | 0 |
| <u>Dinobryon sertularia</u> | 39 | 35 |
| <u>Mallomonas pseudocoronata</u> | 0 | 0 |
| <u>Mallomonas</u> sp. | 11 | 0 |
| <u>Ochromonas</u> sp. | 36 | 32 |

Date: August 19, 1982
Station: Birchbank

(Continued)

Replicates

Species

Chlorophyta

| | | | |
|--------------------------------|----|---|----|
| <u>Ankistrodesmus falcatus</u> | 7 | 3 | 25 |
| <u>Carteria</u> sp. | 0 | 0 | 0 |
| <u>Chlamydomonas</u> sp. | 0 | 0 | 7 |
| <u>Cosmarium</u> sp. | 7 | 0 | 0 |
| <u>Crucigenia</u> sp. | 0 | 0 | 0 |
| <u>Elakatothrix gelatinosa</u> | 0 | 0 | 0 |
| <u>Elakatothrix</u> sp. | 0 | 0 | 0 |
| <u>Franceia</u> sp. | 0 | 0 | 0 |
| <u>Gemellicystis neglecta</u> | 0 | 0 | 0 |
| <u>Gemellicystis</u> sp. | 0 | 0 | 0 |
| <u>Gonium</u> sp. | 0 | 0 | 0 |
| <u>Lagerheimia</u> sp. | 0 | 0 | 0 |
| <u>Scenedesmus quadricauda</u> | 57 | 8 | 0 |
| <u>Scenedesmus</u> sp. | 0 | 0 | 0 |
| <u>Selenastrum</u> sp. | 0 | 0 | 0 |
| <u>Staurastrum</u> sp. | 0 | 0 | 0 |
| <u>Stigeoclonium</u> sp.* | 0 | 0 | 0 |

Cryptophyta

| | | | |
|------------------------|-----|----|----|
| <u>Chroomonas</u> sp. | 108 | 62 | 90 |
| <u>Cryptomonas</u> sp. | 25 | 14 | 32 |

Cyanophyta

| | | | |
|-----------------------------------|---|----|---|
| <u>Chroococcus</u> sp. | 0 | 11 | 0 |
| <u>Oscillatoria planctonica</u> * | 0 | 0 | 0 |
| <u>Oscillatoria</u> sp.* | 0 | 0 | 0 |
| Unidentified colony | 0 | 0 | 0 |

Pyrrhophyta

| | | | |
|------------------------------|---|---|---|
| <u>Ceratium hirundinella</u> | 0 | 0 | 0 |
| <u>Peridinopsis</u> sp. | 0 | 0 | 0 |
| <u>Peridinium</u> sp. | 0 | 3 | 7 |

Miscellaneous

| | | | |
|-------------------------------|---|---|---|
| Unidentified unicellular alga | 0 | 0 | 0 |
|-------------------------------|---|---|---|

| | | | |
|-------------|------|-----|------|
| Total Count | 1131 | 869 | 1321 |
|-------------|------|-----|------|

DATA TRANSFERS

The communications protocol for the data transfers described below employs the 3101 Terminal Emulator Program.

Osborne to PC

Data tables or data matrices stored in SUPERCALC (.CAL) files may be transferred directly to the IBM-PC-XT with the /OUTPUT command.

1. Connect the Osborne to the PC with a cable (Remove the cable attached to the PC from DB-25 wall plug and attach it to the RS-232C serial plug on the front of the Osborne (the plug to which the printer attaches)).
2. Prepare the PC to receive data. When the C prompt

C>

appears, type

osb

This batch program enables the PC to interpret output from the Osborne.

3. Using the Supercalc /LOAD command, bring the file you wish to transfer into the workspace.
4. On the PC, type

ALT F3

(ie., hold down the ALT key while pressing down the F3 key).

The computer will respond

Enter name of diskette file to be written:

If you wish to store the file on a floppy disk, type

a:filename.prn

If you wish to store the file on the hard disk (drive C), simply type

filename.prn

[Note: to access transferred files stored on drive C, it is necessary to include the directory name

term

with the dir or type command (ie., if the 3101 terminal emulator program is stored in the directory/term, to find the file one must either change the directory to term or call up the file as /term/filename.)]

5. On the Osborne type

DD [first column row:last column row], P.

Supercalc "thinks" it is sending the file to the printer, but actually sends it to the PC. You should be able to see the file being printed on the PC screen.

[Note: Before transferring the first file, it is a good idea to check Setup and make sure that page length is set to 0 for continuous flow.]

6. When the transfer is complete (indicated by "End of Report" appearing on the Osborne screen), type

ALT F3

on the PC. The PC will respond with

Download terminated

7. Another file can be transferred if desired by repeating steps 3-6. When all files have been transferred, end the communication program by typing

ALT F10

Wordstar (.PRN) files can be transferred in a similar manner. In place of steps 3 and 5, use the Wordstar command disk and the PRINT (P) option. Several Wordstar files can be combined into one file on the PC with the MERGE-PRINT (M) Command. Respond to all prompts as if the file(s) were being sent to the printer.

PC to MTS

Data can be transferred from the IBM-PC-XT to a mainframe computer which uses the MTS operating system (eg. SFU, UBC) with the batch program MTS.

1. When the C> appears on the PC, type

MTS

which calls the terminal emulator program and sets up the PC for communication with the mainframe.

2. Hit

ENTER (_I)

to begin communication with SFUnet, and then specify the system with which you wish to communicate (eg. g, ubc).

3. When the prompt (#) appears, type

%term pc3101

You are now ready to signon, using the PC as a terminal.

4. After signing on, enter

%xxi on

%xxo on

to insure that SFUnet handles data flow correctly

5. Create a file (or files) in which to store your data - by typing

CRE Filename1

CRE Filename2

Then enter

COPY *MSOURCE* Filename

6. When the prompt (>) appears, enter

ALT F5

The PC will respond

Enter name of diskette file to copy to host:

Enter name of the file to be transferred (prefaced by a: if the file is on a floppy disk), and the transfer will begin. You can see the file being printed on the screen.

7. When the PC signals

Upload complete

hit the END key. MTS will respond with

END OF FILE

and the # prompt.

8. You can now transfer another file by repeating steps 6 and 7, edit the file, or do any other activity you would carry out in a normal terminal session. Signing off ends the session as usual.

9. To exit the terminal emulator program, press

ALT F10

It is possible to exit the terminal emulator without signing off and without breaking the link to the mainframe (eg., you may wish to check a directory to find the name of a file for transferring). To return to terminal mode type

MTS

again.

10. Transferring files with exceptionally long lines may present special difficulties. Transfer may stop at the end of each line and resume only when the ENTER key is pressed. Also, characters or whole lines may be dropped. If you encounter these problems, substitute the batch program MTSLL for MTS.

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