4-25-1995

Phytoplankton in Mt. St. Helens Lakes, Washington

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<https://doi.org/10.15760/etd.6893>

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THESIS APPROVAL

The abstract and thesis of Cynthia Fay Baker for the Master of Science in Biology were presented April 25, 1995, and accepted by the thesis committee and the department.

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ABSTRACT

An abstract of the thesis of Cynthia Fay Baker for the Master of Science in Biology presented April 25, 1995.

Title: Phytoplankton in Mount St. Helens Lakes, Washington

Phytoplankton communities in fifteen lakes in the Mt. St. Helens area were surveyed to assess the abundance and species present. Eleven of the lakes were inside the blast zone of the 1980 eruption and four were located outside the blast zone as a comparison. The hypothesis is that lakes will cluster together based on the algal species present and that some algae will be correlated with certain environmental conditions.

A cluster analysis was performed to determine if the lakes would group together based on algal abundance. There did not appear to be any distinct clustering among the study lakes, but this analysis did help to sort out some similarities of algal species present between lakes. It demonstrated that the lakes outside the blast zone were not functional as control lakes because they were very different from the blast-zone lakes. They had different assemblages of algae and their origin was so different from the blast-zone lakes that there was little overlap between them.

The factor analysis was applied to determine the relationships between environmental variables and phytoplankton. The hypothesis is that certain algae are associated with each other and with identifiable environmental factors. Factor analysis should detect these patterns. The factors represent some condition in the environment but the analysis would be virtually meaningless unless these conditions can be recognized and the factors named. From the factor analysis alone, I could not name the factors but

returned to the task after the canonical correlation analysis was performed. The canonical correlation analysis gave some clues to identify the environmental conditions that exert control on these algae.

The most useful statistical technique used in this study was the canonical correlation analysis. This analysis is a useful tool in community ecology studies where species-environment relationships can be inferred from community composition and environmental data. The environmental data used was nutrient and light attenuation present at the time the phytoplankton samples were taken. From this analysis I summarized a list of algae and with what environmental conditions that they are associated.

Trophic state categories were assigned to the lakes from a trophic state index based on phytoplankton biovolume.

(
PHYTOPLANKTON IN MOUNT ST. HELENS LAKES, WASHINGTON
)

by

CYNTHIA FAY BAKER

A thesis submitted in partial fulfillment of the
requirements for the degree of

MASTER OF SCIENCE
in
BIOLOGY

Portland State University
1995

ACKNOWLEDGEMENTS

Many people contributed to this work for whom I would like to show my appreciation by mentioning. Dr. Richard Petersen, my graduate advisor, gave me the opportunity to do this work. Many students of his participated in collecting the samples. I am very grateful to Jim Sweet for helping me learn to identify the phytoplankton and for all of his reliable advice throughout this project. Dr. Bob Fountain and Damon Shepherd from the statistic counseling service provided the statistical analysis, advice on the interpretation of their analysis, and were patient with me as I tried to understand the techniques that they used. Nutrient data used in the canonical correlation analysis and my discussion of the ordination diagrams was provided by Kurt Carpenter. The map of the study area is due largely to Dr. Joe Porasky who helped my learn how to make the map and assisted with its editing. I thank my committee members: Dr. Richard Petersen, Dr. Mark Sytsma, Dr. John Reuter, and Dr. Bob Fountain for their advice and ideas. I would like to thank my family for their encouragement to continue my education, especially the unwavering support of my husband, Thomas.

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Introduction

Mount St. Helens has drawn interest from the scientific community since its eruption on May 18, 1980 as it has provided an opportunity to study an environment which has undergone a large-scale natural disturbance. Lakes inside the blast zone were chosen as study lakes and compared with lakes outside the blast zone. This paper covers the phytoplankton portion of the study. It is a mensurative experiment. The phytoplankton communities were surveyed and the relationships between the algae in these assemblages and the chemical and physical environment are described in this work. The hypothesis is that some algae will be correlated with certain environmental conditions. Samples (208 total, see Appendix A) from 15 lakes were collected during 1992 and 1993 on several sampling trips. Phytoplankton in the samples were identified and counted. A cluster analysis, factor analysis, and a canonical correlation analysis was performed with the help of the Statistic Counseling Service at Portland State University.

The cluster analysis is a procedure used to form groups of similar objects. The purpose of this cluster analysis is to determine if lakes are similar based on which algae were present in the samples and the quantity that were present. In a similar study, Allen and Koonce (1973) used an agglomerative cluster analysis to identify the functional place of algal species in a lake community. They identified persistent species with slow growth rates or rarer species with rapid growth rates.

Norusis (1993) defines the factor analysis as a statistical technique used to identify a small number of factors that can be used to represent relationships among sets of many interrelated variables; groups of variables constitute the factors. In this thesis, many algal

species were identified in the lakes and it was the goal to fit them into a much smaller number of factors. Phytoplankton species that are similar were put in the same factor, but some species appear in more than one factor. Algae can be positively or negatively correlated with a particular factor. A positive correlation reveals that particular alga belongs with the factor. Likewise, a negative correlation means that that species will probably not be present when the other species that positively correlate with that factor group are present. Canonical correlation analysis is a useful tool in community ecology studies where species-environment relationships can be inferred from community composition data and associated habitat measurements (ter Braak 1986). The data set included: 1) abundance of phytoplankton species at a series of sites (lake, depth, time); and 2) environmental variables including nutrients and light attenuation. The canonical correlation analysis summarizes the main variation in the species data by ordination and relates the ordination axes to the environmental variables by calculating coefficients. The result can be shown graphically (ter Braak 1986).

Trophic state indices were calculated from phytoplankton biovolume data and lakes are described by their trophic categories.

Study Lakes:

Fifteen lakes in the Mt. St. Helens area (Table 1) were sampled during 1992-93 to assess the biological, chemical, and physical characteristics of the lakes; eleven lakes were located within the blast zone of Mt. St. Helens and four were located out of this zone south of the volcano (Figure 1). Coldwater and Castle lakes were created as a result of the May 1980 eruption and are in the blast zone; other lakes within the blast zone are:

Boot, Fawn, Hanaford, Meta, Panhandle, Ryan, Spirit, St. Helens, and Venus. Lakes outside the blast zone include: Blue, June, McBride and Merrill which were sampled for comparison.

Table 1. Brief Description of the Study Lakes

Lake	Elevation (meters)	Max. Depth (meters)	Origin
Blue	1200	23	cirque
Boot	1415	14.5	cirque
Castle	740	32	debris avalanche
Coldwater	740	62	debris avalanche
Fawn	1200	18	cirque
Hanaford	1260	16	cirque
June	985	1.5	landslide/basalt flow
McBride	862	2	landslide
Merrill	474	18	debris avalanche
Meta	1097	8	cirque
Panhandle	1415	18	cirque
Ryan	1018	7	cirque
Spirit	1330	34	debris avalanche
St. Helens	1405	>90	maar
Venus	1415	39	cirque

Lakes in the blast zone were either: 1) newly formed or directly impacted by mudflow, debris avalanche, or pyroclastic deposits (Spirit, Castle and Coldwater lakes); or 2) in the area where timber was blown down or scorched by the blast of hot volcanic gases, and a thick layer of volcanic ash was deposited (Boot, Fawn, Hanaford, Meta, Panhandle, Ryan,

St. Helens, and Venus lakes) (McKnight, Klein, and Wissmar 1980). Mudflows and debris avalanches inundated the Toutle River Valley and formed new lakes by damming Castle and Coldwater creeks on the North Fork of the Toutle River (Wissmar, DeVol, Nevissi, Sedell 1982). Both Castle and Coldwater lakes started out as two smaller lakes, East Castle and West Castle lakes and North Coldwater and South Coldwater lakes. Over a period of time, snowmelt and rain filled them making one larger lake.

Prior to the eruption Spirit Lake was a relatively pristine, sub-alpine lake, but "massive debris and pyroclastic loadings to Spirit Lake raised the lake level ~40m and increased the surface area by ~30 percent" (Wissmar, Devol, Nevissi, Sedell 1982). The lake's natural outlet was blocked by a debris dam 150-180 meters thick (US Army Corps of Engineers 1987). Lake water elevation and volume steadily increased from inflow and the U.S. Army Corps of Engineers was concerned that the dam would be breached. Between June 1984 and April 1985 they constructed a 2592 meter-long tunnel from Spirit Lake to the North Fork Toutle River via South Coldwater Creek (US Army Corps of Engineers 1987). The tunnel is now the outlet for the lake.

Lake watersheds to the north of Coldwater Creek were characterized by denuded vegetation, snapped trees, heavy ashfall, and heat effects. These lakes include Boot, Fawn, Hanaford, Meta, Panhandle, Ryan, Spirit, St. Helens and Venus. Blue, June, McBride, and Merrill lakes received only ashfall (Baross, et al. 1982).

Methods

Sampling Procedure:

Phytoplankton samples were collected using a 2.5 liter Van Dorn bottle and were transferred to 250 ml HDPE Nalgene sample bottles. Pseudo-replicate samples (replicate sample bottles were filled from the same grab sample, but were treated as replicates from the lake) were taken at the deepest part of the lake from 1 meter below the surface, the thermocline (where temperature change was rapid relative to vertical distance), and 1 meter from the bottom. Samples are considered pseudo-replicates because sample bottles were filled from the same grab sample, but were treated as true replicates of the lake when the F-test was performed in the canonical correlation analysis. If the samples were true replicates of the lake, they would not have been filled from water of the same Van Dorn bottle. For the cluster analysis, factor analysis, and canonical correlation analysis, the purely data analysis portion of these routines are not affected by whether the samples were pseudo-replicates or true replicates. The canonical correlation analysis was functional as an analytic tool, but any hypothesis (such as the F-test determining which canonical pair were significant) drawn from it could be affected by pseudo-replication. In shallow lakes that do not stratify, like June and McBride lakes, only two samples were taken, one near the surface and one near the bottom. Only epilimnion samples were taken at Spirit lake and sample depths for Blue lake only included the surface and 10 meters.

In most lakes, samples were collected at the deepest part of the lake. In Coldwater, Castle, and Merrill Lakes samples were collected at two sites as the shapes of these lakes are long and narrow. Lugol's solution was used to preserve the samples; two

milliliters or more of Lugol's solution was put into the samples for approximately a 1% solution and the desired color was achieved. Samples were taken in the daytime from mid-morning to afternoon.

Laboratory Methods:

Preserved samples were permanently mounted onto slides. Aliquots of samples were filtered (using 10 cm Hg vacuum) onto Gelman 0.45 μm , 25 mm Metrical® membrane filters and allowed to dry overnight. The aliquots were 100 ml unless it appeared that the phytoplankton was too dense on the slide or there was too much debris. If so, the sample was refiltered with a smaller aliquot. Edges of the round filters were cut off so they would fit onto the slide. Drops of immersion oil were applied to the dried filter on the slide. When the filter cleared a cover slip was placed on top and clear fingernail polished was painted over the edges of the coverslip to seal it onto the slide.

Identification and Counting:

After the samples were permanently mounted onto slides they were ready for phytoplankton identification and counting. A Zeiss phase-contrast microscope at 1000X magnification was used. A transect on the slide was chosen and the distance that was scanned was recorded in order to calculate the area in which the phytoplankton were counted. At least 100 "algal units (defined as discrete particles - either cells, colonies, or filaments)" (Sweet 1986) or three transects were counted per sample. In low-density samples less than 100 algal units were counted due to time constraints. If fewer than 50 algal units were not counted in three transects I counted all algae in three complete transects (Table 2).

Biovolume estimates were calculated based on conversion factors developed by Sweet (1986). He obtained average biovolume estimates of each species from calculations of microscopical measurements of the dimensions of each alga. These measurements were used to define the three-dimensional shape of the alga giving biovolume in units of $\mu\text{m}^3/\text{ml}$.

For quality assurance, 7.7% of the samples were recounted to measure precision. Jim Sweet of Aquatic Analysts recounted an additional 7.7% of the samples for a measure of accuracy.

Table 2. Samples in which less than 100 algal units were counted.

Lake	Lab Code	Date	Depth	Units Counted	Density (#/ml)
Coldwater	04-05	10/2/93	hypolimnion	52	11.8
Coldwater	04-06	10/2/93	hypolimnion	33	7.0
Coldwater	04-18	8/4/93	hypolimnion	11	5.9
Coldwater	04-24	8/4/93	hypolimnion	50	24.7
Coldwater	04-25	8/4/93	hypolimnion	50	25.8
Hanaford	06-05	8/5/93	epilimnion	43	25.7
St. Helens	14-03	9/92	hypolimnion	13	6.7
St. Helens	14-08	8/10/93	hypolimnion	12	6.0
Venus	15-04	8/10/93	epilimnion	19	9.8
Venus	15-05	8/10/93	epilimnion	26	12.9

Data Analysis:

Raw data were recorded onto a data sheet and later transferred to a spreadsheet (Appendix A) and a taxonomic list of the algae in each lake can be found in Appendix B.

A trophic state index (TSI) based on phytoplankton biovolume was calculated based on Sweet (1986).

$$\text{TSI} = (\log_{10} (B+1)) \times 20, \text{ where } B = \text{phytoplankton biovolume } (\mu\text{m}^3/\text{ml})/1000$$

Lakes may be classified as ultraoligotrophic, oligotrophic, mesotrophic, eutrophic or hypereutrophic (from relatively non-productive to very productive).

A cluster analysis was performed on the phytoplankton data to determine if the lakes would cluster into distinct categories based on the presence of algal species. The hypothesis is that lakes will cluster together based on their similarities. The data were organized in two spreadsheets; one with the total biovolume ($\mu\text{m}^3/\text{ml}$) per algal species for each sample, and the other with the total density (# algal units/ml) per algal species for each sample. The spreadsheets were arranged so that each species of alga encountered in this study was recorded in a particular column. Each sample, identified by a unique lab code, was entered in a particular row. The spreadsheets were filled in such a way that if a species was identified in a particular sample the biovolume or density of that alga was recorded in the appropriate cell block. Of course, most of the cell blocks had a zero since only few of the algae were identified in any one sample. Dimensions of the spreadsheets were 106 species across and 208 samples long.

The program, SPSS for Windows 6.0, was used to generate:

- a hierarchical clustering of cases (samples)
- a k-means clustering of cases (samples)

SPSS makes a squared Euclidean dissimilarity coefficient matrix where cases are in the columns as well as rows and all pairs of cases have a value which is the distance between

the two cases. The squared Euclidean distance is a commonly used index which is the sum of the squared differences over all the variables. The method used to form clusters was an agglomerative hierarchical cluster analysis. The criterion for deciding which cases or clusters should be combined at each step was the nearest neighbor technique. The hierarchical cluster analysis procedure results in a series of solutions corresponding to different numbers of clusters.

The k-means cluster analysis procedure produces only one solution for the number of clusters requested, which must be specified by the user. Hierarchical cluster analysis is a useful start to determine the initial cluster centers for the k-means cluster analysis. In a hierarchical method a tree or icicle diagram represents a gradient of all the solutions; it starts out with every case in its own cluster, then it starts joining cases and clusters until, at the end, there is only one cluster. If five solutions are requested, the k-means method will cut the hierarchical diagram where there are five clusters.

Factor analysis was used to determine if there were any associations among the algal species identified in the samples. SAS was used to perform two factor analyses on algal data; one using biovolume data and one using density data. The same initial matrices for the cluster analysis were used in the factor analysis. Factor analysis identifies a small number of factors that can be used to represent relationships among sets of many interrelated variables. Each variable is expressed as a linear combination of factors that are not actually observed. A symmetric correlation matrix for all variables is computed. This matrix has the algal species in both the rows and the columns, and values represent linear combinations of these variables. From the matrix, the program finds Eigenvalues

and Eigenvectors which form the principal components. Principal components is the factor extraction method. It retains a subset of the principal components based on Kaiser's rule, where factors are kept if the Eigenvalue is greater or equal to one. After identifying the factors, an orthogonal rotation of the factors is done to transform the initial matrix into one that is easier to interpret. When the axes are maintained at right angles the rotation is called orthogonal. Rotation redistributes the explained variance for the individual factors. The algorithm used for orthogonal rotation to a simple structure is the varimax method, which minimizes the number of variables that have high loadings on a factor. Linear combinations which represent algae were put into factor groups if the correlation was greater than 0.5.

Canonical correlation analysis (CCA) explains the relationship between two sets of variables by finding a small number of linear combinations from each set of variables that have the highest possible between-set correlations. In this analysis data on algal abundance is used in the cluster and factor analysis with the addition of environmental variables (chemical variables) for the CCA. Two CCA were run for both the biovolume and density data; the first (CCA #1) included all of the lake samples plus PO_4 , $\text{NO}_3 + \text{NO}_2$, NH_4 , and SiO_2 as environmental variables. For the second CCA (CCA #2) June Lake samples were removed and light attenuation (natural log of the extinction coefficient) was included in the environmental variables. There were no nutrient data available for Blue or Spirit Lakes, so they were not included in the CCA. Also, nutrient data was not available for fall 1992 samples or samples from Coldwater Lake on 3/24/93. The program SAS was used for the CCA and the CANCORR procedure was used to find a linear

combination from each set, called a canonical variable, such that the correlation between the two variables is maximized. The coefficients of the linear combinations are canonical weights. Only those canonical dimensions which the F-test shows to be significant are considered. The F-test is SAS's version of Bartlett's chi squared test. Both canonical weights and canonical variates are interpreted by considering the magnitude of each value in relation to the direction of their signs.

Results and Discussion

There did not appear to be any distinct clustering among the lakes studied based on algal abundance, but the cluster analysis did bring many similarities to light. The lakes were clustered by biovolume of the algae present in the samples and by the density of algae present in the samples. When samples were forced into five clusters by the k-means method, there was one sample in clusters one through four, with the rest of the samples appearing in cluster five. If the samples were forced into 30 and 40 clusters the large group of samples could be broken up. Several samples stood apart so far from the others that when five clusters were requested, four samples appeared in their own cluster. By forcing samples into a large number of clusters some similarities became apparent. Each method brought out different characteristics: Clustering by biovolume brought out the species that were large relative to the assemblage in the sample. For example, a rare species in the sample that was large could overshadow a common species with a small biovolume. Clustering by density highlighted the species that were common even though they may not have represented much of the biovolume.

Patterns found clustering by biovolume:

Clustering by biovolume showed that *Cyclotella comta* was a dominant diatom in Coldwater, Fawn, and Hanaford Lakes (Table 3). Boot and Panhandle Lakes grouped together fairly well according to the biovolume clustering. Samples taken in Boot Lake during the summer of 1993 at the surface were clustered with epilimnion samples from Panhandle Lake taken during the summer due to the biovolume of *Glenodinium sp.* and *Fragilaria crotonensis*. Summer metalimnion samples of Boot Lake clustered with

summer metalimnion samples of Panhandle Lake; there were large biovolumes of *Fragilaria crotonensis* with *Glenodinium sp.* or *Dinobryon sp.* as the sub-dominant species. Summer 1993 Castle Lake samples and samples from Blue Lake (7/11/93) are similar because of the dominance of a *Chlamydomonas*-like alga and *Glenodinium sp.* (Table 4). In some clusters there were only a pair of sample replicates which indicates that those replicates were similar. There was a "catch-all" cluster which seemed to have samples from many different lakes dominated by different species, but with similar biovolume. Two clusters had only a few samples from different lakes based on common algae, but with no discernable pattern.

Table 3. Abundance of *Cyclotella comta* in Coldwater, Fawn, and Hanaford lakes by average percent biovolume.

Date	Depth (-limnion)	Coldwater (average % biovolume)	Fawn (average % biovolume)	Hanaford
10/92	epi			77.6*
10/92	meta			77.6*
10/92	hypo	57.7*		82.7*
3/24/93	epi	39.1		
3/24/93	meta	52.7		
3/24/93	hypo	28.2		
8/4/93	epi	33.3	53.3	
8/4/93	meta	60.3	68.7	
8/4/93	hypo	71.0	36.7	
8/4/93	prod.	90.0* (15M)		
10/2/93	epi	50.7	20.2	66.6
10/2/93	meta	62.0	34.8	80.1
10/2/93	hypo	67.4	77.6	64.4
10/2/93	prod.	54.1* (4M)	73.6*	72.5*

*no replicates averaged

Table 4. Comparison of *Chlamydomonas-like* sp. (CHLK) and *Glenodinium* sp. (GDXX) in Castle and Blue lakes by average percent biovolume.

Castle Lake (9/17/93)			Blue Lake (7/11/93)		
Depth	CHLK	GDXX	Depth	CHLK	GDXX
epilimnion	43%	19.9%	1M	43.1%*	42.2%*
metalimnion	62.4%	9.9%	10M	39.1%*	45.1%*

*no replicates averaged

June and Spirit lakes stood out based on the species of algae present. June Lake was unusual because its phytoplankton assemblage consisted strictly of diatoms, many of

which were identified only in this lake. Spirit Lake samples (Summer 1993) clustered together based on the presence of *Fragilaria crotonensis* and *Cyclotella comta*.

Patterns found clustering by density:

Clustering the samples by density of the algae revealed more groupings of the samples due to similar algae. Fall 1993 samples from Merrill and Hanaford Lakes had high densities of *Chromulina sp.* and *Rhodomonas minuta* (Table 5). *Kephyrion sp.* was a dominant species in several lakes including: Coldwater (3/24/93) at all depths; Ryan (8/24/93) epilimnion and hypolimnion, and (10/9/93) at all depths; Meta (10/9/93) hypolimnion; all of the samples from Castle Lake. *Dinobryon sp.* was common in Panhandle and Boot lakes, but was probably underestimated because the lorica surrounding the chloroplast was not always visible. In a later analysis of prepared slides of Boot Lake for *Dinobryon sp.* I found that epilimnion and metalimnion samples taken on 8/15/93 had many *Dinobryon sp.* and hypolimnion (8/15/93) and Fall 1992 metalimnion and hypolimnion samples had fewer. *Ochromonas sp.* was dominant in Meta Lake (10/9/93) in the epilimnion and metalimnion, and also in Boot Lake (8/15/93) in the hypolimnion. *Fragilaria crotonensis* was the most common species in McBride Lake (5/28/93) metalimnion and hypolimnion; Spirit Lake (Summer 1993) in the epilimnion; Boot Lake (9/92) at all depths of the water column; and Panhandle Lake (8/14/93) in the epilimnion and metalimnion. St. Helens Lake was dominated by *Ankistrodesmus falcatus* during the sample period (9/92) metalimnion and (8/10/93) epilimnion and metalimnion (average 74.3% algal units/ml) This taxon was also common (86.5% average density) in Ryan lake during part of its yearly cycle; (6/17/93) at all depths.

Table 5. Comparison of *Chromulina* sp. (KMXX) and *Rhodomonas minuta* (RDMN) in Merrill and Hanaford lakes by average percent density.

	Merrill Lake (10/17/93)		Hanaford Lake (10/2/93)	
Depth	KMXX	RDMN	KMXX	RDMN
epilimnion	47.8	26.4	70.6	9.0
metalimnion	55.1	24.7	72.4	13.4
hypolimnion	50.4	27.1	63.3	9.1

Coldwater Lake grouped with Fawn and Hanaford lakes because of the similar biovolume of *Cyclotella comta*. However, the data from Coldwater Lake produced very different results because of the abundance of *Planktosphaeria gelatinosa* (Table 6).

Table 6. Abundance of *Planktosphaeria gelatinosa* found in Coldwater Lake by average percent density.

Date	Depth	% PTGL
10/9/92	metalimnion	12.6*
3/24/93	epilimnion	7.8 (site 1 only)
3/24/93	metalimnion	21.8
3/24/93	hypolimnion	5.3
8/4/93	epilimnion	54.7
8/4/93	metalimnion	69.2
8/4/93	hypolimnion	16.0 (site 2 only)
8/4/93	productivity (4M)	75.3*
8/4/93	productivity (15M)	54.8*
10/2/93	epilimnion	85.0
10/2/93	metalimnion	41.4%
10/2/93	hypolimnion	73.5 (site 2 only)

*no replicates averaged

Venus Lake was dominated by species not found in other lakes. *Cyclotella stelligera* was found at all three depths sampled in 9/92 (average 86.9% of the density). *Crucigenia fenestrata* was 87.5% of the biovolume in the metalimnion samples from 8/10/93.

Comparison of dominant phytoplankton:

Phytoplankton data from 13 of the study lakes were compared to examine which algae dominate the communities at the depth of one meter in samples taken in the summer of 1991 and the summer of 1993. Unpublished data from 1991 were used in this comparison; students from Portland State University collected epilimnion samples in the manner described under *sampling procedure* and Aquatic Analysts (AA) counted and identified the phytoplankton. Data from 1993 are taken from this study (PSU). Two sample dates from 1993 and their respective data are presented for June, McBride, Meta, and Ryan Lakes as neither 1993 sample dates were very close to the 1991 sample date (Table 7). Dominant species in Boot, Fawn, June, McBride, Merrill and Meta Lakes present in 1991 were found in the same lakes in 1993, but not in the same proportion (Table 7). Hanaford, Panhandle, Ryan, St. Helens, and Venus Lakes did not have the same phytoplankton dominating the assemblage in 1993 as they did in 1991. All data tabled from 1993 had sample replicates and were averaged. Sample replicates from Hanaford Lake had a significant amount of variation; sample 06-04 had a density of 158.8 algal units/ml and sample 06-05 had only 25.7 algal units/ml and only 43 algal units were counted in this sample. Only data from sample 06-04 were reported in the table. It may be that these were true replicates (did not come from the same grab sample) or that they were not properly mixed before filtering. Sample replicates from Venus Lake also had a

high degree of variation, but they both had low densities of algae present and only 26 and 19 algal units were counted. In one sample (15-04) *Crucigenia quadrata* was the dominant alga, while in the replicate (15-05) *Crucigenia fenestrata* was the dominant taxon. Coldwater and Castle Lakes were compared on a different table (Table 8) because there were two samples per lake being compared and data in the PSU data were the average of sample replicates from both sites one and two. June samples of Castle Lake were dominated by *Cryptomonas erosa* in both years. September samples from this lake had different algae dominating the assemblage in the 1991 samples compared to the 1993 samples. Samples from Coldwater lake had a high density of *Planktosphaeria gelatinosa* in 1993, which differed from the algal species reported in 1991. *Cyclotella comta* dominated the phytoplankton biovolume in Coldwater Lake in both sample dates in 1991 and 1993.

Table 7. Comparison of phytoplankton in lakes analyzed by Aquatic Analysts (AA) and Portland State University (PSU).

Lake	AA sample dates	PSU sample dates	AA % density	PSU % density*	AA % biovolume	PSU % biovolume*
Boot	8/14/91	8/15/93	<i>Glenodinium</i> sp. 34.7; <i>Kephyrion</i> sp. 20.8	<i>Glenodinium</i> sp. 49.2; <i>Fragilaria crotonensis</i> 35.4	<i>Glenodinium</i> sp. 81.4	<i>Glenodinium</i> sp. 49.2; <i>Fragilaria crotonensis</i> 42.7
Fawn	7/25/91	8/5/93	<i>Cyclotella comta</i> 55.6; <i>Rhodomonas minuta</i> 22.2	<i>Microcystis aeruginosa</i> 23.5; <i>Kephyrion spirale</i> 27.9	<i>Cyclotella comta</i> 80.2; <i>Ceratium hirundinella</i> 16.0	<i>Cyclotella comta</i> 53.3; <i>Cryptomonas erosa</i> 11.5
Hanaford	7/24/91	8/5/93	<i>Cyclotella stelligera</i> 77.6; <i>Kephyrion</i> sp. 11.2	<i>Kephyrion</i> sp. 53.4; <i>Cryptomonas erosa</i> 12.6	<i>Cyclotella stelligera</i> 55.2; <i>Cryptomonas erosa</i> 17.4	<i>Cryptomonas erosa</i> 43.2; <i>Kephyrion</i> sp. 22.1
June	7/17/91	5/29/93	<i>Achnanthes lanceolata</i> 25.6; <i>Fragilaria construens</i> 15.6; <i>Gomphonema angustatum</i> 10.0	<i>Nitzschia palea</i> 18.7; <i>Achnanthes lanceolata</i> 17.8	<i>Diatoma hiemale mesodon</i> 26.5; <i>Achnanthes lanceolata</i> 18.7; <i>Fragilaria construens</i> 10.8	<i>Diatoma vulgare</i> 15.6; <i>Diatoma hiemale mesodon</i> 12.9
		9/9/93		<i>Diatoma hiemale mesodon</i> 19.8; <i>Nitzschia palea</i> 13.1		<i>Diatoma hiemale mesodon</i> 41.3

*epilimnion sample replicates were averaged

Table 7 cont. Comparison of phytoplankton in lakes analyzed by Aquatic Analysts (AA) and Portland State University (PSU).

Lake	AA sample dates	PSU sample dates	AA % density	PSU % density*	AA % biovolume	PSU % biovolume*
McBride	7/18/91	5/29/93	<i>Fragilaria crotonensis</i> 13.3; <i>Anabaena sp.</i> 13.3; <i>Synedra radians</i> 12.2	<i>Fragilaria crotonensis</i> 68.8	<i>Fragilaria crotonensis</i> 39.9; <i>Anabaena sp.</i> 16.3; <i>Ceratium hirundinella</i> 13.3	<i>Fragilaria crotonensis</i> 89.5
		9/8/93		<i>Microcystis aeruginosa</i> 98.9		<i>Microcystis aeruginosa</i> 60.9; <i>Cryptomonas erosa</i> 25.7
Merrill	7/17/91	9/8/93	<i>Cyclotella comta</i> 68.3; <i>Ankistrodesmus falcatus</i> 12.9	<i>Kephyrion spirale</i> 28.1; <i>Cyclotella comta</i> 8.6	<i>Cyclotella comta</i> 96.8	<i>Cyclotella comta</i> 41.6
Meta	7/16/91	6/17/93	<i>Rhodomonas minuta</i> 35.1; <i>Cryptomonas erosa</i> 29.7	<i>Dinobryon sp.</i> 72.3; <i>Synedra rumpens</i> 24.4	<i>Cryptomonas erosa</i> 60.9	<i>Dinobryon sp.</i> 67.7; <i>Synedra rumpens</i> 25.6
		8/26/93		<i>Oocystis pusilla</i> 59.4; <i>Asterionella formosa</i> 20.2		<i>Asterionella formosa</i> 39.7; <i>Oocystis pusilla</i> 27.8; <i>Cryptomonas erosa</i> 25.2
Panhandle	8/14/91	8/14/93	<i>Glenodinium sp.</i> 71.8; <i>Kephyrion sp.</i> 9.7	<i>Dinobryon sp.</i> 52.8; <i>Fragilaria crotonensis</i> 40.1	<i>Glenodinium sp.</i> 93.8	<i>Fragilaria crotonensis</i> 78.6; <i>Dinobryon sp.</i> 15.7

*epilimnion sample replicates averaged

Table 7 cont. Comparison of phytoplankton in lakes analyzed by Aquatic Analysts (AA) and Portland State University (PSU).

Lake	AA sample dates	PSU sample dates	AA % density	PSU % density*	AA % biovolume	PSU % biovolume*
Ryan	7/16/91	6/17/93	Unidentified flagellate 86.7; <i>Dinobryon sertularia</i> 9.3	<i>Ankistrodesmus falcatus</i> 85.6	Unidentified flagellate 41.3; <i>Dinobryon sertularia</i> 47.8	<i>Ankistrodesmus falcatus</i> 55.7; <i>Cryptomonas erosa</i> 11.5
		8/24/93		<i>Kephyrion</i> sp. 53.1; <i>Cryptomonas erosa</i> 41.7		<i>Cryptomonas erosa</i> 66.9
St. Helens	8/14/91	8/10/93	<i>Tetraedron minimum</i> 35.4; <i>Rhodomonas minuta</i> 18.8; <i>Cryptomonas erosa</i> 14.6	<i>Ankistrodesmus falcatus</i> 94.5	<i>Cryptomonas erosa</i> 37.5; <i>Tetraedron minimum</i> 31.5; <i>Chlamydomonas</i> sp. 10.0	<i>Ankistrodesmus falcatus</i> 86.7
Venus	8/14/91	8/10/93	<i>Cyclotella stelligera</i> 81.6	<i>Crucigenia fenestrata</i> 32.7; <i>Crucigenia quadrata</i> 21.1	<i>Cyclotella stelligera</i> 62.2; <i>Sphaerocystis Schroeteri</i> 27.8	<i>Crucigenia fenestrata</i> 25.2; <i>Crucigenia quadrata</i> 13.8

*epilimnion sample replicates averaged

Table 8. Comparison of phytoplankton in Castle and Coldwater lakes analyzed by Aquatic Analysts (AA) and Portland State (PSU)

Lake	AA sample dates	PSU sample dates	AA % density	PSU % density*	AA % biovolume	PSU % biovolume*
Castle	6/13/91	6/26/93	<i>Rhodomonas minuta</i> 34.8; <i>Acnathes minitamus</i> 15.2; <i>Cryptomonas erosa</i> 10.6	<i>Cryptomonas erosa</i> 54.2; <i>Kephyrion sp.</i> 33.1	<i>Cryptomonas erosa</i> 33.8; <i>Synedra radians</i> 13.4	<i>Cryptomonas erosa</i> 73.1; <i>Glenodinium sp.</i> 19.4
Castle	9/13/91	9/17/93	<i>Gloeocystis-like sp.</i> 45.4; <i>Dinobryon sp.</i> 21.3; <i>Cryptomonas erosa</i> 15.7	<i>Kephyrion sp.</i> 32.9; <i>Chlamydomonas-like sp.</i> 22.1; <i>Quadrigula lacustris</i> 13.6	<i>Cryptomonas erosa</i> 39.6; <i>Gloeocystis-like sp.</i> 31.3; <i>Dinobryon sp.</i> 15.7	<i>Chlamydomonas-like sp.</i> 42.9; <i>Glenodinium sp.</i> 19.9
Coldwater	7/27/91	8/4/93	<i>Gloeocystis-like sp.</i> 31.3; <i>Rhodomonas sp.</i> 13.3; <i>Chrysochromulina sp.</i> 10.8	<i>Planktosphaeria gelatinosa</i> 54.5; <i>Kephyrion sp.</i> 34.6	<i>Cyclotella comta</i> 64.0; <i>Gloeocystis-like sp.</i> 11.8; <i>Cryptomonas erosa</i> 11.0	<i>Kephyrion sp.</i> 42.0; <i>Cyclotella comta</i> 33.3
Coldwater	9/5/91	10/2/93	<i>Kephyrion sp.</i> 18.9; <i>Cyclotella comta</i> 18.9; <i>Cryptomonas erosa</i> 17.0	<i>Planktosphaeria gelatinosa</i> 84.9	<i>Cyclotella comta</i> 64.7; <i>Ceratium hirundinella</i> 14.0; <i>Cryptomonas erosa</i> 13.3	<i>Cyclotella comta</i> 50.6; <i>Planktosphaeria gelatinosa</i> 21.7

*epilimnion sample replicates from sites 1 and 2 were averaged

Comparison with other Studies:

Results from previous studies in the Mt. St. Helens area involving phytoplankton demonstrate that these populations have been changing since the eruption. By comparing phytoplankton populations in given lakes at the same time period one can determine if these systems are relaxing back to their original regimen before the eruption. Reynolds (1984) explains that phytoplankton cycles in lakes are reproducible so that in a lake which is stable, a similar assemblage of phytoplankton should be present from summer to summer.

Larson and Geiger (1982) studied phytoplankton and water chemistry from Spirit Lake; samples were taken from the surface October 21, 1980. They report that 73% of the total phytoplankton counted were *Cyclotella stelligera*, *Stephanodiscus astrea* v. *minuta*, *Fragilaria construens* v. *venter*, and *Melosira distans*, which are all diatoms (Table 9). They concluded that the species composition was typical of other eutrophic lakes in the Oregon Cascade Range and that populations of highly tolerant phytoplankton were recolonizing the lake and that recovery was underway at that time.

Smith and White (1985) collected surface water samples from Castle, McBride, Meta, Coldwater, and Spirit lakes in mid-August 1982 and identified the algae which occurred at a 5% or greater relative frequency in these lakes (Table 9). Very few of the phytoplankton identified in this study were found in these lakes during the 1992 and 1993 sample period. The only species of phytoplankton identified in Smith and White's paper that was identified in the same lake during this study was *Cryptomonas erosa* in Spirit Lake, however in 1982 Smith and White found *Cryptomonas erosa* to occur at 57.9%

relative frequency and in 1993 it occurred less than 1% total density.

Kelly (1992) found that in Castle Lake from August 1989 samples *Chromulina* sp., *Oocystis puscilla*, *Ochromonas* sp., and *Cryptomonas erosa* were the dominant phytoplankton (Table 9). In Coldwater Lake from August 1989 samples, she found *Rhodomonas minuta*, *Chlamydomons-like* sp., *Gloeocystis* sp., and *Cyclotella meneghiniana* to be the taxa with the greatest abundance.

Table 9 illustrates the cyclic nature in some of the lakes that have stabilized to some degree. In Coldwater Lake, *Gloeocystis* sp. is present in 1989, 1991 and 1993; in 1993, I identified this species as *Planktosphaeria gelatinosa* whereas Mr. Sweet and Vallerie Kelly identified the alga as *Gloeocystis* sp. (see *accuracy in identifying and counting the algae*, Coldwater Lake). *Cryptomonas erosa* was present in Castle Lake in 1989 and 1991 and in Meta Lake in 1991 and 1993. In McBride Lake *Fragilaria crotonensis* is present in 1991 and 1993. Unfortunately there were no phytoplankton data available for Spirit Lake between 1982 and 1993; the available data for this lake suggests that the system is still in flux.

Table 9. Comparison of studies of lakes in the Mt. St. Helens area after the 1980 eruption.

Lake	Oct. 21, 1980 % density	mid-August 1982 % relative freq.	August 1989 % density	Summer 1991 % density	Summer 1993 % density
Spirit	<i>Cyclotella stelligera</i> 26.0; <i>Stephanodiscus astrea minuta</i> 22.0; <i>Fragilaria construens venter</i> 17.0; <i>Melosira distans</i> 8.0	<i>Cryptomonas erosa</i> 57.9; other flagellates 23.5; <i>Cyclotella meneghiniana</i> 8.9			(Summer '93) <i>Fragilaria crotonensis</i> 37.5; <i>Cyclotella comta</i> 18.5; <i>Kephyrion sp.</i> 21.9
Coldwater		Chrysophyte statocysts 28.4; fungal didymospores 44.7	(8/15/89) <i>Rhodomonas minuta</i> 27; <i>Chlamydomonas-like sp.</i> 15; <i>Gloeocystis sp.</i> 14; <i>Cyclotella meneghiniana</i> 14	(7/27/91) <i>Gloeocystis-like sp.</i> 31.3; <i>Rhodomonas minuta</i> 13.3; <i>Chrysochromulina sp.</i> 10.8	(8/4/93) <i>Planktosphaeria gelatinosa</i> 54.5; <i>Kephyrion sp.</i> 34.6
Castle		Chrysophyte statocysts 31.9; <i>Rhizosolenia sp.</i> 29.2; <i>Synedra delicatissima angustissima</i> 18.6; <i>Fragilaria crotonensis</i> 10.3	(8/8/89) <i>Chromulina sp.</i> 49; <i>Oocystis puscilla</i> 29; <i>Ochromonas sp.</i> 14; <i>Cryptomonas erosa</i> 5	(9/13/91) <i>Gloeocystis-like sp.</i> 45.4 <i>Dinobryon sp.</i> 21.3; <i>Cryptomonas erosa</i> 15.7	(9/17/93) <i>Kephyrion sp.</i> 32.9; <i>Chlamydomonas-like sp.</i> 22.1; <i>Quadrigula lacustris</i> 13.6

Table 9 (cont.). Comparison of studies of lakes in the Mt. St. Helens area after the 1980 eruption.

Lake	Oct. 21, 1980 % density	mid-August 1982 % relative freq.	August 1989 % density	Summer 1991 % density	Summer 1993 % density
Meta		<i>Dinobryon cylindricum palustris</i> 90.5		(7/16/91) <i>Rhodomonas minuta</i> 35.1; <i>Cryptomonas erosa</i> 29.7	(8/26/93) <i>Oocystis puscilla</i> 59.4; <i>Asterionella formosa</i> 20.2; <i>Cryptomonas erosa</i> 8.8
McBride		Chrysophyte statocysts 48.5; <i>Nitzschia acicularis</i> 27.1; <i>Mallomonas crassisquama</i> 18.7		(7/18/91) <i>Fragilaria crotonensis</i> 13.3; <i>Anabaena sp.</i> 13.3; <i>Synedra radians</i> 12.2	(5/29/93) <i>Fragilaria crotonensis</i> 68.8

The Factor Analysis:

The purpose of this factor analysis was to determine if there were any associations between algal species based on their ability to coexist, or if any competitive exclusion between species. Data on density and biomass were analyzed separately. The results of the two factor analyses were similar; the analysis using biovolume data produced 38 factor groups, which explained 78.6% of the variance and the analysis using density data gave 41 factor groups, which explained about 80% of the variance. The strongest pattern found in the factor analysis was that many diatoms load together, perhaps due to their need for a high concentration of SiO_2 in their aquatic environment (Table 10). In the biovolume factor analysis, factors one through four explained 21.7% of the variance among the variables; factor one alone explained 9.7% of the variance with decreasing amount of variance explained by each successive factor. Many diatoms found in June Lake, which had the highest SiO_2 concentration during the sample period (averaging over 24 mg/l SiO_2), loaded together into factor groups. Many of these diatoms were found only in June Lake. June Lake also had a high concentration of PO_4 and $\text{NO}_3 + \text{NO}_2$, averaging 46.3 $\mu\text{g/l}$ and 48.4 $\mu\text{g/l}$, respectively. In Table 10, the percent variance explained by a variable can be calculated by squaring the correlation value and multiplying by 100. For example, *Acnantes lanceolata*, which is in factor 1 of the biovolume group, had a degree of correlation of 0.72, therefore $(0.72)^2 \times 100 = 51.8\%$ of the variance for *Acnantes lanceolata* is accounted for in factor 1. *Cymbella minuta* appears in factor groups one and two. A total of $(0.59)^2 \times (0.66)^2 \times 100 = 78.4\%$ of the variance for *Cymbella minuta* is explained in factors one and two. The factor analysis labels the factor groups so that

Table 10. Diatoms that loaded into the first four factor groups and their degree of correlation with that factor group.

Species	June Lake Only	Biovolume Data Used		Density Data Used	
		Factor Group	Deg. of Corr.	Factor Group	Deg. of Corr.
<i>Acnanthes lanceolata</i>		F1	.72	F2	.72
<i>Cymbella minuta</i>		F1,F2	.59,.66	F1	.77
<i>Diatoma vulgare</i>	*	F1	.98	F2	.98
<i>Fragilaria brevistriata</i>	*	F1	.73	F1,F2	.64,.69
<i>Hannaea arcus</i>	*	F1	.98	F2	.99
<i>Navicula cincta</i>	*	F1	.99	F2	.99
<i>Nitzschia fonticola</i>	*	F1	.87	F2	.76
<i>Nitzschia palea</i>		F1	.82	F2	.78
<i>Rhoicosphenia curvata</i>	*	F1,F2	.63,.60	F1	.79
<i>Cymbella mexicana</i>		F2	.98	F1	.98
<i>Cocconeis pediculus</i>		F2,F3	.58,.61	F1	.59
<i>Diatoma hiemale mesodon</i>		F2	.68	F1	.85
<i>Gomphonema olivaceum</i>		F2	.95	F1	.96
<i>Meridion circulare</i>	*	F2	.98	F1	.99
<i>Navicula radiosa</i>		F2	.85	F1	.85
<i>Eunotia curvata</i>		F3	.92		
<i>Nitzschia hungarica</i>		F3	.83		
<i>Nitzschia linearis</i>		F3	.74		
<i>Fragilaria crotonensis</i>		F4	.66		
<i>Navicula cryptocephala</i>		F4	.52		
<i>Navicula minima</i>		F4	.80	F3	.99
<i>Nitzschia sp.</i>		F4	.56		
<i>Synedra sp.</i>		F4	.85		
<i>Acnanthes minutissima</i>			.68	F3	.95
<i>Navicula rhynchocephala</i>				F3	.99

species falling into the factor group can be correlated with a particular environmental variable and thus be predicted in the future if the environmental variables are known. For example, algae in factor group F1 may be labeled "algae that positively correlate with silica." In this factor analysis it was difficult to label the factor groups because it was not clear why species loaded into their factor groups. Canonical correlation analysis (CCA) provided additional information which made it possible to label the factor groups. The interpretation of Table 10 using the biovolume or density data is similar. For the biovolume data, most algae in group F1 strongly correlate with PO_4 and SiO_2 . The species that do not correlate with PO_4 and SiO_2 do correlate with NH_4 ; these are *Diatoma vulgare*, *Hannaea arcus*, *Navicula cincta*, *Nitzschia fonticola*, and *Rhoicosphenia curvata*. Diatoms in group F2 correlate only with PO_4 and SiO_2 . Species in group F3 have a weaker correlation with PO_4 and SiO_2 and algae in group F4 appear to have no correlation with any of the environmental variables examined in the first CCA. Based on factor analysis of the density data, diatoms in group F1 correlate positively with PO_4 and SiO_2 . Diatoms in group F2 correlate either with PO_4 and SiO_2 or NH_4 as in group F1 of the biovolume data. Group F3 algae do not appear to load on any canonical variables. Other patterns found were that *Planktosphaeria gelatinosa* correlated negatively with *Cyclotella stelligera*. *Planktosphaeria gelatinosa*, which proliferated in Coldwater Lake during the summer and fall of 1993, grew well in conditions where nitrogen was plentiful. Carpenter (1995) reports that phytoplankton in Coldwater Lake were likely phosphorus limited as soluble reactive phosphorus and chlorophyll *a* concentrations decreased from March through August '93, but the nitrogen concentrations were consistently high.

Cyclotella stelligera were abundant in Venus and Panhandle Lakes in September of 1992. Unfortunately no nutrient data are available for this period to correlate the environmental conditions with the species present. *Ankistrodesmus falcatus* and *Crucigenia fenestrata* loaded together and were both found in Venus Lake where there were high concentrations of nitrate and nitrite in the summer 1993 samples (averaging 56.3 $\mu\text{g/l}$) while PO_4 concentration was very low (averaging 2.3 $\mu\text{g/l}$). Noticeably missing from the factor groups are *Cyclotella comta*, *Chromulina* sp., *Rhodomonas minuta*, and *Cryptomonas erosa*, which are common to many samples, but did not strongly correlate with any factor groups.

The Canonical Correlation Analysis:

In canonical correlation analysis (CCA), axes are put through each of the two clusters of variables (the two clusters being algae and environmental variables) so that they account for the maximum amount of variance within each set while simultaneously accounting for the maximum covariance between each set. So, the first pair of axes identifies the most important pattern that is common to the two data sets. SAS labeled the sets of linear combinations of algae data "V" and the sets of linear combinations of environmental variables "W." V1 correlates with W1 as they are a pair of axes or canonical variables. Therefore, the most important pattern would be the pair, V1 and W1. After the best positions are found for the first pair, further pairs of axes may be stuck through the vector clusters at right angles to the first set, and rotated until they account for the next best correlation between the sets. This occurs until there are as many pairs of axes as there are variables in the smaller data set. The first CCA (CCA #1), based on four

environmental variables (PO_4 , $\text{NO}_3 + \text{NO}_2$, NH_4 , and SiO_2) produced four pair of canonical variables. In order to determine if a pair of variables are significant the F-test was performed. A high F-value leads to a low P-value and if the P-value is less than or equal to 0.05, then that pair of canonical variables is significant. For CCA #1 based on biovolume, there were four pairs of canonical variables significant and based on the density data two pair were significant. For CCA #2 there were three significant pair for the biovolume data and only one pair of significance for the density data (Table 11).

Table 11. Significance of canonical variable pairs.

Analysis	Pair	Proportion (%)	Cumulative (%)	P-value
CCA #1-biovolume	1	80.17	80.17	0.0001
CCA #1-biovolume	2	9.14	89.31	0.0001
CCA #1-biovolume	3	6.51	95.82	0.0001
CCA #1-biovolume	4	4.18	100	0.0065
CCA #1-density	1	83.42	83.42	0.0001
CCA #1-density	2	8.80	92.22	0.0001
CCA #2-biovolume	1	42.62	42.62	0.001
CCA #2-biovolume	2	20.57	63.19	0.0001
CCA #2-biovolume	3	18.97	82.16	0.0004
CCA #2-density	1	48.22	48.22	0.0002

The data output for the CCA appear in a matrix of data; the algae matrix is above the environmental variables matrix. The variables make up the row headings and the canonical variables (V1, W1, etc.) make up the column headings. Canonical weights are the values in the matrix and represent coefficients of the linear combinations for each

species or environmental variable. A canonical weight is given for each variable across all the canonical variables. Ideally some species will have a large canonical weight in V1 which corresponds to a high value of a particular environmental variable W1 (e.g. PO_4). If so, these algae are said to be loading highly on the canonical variable W1. Other species will associate with V2 and W2, and so on. Not all canonical weights are significant. Optimally, one would like to see either -1, 0, or +1 for values in the V and W columns. Zero's indicate that there is no correlation; -1 and +1 indicate either a strong negative or strong positive correlation. For example, if a canonical weight in V2 is -0.78 and a canonical weight in W2 is -0.84, then there is a high, positive correlation (they are large numbers and the same sign). Likewise if a canonical weight in V3 is +0.31 and a canonical weight in W3 is -0.24 then there is a weak, negative correlation.

In CCA #1, for both biovolume and density, the environmental variables PO_4 and SiO_2 in W1 had large canonical weights. Many algae in the V1 column were loading highly on W1. They were all diatoms, many of which were peculiar to June Lake. The first pair of canonical variables for both sets accounted for over 80% of the variance (Table 10). It was felt that June Lake was so different from the rest of the lakes that it may have been overshadowing the effects of the other lakes in the analysis. Therefore, data for June Lake were removed from the initial spreadsheet. In addition, light attenuation data were included as an environmental variable (in CCA #2).

In CCA #2, SiO_2 was still the dominant variable in W1, but different algae were loading onto W1. *Kephyrion* sp. and *Chroococcus dispersus* have a positive correlation with SiO_2 in W1 from the density data and *Chromulina* sp., *Cyclotella glomerata*,

Crucigenia quadrata, *Crucigenia fenestrata*, and *Nitzschia amphibia* correlate negatively with W1. From the biovolume data *Chroococcus dispersus* and *Planktosphaeria gelatinosa* are positively correlated with SiO_2 and *Chromulina sp.*, *Cyclotella glomerata*, *Crucigenia crucifera*, *Crucigenia fenestrata*, *Crucigenia quadrata*, and *Nitzschia amphibia* are negatively correlated. In the second pair of canonical variables in the biovolume data set PO_4 and $\text{NO}_3 + \text{NO}_2$ are the principal environmental variables and are positively correlated with *Ankistrodesmus falcatus*, *Cyclotella glomerata*, and *Crucigenia fenestrata*. *Asterionella formosa*, *Rhodomonas minuta*, and *Synedra rumpens* are negatively correlated with these variables. By the time the third pair of axes is identified, relationships are not as clear, but the canonical variables are nevertheless significant in the biovolume data set. The dominance among the environmental variables is split between PO_4 , SiO_2 , and $\text{NO}_3 + \text{NO}_2$. *Ankistrodesmus falcatus*, *Cyclotella stelligera*, *Chlamydomonas sp.*, and *Glenodinium sp.* are positively correlated with $\text{NO}_3 + \text{NO}_2$, but negatively correlated with PO_4 and SiO_2 . *Nitzschia sp.* and *Quadrigula lacustris* are negatively correlated with $\text{NO}_3 + \text{NO}_2$ but positively correlated with PO_4 and SiO_2 . In either analysis, NH_4 and light attenuation did not appear to be a strong influence on the algae present relative to the other environmental factors.

The solution of the CCA can be displayed in an ordination diagram much like the diagrams shown in ter Braak (1986). Sites are represented by points and environmental variables are represented by arrows (Figures 2 - 18). The sites represent the dominant patterns in community composition to the extent they can be explained by the environmental variables and the arrows of the environmental variables reflect the species

distribution along each of the vectors. For example, the arrow which represents PO_4 points toward site 316. As can be seen in Appendix A, sample 03-16 is the third lake (Castle Lake) and the sixteenth sample from that lake. Accordingly, the algae found in that sample evidently require a relatively large amount of PO_4 . If a site is directly behind the arrow representing PO_4 , one can infer that at that site, the algae must not require as much PO_4 . The arrows represent a gradient of a high to low requirement for the environmental variables that they represent. The length of an arrow is determined by the strength of the two vectors being graphed.

Samples from thirteen lakes were analyzed by the CCA and graphs were made for each lake, as discussed in the following section. All references to nutrient data were taken from Carpenter (1995).

Boot Lake: Samples from 8/15/93 were graphed with canonical variables V1 vs. V2 showing the best pattern (Figure 2). The SiO_2 vector points directly at the hypolimnion samples (208, 209), which are dominated by *Ochromonas sp.*, a Chrysophyte that requires SiO_2 for its lorica. The epilimnion samples (204, 205) were dominated by *Fragilaria crotonensis* and *Glenodinium sp.*, both of which have a positive correlation with W2, representing PO_4 and NO_3+NO_2 . The presence of *Fragilaria crotonensis*, a pennate diatom, may pull these samples toward the SiO_2 vector. The metalimnion samples (206, 207) are dominated by *Fragilaria crotonensis*, *Glenodinium sp.* and *Kephyrion sp.*; *Kephyrion sp.* also has a positive correlation with W2. The metalimnion samples position on the graph is unclear.

Castle Lake: Samples from 6/26/93 are graphed in Figure 3 (V1 vs. V2). Most of

Fig. 2 Boot Lake
canonical variables V1 vs. V2

using biovolume data from CCA #2

Fig. 3 Castle Lake - samples from 6/26/93
canonical variables V1 vs. V2

using biovolume data from CCA #2

Fig. 4 Castle Lake - samples from 9/17/93

using biovolume data from CCA #1

the samples lie between PO_4 and NO_3+NO_2 vectors. In the epilimnion samples (301, 302, 307, 308), *Cryptomonas erosa* and *Glenodinium sp.* are the dominant algae. In the metalimnion samples (303, 304, 309, 310) *Glenodinium sp.* is dominant, followed by *Cryptomonas erosa* and *Kephyrion sp.* The hypolimnion samples (305, 306, 311, 312) are dominated by *Cryptomonas erosa* and *Kephyrion sp.* *Cryptomonas erosa* has a weak negative relationship with W2, which correlates with PO_4 and NO_3+NO_2 , *Glenodinium sp.* and *Kephyrion sp.* have a stronger positive correlation with W2. Carpenter (1995) reports that nitrogen and phosphorus limit the growth of plankton in Castle Lake. He reported that phosphorus is the primary limiting nutrient, while nitrogen co-limits productivity. In Figure 4, epilimnion and metalimnion samples from 9/17/93 are graphed which correlates with SiO_2 and NO_3+NO_2 and *Chlamydomonas-like sp.* weakly loads on W2. In metalimnion site #2 samples, 321 and 322, *Chlamydomonas-like sp.* is dominant.

Coldwater Lake: Samples from 8/4/93 and 10/2/93 are graphed in Figure 5 (V1 vs. V2). Most of the samples are clustered between the NO_3+NO_2 and SiO_2 vectors and were dominated by *Planktosphaeria gelatinosa*. *Planktosphaeria gelatinosa* loads highly on W1, in which SiO_2 is the strongest environmental variable followed by NO_3+NO_2 . Carpenter (1995) reports that during 1993, PO_4 remained low (averaging $4.2 \mu\text{g/l}$) while NO_3+NO_2 concentrations were high (averaging $46.1 \mu\text{g/l}$) and NH_4 concentrations averaged $9.7 \mu\text{g/l}$. A small group of samples are scattered opposite the PO_4 vector. These do not have a great abundance of *Planktosphaeria gelatinosa*, but small flagellates (*Cryptomonas erosa* and *Rhodomonas minuta*) are the primary algae. Both of these

Fig. 5 Coldwater Lake
canonical variables V1 vs. V2

using biovolume data from CCA #2

Fig. 6 Fawn Lake
canonical variables V1 vs. V2

using biovolume data from CCA #2

flagellates load on W2 and have a negative correlation with PO_4 and NO_3+NO_2 .

Fawn Lake: Samples from the fall and summer 1993 are plotted on Figure 6 (V1 vs. V2). Samples from the summer 1993 are clustered behind the NO_3+NO_2 vector. The alga with the greatest biovolume in the epilimnion and metalimnion samples was *Cyclotella comta* which has a negative correlation with SiO_2 and NO_3+NO_2 (W1). *Cyclotella comta* and *Cryptomonas erosa* are dominant in the hypolimnion samples (508, 509). Sample 511 was also near this group of samples, but *Ochromonas sp.* was the dominant alga. The NH_4 and NO_3+NO_2 vector points toward the fall hypolimnion samples (514, 515) in which *Cyclotella comta* has the greatest biovolume, but with many *Chroococcus minima* present as well. During this period the hypolimnion was anoxic favoring reduced nitrogen (NH_4) over oxidized nitrogen (NO_3+NO_2), 41.4 g/l and 13.1 g/l respectively (Carpenter 1995). Cyanophytes require a large amount of nitrogen. Perhaps the *Chroococcus sp.* were present due to the NH_4 being released from the bottom sediments when the oxygen was depleted in the overlying water column.

Hanaford Lake: Summer and fall 1993 samples from Hanaford Lake were graphed in Figure 7 (V2 vs. V3). Summer epilimnion (604,605) and metalimnion (607,608) samples are in the path of the NO_3+NO_2 vector. In the epilimnion samples, *Cryptomonas erosa* is the alga with the greatest biovolume; in 604 some *Kephyrion sp.* are present which may explain the proximity to the SiO_2 vector. The dominant algae in the metalimnion samples are *Rhodomonas minuta* and *Cryptomonas erosa*. All of the fall samples are directly behind the NO_3+NO_2 vector. In the epilimnion samples (611,612) and metalimnion samples (613,614) *Cyclotella comta* contributed to the greatest biovolume

Fig. 7 Hanaford Lake
canonical variables V2 vs. V3

using biovolume data from CCA #2

Fig. 8 June Lake
canonical variables V1 vs. V2

using biovolume data from CCA #1

followed by *Chromulina* sp. In the hypolimnion, *Cyclotella comta* is the dominant alga, then *Cryptomonas erosa* and *Chromulina* sp. *Cyclotella comta* (in V2) has a weak negative relationship with W2, which correlates with $\text{NO}_3 + \text{NO}_2$.

June Lake: Samples from three sample dates were graphed in Figure 8, which shows canonical variables V1 vs. V2 from CCA #1. All points are between the SiO_2 and PO_4 vectors. Samples from 5/28/93 (701, 702) are closest to the SiO_2 vector and the entire assemblage consisted of diatoms. Nearly all of the diatoms load very highly on W1 where there is a strong correlation with PO_4 and SiO_2 . These samples appear to be very diverse and there does not seem to be a dominant species. Samples from 9/9/93 (703, 704) and 10/17/93 (705, 706) are close together in between the two vectors and their assemblages consisted only of diatoms. Samples 703 and 704 are dominated by *Diatoma hiemale mesodon*, which loaded highly on W1 and correlates with PO_4 and SiO_2 , and samples 705 and 706 were dominated by *Diatoma hiemale mesodon* and *Gomphonema olivaceum*; *Gomphonema olivaceum* also loaded highly on W1.

McBride Lake: Canonical variables V1 vs. V2 were graphed (Figure 9) for samples taken in May, September, and October 1993. All samples in May (801-804) clustered beyond the PO_4 vector. Carpenter (1995) states that phosphorus was not a limiting nutrient in this lake during 1993. *Fragilaria crotonensis* was by far the most abundant alga in the May samples and it loads on W2, where PO_4 is the strongest environmental variable followed by $\text{NO}_3 + \text{NO}_2$. In September, samples (805, 806) are dominated by *Microcystis aeruginosa*, a Cyanophyte. Carpenter (1995) indicated that nitrogen is clearly the limiting nutrient in McBride Lake, especially as the growing season

Fig. 9 McBride Lake
canonical variables V1 vs. V2

using biovolume data from CCA #2

Fig. 10 Merrill Lake - samples from 4/17/93
canonical variables V1 vs. V2

using biovolume data from CCA #2

Fig. 11 Merrill Lake - September 1993 samples
canonical variables V1 vs. V2

using bivolume data from CCA #2

progressed into the fall season. *Microcystis aeruginosa* may be fixing atmospheric nitrogen. In October, *Cryptomonas erosa* had the greatest biovolume in the samples (807,808). Sample 807 is near the origin, and 808 is along the SiO_2 vector, in which *Nitzschia palea* is the second most abundant alga; *Nitzschia palea* has a moderate correlation with W1, hence SiO_2 .

Merrill Lake: Carpenter (1995) found that nitrogen and phosphorus concentrations were always low in Merrill Lake and this indicates a co-limitation by both nutrients; there appears to be a shift from phosphorus limited growth in the spring to limitation by nitrogen in the summer and fall. Most of the spring samples are clustered in the vicinity of the PO_4 path (Figure 10) and in the graph showing September samples (Figure 11) there is a linear gradient from NO_3+NO_2 to PO_4 and samples are scattered between the extremes. In the graph of October samples (Figure 12), the points are clustered behind the NO_3+NO_2 vector. In the spring (4/17/93) many *Cryptomonas erosa*, *Cyclotella comta*, and *Synedra rumpens* were present and loaded on W2. These species were thus negatively correlated with PO_4 , suggesting that these algae can grow when PO_4 is limited. In the summer (9/9/93) *Cyclotella comta* was much more dominant than in the spring and *Anabaena sp.* was present in most of these samples. *Cyclotella comta* correlates negatively with NO_3+NO_2 as well as PO_4 on W2. NO_3+NO_2 concentrations were low (average $0.9 \mu\text{g/l}$) during this period giving a competitive advantage to blue-green algae such as *Anabaena sp.*, with efficient capabilities for fixing molecular nitrogen (Wetzel 1983). Fall samples (Figure 12) from 10/17/93 are dominated by *Chromulina sp.* and *Rhodomonas minuta*. These algae may not have the greatest biovolume in the samples, but they are common to

Fig. 12 Merrill Lake - October 1993 samples
canonical variables V1 vs. V2

using biovolume data from CCA #2

Fig. 13 Meta Lake - samples from June and August 1993

using biovolume data from CCA #1

Fig. 14 Meta Lake - samples from October 1993

canonical variables V1 vs. V3

using biovolume data from CCA #2

Fig. 15 Panhandle Lake
canonical variables V1 vs. V2

using biovolume data from CCA #2

NO_3+NO_2 vector points toward the epilimnion samples, 1104 and 1105. The dominant algae are *Fragilaria crotonensis* and *Glenodinium sp.* Both algae load moderately onto W2, which correlates with PO_4 and NO_3+NO_2 . Carpenter (1995) states that during this sample period phosphorus was the limiting nutrient. In the epilimnion there were 118.4 $\mu\text{g/l}$ NO_3+NO_2 , while only 0.2 $\mu\text{g/l}$ PO_4 . In the metalimnion (1106, 1107) *Fragilaria crotonensis* and *Dinobryon sp.* were dominant and *Cryptomonas erosa* and *Dinobryon sp.* were dominant in the hypolimnion (1108, 1109). Metalimnion and hypolimnion samples appeared behind the PO_4 vector and possibly a little toward the SiO_2 vector; *Fragilaria crotonensis* is a pennate diatom and *Dinobryon sp.* is a Chrysophyte (Appendix B). Both require silica for their frustules or loricas. In the metalimnion and hypolimnion, there was still plenty of NO_3+NO_2 (average 38.9 $\mu\text{g/l}$), but PO_4 was again in short supply 0.5 $\mu\text{g/l}$ (Carpenter 1995).

Ryan Lake: Three sample dates are represented in Figure 16 (V1 vs. V2); 6/17/93, 8/24/93, and 10/9/93. *Ankistrodesmus falcatus* was the dominant alga in the lake during the sample period, 6/17/93, followed by *Cryptomonas erosa* (1201-1203).

Ankistrodesmus falcatus loads on W2, which correlates with PO_4 and NO_3+NO_2 . Samples from 8/24/93 and 10/9/93 are scattered below the PO_4 and NO_3+NO_2 vectors. The epilimnion and metalimnion samples from 8/24/93 (1204-1207) are dominated by *Cryptomonas erosa* followed by *Kephyrion sp.*. Hypolimnion samples (1208, 1209) have *Cryptomonas erosa* and *Cryptomonas ovata* as the dominant algae. *Cryptomonas erosa* and *Cryptomonas ovata* have a weak negative relationship with W2 and correlated negatively with PO_4 and NO_3+NO_2 . Epilimnion and metalimnion samples (1210-1213) are

Fig. 16 Ryan Lake
canonical variables V1 vs. V2

using biovolume data from CCA #2

Fig. 17 St. Helens Lake
canonical variables V1 vs. V2

using biovolume data from CCA #2

Fig. 18 Venus Lake
canonical variables V2 vs. V3

using biovolume data from CCA #2

dominated by *Cryptomonas erosa* and *Cryptomonas ovata*, followed by *Kephyrion spirale* and/or *Kephyrion sp.* The hypolimnion samples (1214,215) from this data are dominated by *Cryptomonas erosa* followed by *Kephyrion spirale* or *Kephyrion sp.* Carpenter found that both nitrogen and phosphorus limit phytoplankton growth in Ryan Lake.

St. Helens Lake: Summer 1993 samples are graphed in Figure 17 (V1 vs. V2). Epilimnion and metalimnion samples (1404-1407) were dominated by *Ankistrodesmus falcatus*, although in 1406 there were about 26% more *Cryptomonas erosa* than *Ankistrodesmus falcatus*. These samples were in the path of the NO_3+NO_2 vector. *Ankistrodesmus falcatus* is positively correlated with NO_3+NO_2 as it loads on W2. There was only one hypolimnion sample (1408), that was dominated by *Cryptomonas erosa*. This sample was very sparse with algal units (only 6 units/ml), and was located below the PO_4 and NO_3+NO_2 vectors. *Cryptomonas erosa*, loads on W2 and is negatively correlated with PO_4 and NO_3+NO_2 . Carpenter reports abundant NO_3+NO_2 concentrations during this sample period (average 143.8 $\mu\text{g/l}$). Phosphorus appeared to be the limiting nutrient. The concentration of PO_4 decreased with depth from 3.7 $\mu\text{g/l}$ in the epilimnion to 0.1 $\mu\text{g/l}$ in the hypolimnion.

Venus Lake: Samples from 8/10/93 are graphed in Figure 18 (V2 vs. V3). There was a low density of algae in the epilimnion samples, 9.7 and 12.9 algal units/ml respectively. Fewer than 100 algal units were counted from each sample. Sweet (1986) has demonstrated that results from counting less than 100 algal units in a sample are significantly different than if 100 or more algal units are counted, so one should not have

great confidence in what these samples represent. The metalimnion samples (1506, 1507) are dominated by *Crucigenia fenestrata*, which loads highly on W2 and positively correlates with PO_4 and $\text{NO}_2 + \text{NO}_3$. The metalimnion samples lie between the PO_4 and $\text{NO}_3 + \text{NO}_2$ vectors. The alga with the greatest biovolume in the hypolimnion samples is *Cryptomonas erosa*. There is a weak, negative correlation between *Cryptomonas erosa* and W2, which may explain the location of these samples on the graph; they are far from the PO_4 and $\text{NO}_3 + \text{NO}_2$ vectors.

Summary of Factor Analysis and Canonical Correlation Analysis Results:

The most conspicuous associations between algal species and environmental variables found in the ordination diagrams can be summarized as follows:

For Canonical Correlate #1:

- *Asterionella formosa* in Meta Lake negatively correlates with $\text{NO}_3 + \text{NO}_2$ and SiO_2 .
- *Cryptomonas erosa* in Castle Lake positively correlates with SiO_2 and $\text{NO}_3 + \text{NO}_2$.
- *Cryptomonas erosa* in Meta Lake negatively correlates with PO_4 and SiO_2 .

There appears to be a discrepancy between the relationship of *Cryptomonas erosa* and silica. In both instances, the correlation is fairly weak and SiO_2 may not be significant in the physiology of this alga.

For Canonical Correlate #2:

- *Kephyrion* sp., *Fragilaria crotonensis*, and *Glenodinium* sp. in Boot, McBride, and Panhandle lakes correlate positively with PO_4 and $\text{NO}_3 + \text{NO}_2$.
- *Cryptomonas erosa* in Merrill, Ryan, St. Helens, and Venus lakes and *Cryptomonas ovata* in Ryan Lake have a weak, negative correlation with PO_4 and $\text{NO}_3 + \text{NO}_2$.

- Rhodomonas minuta* in Coldwater Lake negatively correlates with PO_4 and NO_3+NO_2 .
- Ankistrodesmus falcatus* in Ryan and St. Helens lakes positively correlate with PO_4 and NO_3+NO_2 .
- Crucigenia fenestrata* in Venus Lake positively correlates with PO_4 and NO_3+NO_2 .
- Planktosphaeria gelatinosa* in Coldwater Lake is positively correlated with SiO_2 and NO_3+NO_2 .
- Cyclotella comta* in Fawn and Hanaford lakes negatively correlate with SiO_2 and NO_3+NO_2 .
- Diatoma hiemale mesodon* and *Gomphonema olivaceum* in June Lake strongly correlate with SiO_2 and PO_4 .
- Nitzschia palea* moderately correlates with silica in June Lake.
- Ochromonas sp.* in Boot Lake was found to have a positive correlation with silica.
- Cryptomonas erosa*, *Cyclotella comta*, and *Synedra rumpens* negatively correlate with PO_4 in Merrill Lake.
- Chromulina sp.* and *Rhodomonas minuta* negatively correlate with NO_3+NO_2 in Merrill Lake.

Corel Chart 3.0 was used to construct these diagrams using coordinates for the environmental variables produced by the CCA procedure in SAS. There is an assumption that the dominant algae in the samples, on the basis of their canonical weights with respect to the canonical weights of the environmental variables, explain the position of the sample on the ordination diagram with reference to the vectors. ter Braak (1986) describes a multivariate analysis technique, detrended canonical correspondence analysis, in which

points represent species and sites, and vectors represent environmental variables.

Therefore, his ordination diagrams not only show the sites, but also plot the species.

Trophic State Indices among Lake Samples:

The trophic state indices (TSI) of the lake samples were compared against a list of TSI values from Atlas of Oregon Lakes (1985). The authors define an ultraoligotrophic lake to have a TSI value less than 20, oligotrophic lakes have TSI values between 20 and 35, and mesotrophic lakes have values between 35 and 50 (based on Carlson 1977). Table 12 summarizes classification of the 13 St. Helens lakes in this thesis according to a TSI based on algal biomass. Lake samples in the ultraoligotrophic range are: all the samples from St. Helens Lake; most of the Merrill Lake samples from 10/16/93, except for the epilimnion site 1 samples, which are oligotrophic; Ryan Lake samples from 6/17/93; Venus (8/10/93) epilimnion and metalimnion; epilimnion samples from Coldwater Lake on 8/4/93 and 10/2/93; and epilimnion samples from McBride Lake (9/8/93). Hanaford Lake samples from 8/5/93 are on the boarder of ultraoligotrophic and oligotrophic. Lake samples in the oligotrophic category are: all samples from Castle, Blue, Meta, and June lakes; most of the Coldwater Lake samples; Boot Lake metalimnion and hypolimnion samples from 8/15/93; Ryan Lake samples from 8/24/93 and 10/9/93; Fawn Lake, except for the metalimnion samples from 8/5/93; fall '93 samples from Hanaford and McBride Lakes; most Merrill Lake samples from 4/17/93 and 9/8/93; and hypolimnion samples from Venus Lake (8/10/93). The mesotrophic category includes: samples from Spirit Lake; Boot Lake samples from 9/92 and epilimnion samples from 8/15/93; epilimnion (8/14/93) samples from Panhandle Lake; surface and bottom sample from McBride Lake

on (5/29/93); and metalimnion samples from Fawn Lake (8/5/93).

Table 12. Trophic State Categories of Mt. St. Helens Lakes assigned from phytoplankton biovolume.

Lake	Category
Blue	oligotrophic
Boot	oligotrophic-mesotrophic
Castle	oligotrophic
Coldwater	ultraoligotrophic-oligotrophic
Fawn	oligotrophic-mesotrophic
Hanaford	ultraoligotrophic-oligotrophic
June	oligotrophic
McBride	ultraoligotrophic-oligotrophic-mesotrophic
Merrill	ultraoligotrophic-oligotrophic
Meta	oligotrophic
Panhandle	mesotrophic
Ryan	ultraoligotrophic-oligotrophic
Spirit	mesotrophic
St. Helens	ultraoligotrophic
Venus	ultraoligotrophic-oligotrophic

Quality Assurance:

In order to check the precision and accuracy of the principle investigator, 7.7% of the samples initially counted were recounted: 1) by the principle investigator to check for precision, and 2) by Jim Sweet of Aquatic Analysts to check for accuracy. Sample replicates were also compared; these are actually pseudo-replicates as explained in the *sampling procedure* section, but they measure how homogenous the algae were in the

grab sample and error can be introduced by the experimenter when preparing the slides, identifying and counting the algae, or in data management.

Comparison of sample replicates:

There are 83 pairs of phytoplankton sample replicates in this study. The TSI value (Sweet 1986) was used to compare the replicates because it is based on the total biovolume of phytoplankton found in the samples. The sum of squares of the differences between replicates was divided by the 83 observations and the square root of this value was taken, giving an estimate of standard deviation from one replicate to the next. This estimate of standard deviation is 3.8 and the TSI values range from 10.8 to 43.0. The data has a chi squared distribution because the sum of squares is used to construct the statistic. Accordingly, a 95% confidence interval was calculated to be 3.3 to 4.4. The coefficient of variation (CV) was calculated by taking the estimate of the standard deviation, multiplying it by 100 and dividing by the average TSI value (both replicate columns had an average TSI value and these two averages were averaged). The CV is about 13.9%, which means that the standard deviation of the replicates is about 13.9% of the actual size of the measurements.

Precision of the algal identification and enumeration:

Sixteen slides (7.7% of the total slides counted) were recounted to check for precision in identifying and enumerating the algae. Slides were selected from different lakes, times of year, and sample depth. An estimate of standard deviation and CV was calculated for this data set in the same fashion as for the comparison of sample replicates. The estimate of standard deviation is 5.0, 95% confidence interval is 3.7 to 7.6, and the

TSI values range from 12.1 to 40.5. The CV is 21.3%, which is larger than the replicate comparison (13.9%). This difference is due to the increasing skill in identifying and counting the algae over time plus the intrinsic variability in patchy distribution of the algae on the slides. The recounts were fairly precise, but there were a few discrepancies identified in the following section.

Blue Lake (01-02): *Rhodomonas minuta* is the dominant species in the quality assurance (QA) count and in the original count, but *Chlamydomonas-like sp.* was ignored in the QA. In the original count *Chlamydomonas-like sp.* appeared grey/brown with a red spot in the middle, like a pyrenoid, and were about 2 μm in diameter. Other than not counting the *Chlamydomonas-like sp.*, the counts were similar.

Boot Lake (02-02 and 02-06): Quality assurance counts were similar to original counts except that *Dinobryon sp.* were not recognized in the original count but, they turned out to be a significant alga in this lake.

Castle Lake: The recount of 03-13 was close to the original count; *Kephyrion sp.* was the dominant alga, *Rhodomonas minuta* was also abundant. Again *Chlamydomonas-like sp.* was not identified in the QA, but was found in the original sample. This was also the case with the recount of 03-21, where *Chlamydomonas-like sp.* was not counted in the QA transect. *Dinobryon sp.* were identified in the QA count, but not in the original count.

Coldwater Lake (04-22): The QA and original counts were similar, *Planktosphaeria gelatinosa* dominated the sample and *Rhodomonas minuta* was also significant. The larger TSI value in the QA was due to finding more *Cyclotella comta*, which was a large biovolume.

Fawn Lake (05-11 and 05-16): Original and QA counts were similar.

Hanaford Lake (06-10): Original and QA counts were similar, but in the original count three groups of 20 *Planktosphaeria gelatinosa* were counted and no *Planktosphaeria gelatinosa* were identified in the QA transect for this slide; this is probably due to patchy distribution of the colonies of *Planktosphaeria gelatinosa*.

McBride Lake (08-04): Original and QA counts were similar. *Fragilaria crotonensis* was the dominant alga in both transects. Some of the *Microcystis aeruginosa* identified in the summer and fall 1993 samples (08-05 through 08-08) may have been protozoans. When these protozoans lyse they look much like *Microcystis aeruginosa*.

Merrill Lake (09-07): Inadvertently slide 09-07 was counted two times as a QA count, but different transects were used. This data was included as it may demonstrate the patchy distribution of algae on a slide. The transect from 09-07 (count #2) and the original count were very close, 13.2 and 13.7 TSI respectively, but the 19-07 (count #1) had a slightly higher TSI value, 18.3. This higher TSI value is due to two *Cyclotella comta* found in this transect, representing 63% of the biovolume in the sample. In all three counts, *Chromulina* sp. was identified as the dominant species with *Rhodomonas minuta* as the second most abundant species.

Meta Lake (10-02): The original and QA counts were similar; *Dinobryon* sp. is the dominant species in both counts.

Ryan Lake (12-03): The original and QA counts were similar; *Ankistrodesmus falcatus* was the dominant species in both. There were a few more *Cryptomonas erosa* in the QA count than the original, 65.2% *Cryptomonas erosa* biovolume and 44.3% *Cryptomonas*

erosa biovolume, respectively. The protozoans mentioned in McBride Lake were also present in Ryan Lake in the summer and fall 1993 samples at all depths; none were present in samples taken 6/17/93.

St. Helens Lake: The original and QA counts for slide 14-04 were similar;

Ankistrodesmus falcatus is the dominant alga. The TSI value in the QA count for 14-06 is larger than the original, 23.3 and 16.2 respectively. *Ankistrodesmus falcatus* is still the dominant species and similar assemblages were found in each count. In the QA transect there were a few large diatoms identified that brought the total biovolume up considerably; two *Synedra ulna* accounted for 29.1% of the biovolume and 7 *Tabellaria flocculosa* contributed to another 30.2% of the biovolume.

Accuracy in identifying and counting the algae:

Sixteen slides (7.7% of the total slides counted) were selected to have Jim Sweet of Aquatic Analysts recount and check for accuracy. A slide was selected from each lake at various depths and time of year. An estimate of standard deviation and CV was calculated for this data set in the same fashion as for the comparison of sample replicates and precision of the algal identification and enumeration. The estimate of standard deviation is 10.6, 95% confidence interval is 7.9 to 16.2 and the TSI values range from 8.3 to 48.4. The CV is 37.0%. As expected, the CV is larger in this comparison because another factor (a different person identifying and counting the algae) is added to the variables that can affect the results. The intrinsic variability from phytoplankton patchiness and subsampling are included in this variation. The comparison between the slides will be discussed in the following section. The number in parenthesis identifies the lab code and

Mr. Sweet's results are in Appendix C.

Blue Lake (01-01): I identified *Chlamydomonas-like sp.* and *Glenodinium sp.* as the dominant algae in this sample and Mr. Sweet did not identify these species in the sample.

Boot Lake (02-05): As stated earlier in the precision of the algal identification and enumeration section, I underestimated *Dinobryon sp.* in the original counts. Mr. Sweet confirms this, as he has found *Dinobryon sertularia* to be the dominant species. Also, it appears what I had called *Fragilaria crotonensis* he has identified as *Synedra rumpens*. He found some *Glenodinium sp.*, but not to the degree that I had estimated, 13.2% and 38.5% biovolume, respectively.

Castle Lake (03-15): Mr. Sweet identified *Dinobryon sertularia* as the dominant alga in this sample and I identified *Chlamydomonas-like sp.* as the dominant alga. Also, I counted a number of *Quadrigula lacustris*, which he did not identify in this sample, but otherwise the rest of the count is similar.

Coldwater Lake (04-08): There is a great difference in the biovolume TSI value between my count and Mr. Sweet's count of this sample, 16.7 and 38.5 respectively. Actually, the counts were similar except that I identified *Planktosphaeria gelatinosa* as the dominant alga and Mr. Sweet called the dominant alga *Gloeocystis sp.*; I believe we were referring to the same alga. The biovolume of the *Gloeocystis sp.* algal unit is much larger than the biovolume of the *Planktosphaeria gelatinosa* algal unit, which may explain the difference in biovolume TSI values.

Fawn Lake (05-09): Our counts were very similar in this sample, we had no discrepancies over the identification of species. We both identified *Cryptomonas erosa* as the dominant

species, although I estimated that it represented a greater amount of the biovolume in the sample than Mr. Sweet, 24440 $\mu\text{m}_3/\text{ml}$ and 11604 $\mu\text{m}_3/\text{ml}$, respectively.

Hanaford Lake (06-12): Mr. Sweet identified *Chlamydomonas-like sp.* as the dominant alga in this sample and I called this alga *Chromulina sp.* Other than this, our counts were similar; *Cyclotella comta* is the next most abundant species in both counts.

June Lake (07-03): Our counts were similar in this sample; *Diatoma hiemale mesodon* is the dominant alga in both counts.

McBride Lake (08-03): In this sample I identified the dominant alga as *Fragilaria crotonensis* and Mr. Sweet identified this species as *Fragilaria radians*. He does identify some *Fragilaria crotonensis*, but not to the degree that I did, 28.7% and 91.2%, respectively. Also, he identified *Chrysococcus rufescens*, which I did not find in the sample.

Merrill Lake (09-15): These counts were very similar; we both identified *Rhodomonas minuta* and *Chromulina sp.* as the most abundant species by density and *Cyclotella comta* as the alga with the greatest biovolume.

Merrill Lake (09-16): Again, these counts were similar, *Cyclotella comta* is the dominant alga.

Meta Lake (10-10): I identified the dominant alga to be *Ochromonas sp.* and Mr. Sweet identified it as *Ochromonas-like sp.*

Panhandle Lake (11-04): Mr. Sweet identified the dominant algae to be *Synedra rumpens* and *Glenodinium sp.* and I identified *Glenodinium sp.* and *Fragilaria crotonensis* to be dominant. Also, Mr. Sweet identified *Dinobryon sertularia* to be 9.4% of the algal

biovolume and I did not identify this species in my count.

Ryan Lake (12-09): Mr. Sweet and I both agree that *Cryptomonas erosa* is the dominant alga in this sample. I called some of the Cryptomonads *Cryptomonas ovata* because they were much larger than the *Cryptomonas erosa* and their gullets appeared to extend nearly three-quarters the length of the cells (Prescott 1970).

Spirit Lake (13-02): *Cyclotella comta* was the dominant alga in both counts followed by *Fragilaria crotonensis*, although I thought that *Fragilaria crotonensis* was more significant than Mr. Sweet, 41.1% and 7.3% biovolume, respectively. The discrepancy may be because I counted cells that no longer had a chloroplast in them, which means that they were dead at the time the samples were taken.

St. Helens Lake (14-04): Our counts were similar; in both counts *Ankistrodesmus falcatus* was identified as the dominant alga.

Venus Lake (15-06): The results of these counts are similar; Mr. Sweet identified *Crucigenia* sp. and *Ankistrodesmus falcatus* to be the dominant species in terms of density. I called the *Crucigenia* sp., *Crucigenia fenestrata* and also identified *Ankistrodesmus falcatus* to be the second most abundant species. Mr. Sweet identified *Sphaerocystis schroeteri* as the species with the greatest biovolume and I did not identify this alga in my count.

Conclusion

In this study I have attempted to answer the questions 1) What phytoplankton are present in the study lakes? and 2) What is the relationship between the chemical and physical variables and the biologic community that have developed utilizing these

resources? Phytoplankton populations in the study lakes were described and compared with other post-eruption studies involving phytoplankton in Mt. St. Helens lakes. These algal communities appear to be recovering from the eruption as they show signs of stabilization. The cyclic nature of phytoplankton populations gaged from summer populations from year-to-year can be seen in some of the lakes (Coldwater, Castle, Meta, and McBride lakes).

Environmental variables were related to the presence of phytoplankton species in lakes. PO_4 , SiO_2 , and $\text{NO}_3 + \text{NO}_2$ are the nutrients driving the system and exerting bottom-up control over the phytoplankton.

The lakes outside of the blast zone were not useful as control lakes. They are too different from the blast-zone lakes and do not overlap in important characteristics. They are located on the south side of the mountain as opposed to the blast-zone lakes being located on the north side. The origin of the control lakes are from landslides or debris avalanches and most of the blast-zone lakes exist as a result of glacial activity (cirque lakes).

The phytoplankton data were analyzed using the canonical correlation procedure. The results are plotted as ordination diagrams, I have shown some of the associations between specific alga and environmental variables.

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Appendix A

Phytoplankton Data Sheets

**Phytoplankton Data Sheets for
Blue Lake**

Lake: Blue Date: 7/11/93 depth: 1M
 sample: 01-01
 transect (mm): 36.9 width (mm): 0.182 area (mm2): 6.7
 vol. filtered: (ml) 100

Species	count	Biovol	T Biovol (um3/ml)	% Biovol	#/ml	percent
Achnanthes minutissima	1	50	50	0.15	0.7	0.93
Chlamydomonas-like	44	325	14300	43.13	32.2	40.74
Chroococcus dispersus	4	22	88	0.27	2.9	3.70
Crucigenia quadrata	2	85	170	0.51	1.5	1.85
Diatoma sp.	1	500	500	1.51	0.7	0.93
Glenodinium sp.	20	700	14000	42.23	14.6	18.52
Kephyrion sp.	4	63	252	0.76	2.9	3.70
Kephyrion spirale	23	63	1449	4.37	16.8	21.30
Melosira distans	2	198	396	1.19	1.5	1.85
Navicula lanceolata	1	580	580	1.75	0.7	0.93
Navicula radiosa	2	325	650	1.96	1.5	1.85
Nitzschia palea	4	180	720	2.17	2.9	3.70
	108		33155		78.9	

TSI= 30.7

Lake: Blue
 sample: 01-02
 transect (mm): 13.8
 vol. filtered: (ml) 100

Date: 7/11/93 Depth: 10M
 width (mm): 0.182 area (mm2): 2.5

Species	count	Biovolume	T Biovol(um3/ml	% Biovol	#/ml	percent
Cryptomonas erosa	3	520	1560	6.7	5.9	2.1
Kephyrion spirale	3	63	189	0.8	5.9	2.1
Quadrigula lacustris	8	30	240	1.0	15.6	5.7
Glenodinium sp.	15	700	10500	45.1	29.3	10.6
Chlamydomonas-like	28	325	9100	39.1	54.7	19.9
Rhodomonas minuta	84	20	1680	7.2	164.2	59.6
	141		23269		275.6	

TSI= 27.7

**Phytoplankton Data Sheets for
Boot Lake**

Lake: Boot Date: 9/92 Depth: 1M
 sample: 02-01
 transect (mm): 10.9 width (mm): 0.182 area (mm2): 2.0
 vol. filtered: (ml) 100

Species	count	Biovolume	T Biovol (um3/ml	% Biovol	#/ml	percent
Synedra sp.	1	280	280	0.2	2.5	0.5
Achnanthes sp.	4	120	480	0.3	9.9	1.8
Glenodinium sp.	22	700	15400	10.4	54.4	9.9
Chlorococcum sp.	31	900	27900	18.9	76.7	14.0
Chroococcus dispersus	42	22	924	0.6	103.9	18.9
Fragilaria crotonensis	122	840	102480	69.5	301.9	55.0
	222		147464		549.3	

TSI= 43.4

Lake: Boot Date: 9/92 Depth: meta
 sample: 02-02
 transect (mm): 10.9 width (mm): 0.182 area (mm2): 2.0
 vol. filtered: (ml) 50

Species	count	Biovolume	T Biovol (um3/ml	% Biovol	#/ml	percent
Chroococcus dispersus	1	22	22	0.0	4.9	0.8
Gomphonema sp.	1	200	200	0.3	4.9	0.8
Navicula sp.	2	150	300	0.4	9.9	1.5
Kephyrion spirale	3	63	189	0.3	14.8	2.3
Glenodinium sp.	10	700	7000	9.8	49.5	7.5
Fragilaria sp.	11	200	2200	3.1	54.4	8.3
Kephyrion sp.	34	63	2142	3.0	168.3	25.6
Fragilaria crotonensis	71	840	59640	83.2	351.4	53.4
	133		71693		658.2	

TSI= 37.2

Lake:	Boot	Date: 9/92	Depth: hypo
sample:	02-03		
transect (mm):	34.1	width (mm): 0.182	area (mm2): 6.2
vol. filtered: (ml)	25		

Species	count	Biovolume	T Biovol (um3/ml)	% Biovol	#/ml	percent
Achnanthes sp.	1	120	120	0.2	3.2	0.8
Chlorococcum sp.	1	900	900	1.3	3.2	0.8
Cymbella minuta	1	370	370	0.6	3.2	0.8
Navicula radiosa tenella	1	120	120	0.2	3.2	0.8
Navicula sp.	1	150	150	0.2	3.2	0.8
Pinnularia sudetica	1	5350	5350	8.0	3.2	0.8
Chroococcus dispersus	2	22	44	0.1	6.3	1.7
Sphaerocystis Schroeteri	2	35	70	0.1	6.3	1.7
Fragilaria sp.	9	200	1800	2.7	28.5	7.6
Glenodinium sp.	15	700	10500	15.7	47.5	12.7
Kephyrion sp.	30	63	1890	2.8	94.9	25.4
Fragilaria crotonensis	54	840	45360	68.0	170.9	45.8
	118		66674		373.3	

TSI= 36.6

Lake: Boot Date: 8/15/93 Depth: epi (1m)
sample: 02-04
transect (mm): 16.5 width (mm): 0.182 area (mm2): 3.0
vol. filtered: (ml) 100

Species	count	Biovolume	T Biovol (um3/ml)	% Biovol	#/ml	percent
Eunotia tenella	1	180	180	0.2	1.6	0.8
Nitzschia paleacea	1	98	98	0.1	1.6	0.8
Navicula rhynchocephala	2	295	590	0.7	3.3	1.6
Achnanthes lanceolata	3	180	540	0.7	4.9	2.4
Navicula sp.	3	150	450	0.6	4.9	2.4
Kephyrion sp.	11	63	693	0.9	18.0	8.9
Fragilaria crotonensis	35	840	29400	37.0	57.2	28.2
Glenodinium sp.	68	700	47600	59.8	111.2	54.8
	124		79551		202.7	

TSI= 38.1

Lake: Boot Date: 8/15/93 Depth: epi (1m)
sample: 02-05
transect (mm): 17.1 width (mm): 0.182 area (mm2): 3.1
vol. filtered: (ml) 100

Species	count	Biovolume	T Biovol (um3/ml)	% Biovol	#/ml	percent
Amphora sp.	1	100	100	0.1	1.6	0.9
Navicula sp.	1	150	150	0.2	1.6	0.9
Nitzschia paleacea	1	98	98	0.1	1.6	0.9
Achnanthes lanceolata	2	180	360	0.5	3.2	1.9
Navicula minima	3	44	132	0.2	4.7	2.8
Synedra ulna	4	1990	7960	10.0	6.3	3.7
Synedra sp.	6	280	1680	2.1	9.5	5.6
Glenodinium sp.	44	700	30800	38.5	69.4	40.7
Fragilaria crotonensis	46	840	38640	48.3	72.6	42.6
	108		79920		170.4	

TSI= 38.2

Lake: Boot Date: 8/15/93 Depth: meta (7m)
 sample: 02-06
 transect (mm): 10.4 width (mm): 0.182 area (mm2): 1.9
 vol. filtered: (ml) 100

Species	count	Biovolume	T Biovol (um3/ml)	% Biovol	#/ml	percent
Cryptomonas erosa	1	520	520	1.1	2.6	0.8
Cymbella minuta	1	370	370	0.8	2.6	0.8
Navicula minima	1	44	44	0.1	2.6	0.8
Navicula sp.	3	150	450	1.0	7.8	2.5
Synedra sp.	5	280	1400	3.0	13.0	4.1
Glenodinium sp.	13	700	9100	19.8	33.7	10.7
Fragilaria crotonensis	36	840	30240	65.7	93.4	29.5
Kephyrion sp.	62	63	3906	8.5	160.8	50.8
	122		46030		316.4	

TSI= 33.4

Lake: Boot Date: 8/15/93 Depth: meta (7m)
 sample: 02-07
 transect (mm): 8.1 width (mm): 0.182 area (mm2): 1.5
 vol. filtered: (ml) 100

Species	count	Biovolume	T Biovol (um3/ml)	% Biovol	#/ml	percent
Navicula sp.	1	150	150	0.4	3.3	0.8
Pinnularia sp.	1	400	400	1.1	3.3	0.8
Sphaerocystis Schroete	1	35	35	0.1	3.3	0.8
Fragilaria sp.	3	200	600	1.6	10.0	2.3
Kephyrion spirale	6	63	378	1.0	20.0	4.5
Glenodinium sp.	8	700	5600	15.2	26.6	6.1
Fragilaria crotonensis	29	840	24360	66.3	96.6	22.0
Kephyrion sp.	83	63	5229	14.2	276.4	62.9
	132		36752		439.6	

TSI= 31.5

Lake: Boot Date: 8/15/93 Depth: hypo (14.5m)
 sample: 02-08
 transect (mm): 0.7 width (mm): 0.182 area (mm2) 0.1
 vol. filtered: (ml) 25

Species	count	Biovolume	T Biovol (um3/ml)	% Biovol	#/ml	percent
Cryptomonas erosa	1	520	520	2.4	154.1	0.7
Glenodinium sp.	2	700	1400	6.4	308.3	1.5
Chlamydomonas sp.	40	300	12000	55.0	6165.1	29.4
Ochromonas sp.	93	85	7905	36.2	14334.0	68.4
	136		21825		20961.51	

TSI= 27.2

Lake: Boot Date: 8/15/93 Depth: hypo (14.5m)
 sample: 02-09
 transect (mm): 1.1 width (mm): 0.182 area (mm2) 0.2
 vol. filtered: (ml) 25

Species	count	Biovolume	T Biovol (um3/ml)	% Biovol	#/ml	percent
Glenodinium sp.	1	700	700	2.7	98.1	0.7
Chlamydomonas sp.	59	300	17700	67.5	5786.8	38.8
Ochromonas sp.	92	85	7820	29.8	9023.5	60.5
	152		26220		14908.45	

TSI= 28.7

Phytoplankton Data Sheets for
Castle Lake

Lake: Castle Date: 6/26/93 Depth: epi (1m)
 sample: 03-01 Site: 1
 transect (mm): 42.1 width (mm): 0.182 area (mm2): 7.7
 vol. filtered: (ml) 100

Species	count	Biovolume	T Biovol (um3/ml)	% Biovol	#/ml	percent
Eunotia pectinalis minor	2	375	750.0	2.1	1.3	1.8
Glenodinium sp.	17	700	11900.0	33.1	10.9	15.0
Cryptomonas erosa	38	520	19760.0	55.0	24.3	33.6
Kephyrion sp.	56	63	3528.0	9.8	35.9	49.6
	113		35938		72.4	
			TSI=	31.3		

Lake: Castle Date: 6/26/93 Depth: epi (1m)
 sample: 03-02 Site: 1
 transect (mm): 52.2 width (mm): 0.182 area (mm2): 9.5
 vol. filtered: (ml) 100

Species	count	Biovolume	T Biovol (um3/ml)	% Biovol	#/ml	percent
Cryptomonas erosa	56	520	29120	66.5	28.9	49.1
Kephyrion spirale	1	63	63	0.1	0.5	0.9
Navicula pupula	1	270	270	0.6	0.5	0.9
Eunotia pectinalis minor	2	375	750	1.7	1.0	1.8
Glenodinium sp.	16	700	11200	25.6	8.3	14.0
Kephyrion sp.	38	63	2394	5.5	19.6	33.3
	114		43797		58.9	
			TSI=	33.0		

Lake: Castle
sample: 03-03
transect (mm): 48.4
vol. filtered: (ml) 100

Date: 6/26/93
width (mm): 0.182

Depth: meta (8m)
Site: 1
area (mm2): 8.8

Species	count	Biovolume	T Biovol (um3/ml)	% Biovol	#/ml	percent
Kephyrion spirale	4	63	252	0.8	2.2	3.2
Cryptomonas sp.	10	400	4000	12.4	5.6	8.1
Glenodinium sp.	33	700	23100	71.7	18.4	26.6
Kephyrion sp.	77	63	4851	15.1	42.9	62.1
	124		32203		69.1	
			TSI=	30.4		

Lake: Castle
sample: 03-04
transect (mm): 75.6
vol. filtered: (ml) 100

Date: 6/26/93
width (mm): 0.182

Depth: meta (8m)
Site: 1
area (mm2): 13.8

Species	count	Biovolume	T Biovol (um3/ml)	% Biovol	#/ml	percent
Kephyrion spirale	6	63	378	1.8	2.1	5.5
Glenodinium sp.	10	700	7000	34.1	3.6	9.2
Cryptomonas eros	16	520	8320	40.5	5.7	14.7
Kephyrion sp.	77	63	4851	23.6	27.5	70.6
	109		20549		38.9	
			TSI=	26.7		

Lake:	Castle	Date: 6/26/93	Depth: hypo (29m)
sample:	03-05		Site: 1
transect (mm):	17.1	width (mm): 0.182	area (mm2): 3.1
vol. filtered: (ml)	100		

Species	count	Biovolume	T Biovol (um3/ml)	% Biovol	#/ml	percent
Cymbella minuta	1	370	370	2.7	1.6	0.8
Diatoma tenue	1	290	290	2.1	1.6	0.8
Glenodinium sp.	2	700	1400	10.1	3.2	1.7
Cryptomonas erosa	10	520	5200	37.6	15.8	8.5
Kephyrion sp.	104	63	6552	47.4	164.0	88.1
	118		13812		186.1	

TSI= 23.4

Lake:	Castle	Date: 6/26/93	Depth: hypo (29m)
sample:	03-06		Site: 1
transect (mm):	18.2	width (mm): 0.182	area (mm2): 3.3
vol. filtered: (ml)	100		

Species	count	Biovolume	T Biovol (um3/ml)	% Biovol	#/ml	percent
Kephyrion spirale	2	63	126	0.6	3.0	1.4
Cryptomonas erosa	27	520	14040	65.6	40.0	18.8
Kephyrion sp.	115	63	7245	33.8	170.4	79.9
	144		21411		213.4	

TSI= 27.0

Lake: Castle
sample: 03-07
transect (mm): 38.1
vol. filtered: (ml) 100

Date: 6/26/93
width (mm): 0.182

Depth: epi (1m)
Site: 2
area (mm2): 6.9

Species	count	Biovolume	T Biovol (um3/ml)	% Biovol	#/ml	percent
Navicula radiosa	1	325	325	0.7	0.7	0.9
Navicula sp.	1	150	150	0.3	0.7	0.9
Glenodinium sp.	7	700	4900	10.4	5.0	6.2
Kephyrion sp.	27	63	1701	3.6	19.1	23.9
Cryptomonas erosa	77	520	40040	85.0	54.5	68.1
	113		47116		80.0	

TSI= 33.6

Lake: Castle
sample: 03-08
transect (mm): 35.8
vol. filtered: (ml) 100

Date: 6/26/93
width (mm): 0.182

Depth: epi (1m)
Site: 2
area (mm2): 6.5

Species	count	Biovolume	T Biovol (um3/ml)	% Biovol	#/ml	percent
Eunotia pectinalis	1	375	375	0.9	0.8	0.9
Navicula rhynchoce	1	295	295	0.7	0.8	0.9
Achnanthes minutis	2	50	100	0.2	1.5	1.9
Glenodinium sp.	5	700	3500	8.3	3.8	4.7
Kephyrion sp.	27	63	1701	4.0	20.3	25.5
Cryptomonas erosa	70	520	36400	85.9	52.7	66.0
	106		42371		79.9	

TSI= 32.7

Lake:	Castle	Date: 6/26/93	Depth: meta (8m)
sample:	03-09		Site: 2
transect (mm):	40.3	width (mm): 0.182	area (mm ²): 7.3
vol. filtered: (ml)	100		

Species	count	Biovolume	T Biovol (um ³ /ml)	% Biovol	#/ml	percent
Navicula lanceolata	1	580	580	2.3	0.7	0.9
Navicula radiosa	1	325	325	1.3	0.7	0.9
Navicula rhynchocephala	1	295	295	1.2	0.7	0.9
Fragilaria crotonensis	2	840	1680	6.8	1.3	1.9
Rhodomonas minuta	2	20	40	0.2	1.3	1.9
Glenodinium sp.	13	700	9100	36.7	8.7	12.1
Cryptomonas erosa	16	520	8320	33.5	10.7	15.0
Kephyrion sp.	71	63	4473	18.0	47.5	66.4
	107		24813		71.6	
			TSI=	28.2		

Lake:	Castle	Date: 6/26/93	Depth: meta (8m)
sample:	03-10		Site: 2
transect (mm):	51.2	width (mm): 0.182	area (mm ²): 9.3
vol. filtered: (ml)	100		

Species	count	Biovolume	T Biovol (um ³ /ml)	% Biovol	#/ml	percent
Dinobryon sp.	2.6	125	325	1.2	1.4	2.1
Quadrigula lacustris	5	30	150	0.5	2.6	4.0
Glenodinium sp.	6	700	4200	15.1	3.2	4.8
Cryptomonas erosa	35	520	18200	65.6	18.4	27.9
Kephyrion sp.	77	63	4851	17.5	40.6	61.3
	125.6		27726		66.2	
			TSI=	29.2		

Lake:	Castle	Date: 6/26/93	Depth: hypo (25m)
sample:	03-11		Site: 2
transect (mm):	28.4	width (mm): 0.182	area (mm2): 5.2
vol. filtered: (ml)	100		

Species	count	Biovolume	T Biovol (um3/ml)	% Biovol	#/ml	percent
Achnanthes minutissima	1	50	50	0.3	0.9	0.7
Eunotia pectinalis	1	720	720	4.1	0.9	0.7
Kephyrion spirale	1	63	63	0.4	0.9	0.7
Navicula cryptocephala	1	185	185	1.0	0.9	0.7
Nitzschia sp.	1	120	120	0.7	0.9	0.7
Glenodinium sp.	4	700	2800	15.8	3.8	3.0
Cryptomonas erosa	13	520	6760	38.2	12.3	9.7
Kephyrion sp.	111	63	6993	39.5	105.4	82.8
	133		17691		126.3	
			TSI=	25.4		

Lake:	Castle	Date: 6/26/93	Depth: hypo (25m)
sample:	03-12		Site: 2
transect (mm):	14.7	width (mm): 0.182	area (mm2): 2.7
vol. filtered: (ml)	100		

Species	count	Biovolume	T Biovol (um3/ml)	% Biovol	#/ml	percent
Kephyrion spirale	2	63	126	0.5	3.7	1.2
Glenodinium sp.	3	700	2100	9.0	5.5	1.8
Achnanthes minutissima	4	50	200	0.9	7.3	2.5
Fragilaria crotonensis	4	840	3360	14.3	7.3	2.5
Cryptomonas erosa	18	520	9360	39.9	33.0	11.0
Kephyrion sp.	132	63	8316	35.4	242.2	81.0
	163		23462		299.1	
			TSI=	27.8		

Lake:	Castle	Date: 9/17/93	Depth: epi (1m)
sample:	03-13		Site: 1
transect (mm):	17.5	width (mm): 0.182	area (mm2): 3.2
vol. filtered: (ml)	100		

Species	count	Biovolume	T Biovol (um3/ml)	% Biovol	#/ml	percent
Achnanthes minutissima	2	50	100	0.6	3.1	1.6
Dinobryon sp.	2.4	125	300	1.7	3.7	2.0
Glenodinium sp.	7	700	4900	28.5	10.8	5.8
Chlamydomonas-like	9	325	2925	17.0	13.9	7.4
Cryptomonas erosa	9	520	4680	27.3	13.9	7.4
Kephyrion spirale	13	63	819	4.8	20.0	10.7
Rhodomonas minuta	15	20	300	1.7	23.1	12.4
Quadrigula lacustris	27	30	810	4.7	41.6	22.2
Kephyrion sp.	37	63	2331	13.6	57.0	30.5
	121.4		17165		187.1	
			TSI=	25.2		

Lake:	Castle	Date: 9/17/93	Depth: epi (1m)
sample:	03-14		Site: 1
transect (mm):	17.7	width (mm): 0.182	area (mm2 3.2
vol. filtered: (ml)	100		

Species	count	Biovolume	T Biovol (um3/ml)	% Biovol	#/ml	percent
Fragilaria crotonensis	1	840	840	3.6	1.5	0.8
Achnanthes minutissima	2	50	100	0.4	3.0	1.7
Dinobryon sp.	3	125	375	1.6	4.6	2.5
Chroococcus dispersus	4	22	88	0.4	6.1	3.4
Kephyrion spirale	5	63	315	1.4	7.6	4.2
Glenodinium sp.	7	700	4900	21.1	10.6	5.8
Cryptomonas erosa	8	520	4160	17.9	12.2	6.7
Rhodomonas minuta	16	20	320	1.4	24.4	13.4
Quadrigula lacustris	18	30	540	2.3	27.4	15.1
Kephyrion sp.	24	63	1512	6.5	36.6	20.2
Chlamydomonas-like	31	325	10075	43.4	47.2	26.1
	119		23225		181.3	
			TSI=	27.7		

Lake: Castle Date: 9/17/93 Depth: meta (10m)
sample: 03-15 Site: 1
transect (mm): 35 width (mm): 0.182 area (mm2): 6.4
vol. filtered: (ml) 100

Species	count	Biovolume	T Biovol (um3/ml)	% Biovol	#/ml	percent
Nitzschia palea	1	180	180	0.6	0.8	0.7
Navicula minima	2	44	88	0.3	1.5	1.3
Dinobryon sp.	4.9	125	612.5	2.0	3.8	3.2
Glenodinium sp.	6	700	4200	13.9	4.6	3.9
Kephyrion spirale	11	63	693	2.3	8.5	7.2
Cryptomonas erosa	17	520	8840	29.3	13.1	11.1
Kephyrion sp.	20	63	1260	4.2	15.4	13.1
Rhodomonas minuta	23	20	460	1.5	17.7	15.0
Quadrigula lacustris	28	30	840	2.8	21.6	18.3
Chlamydomonas-like	40	325	13000	43.1	30.8	26.2
	152.9		30173.5		117.8	
			TSI=	29.9		

Lake: Castle Date: 9/17/93 Depth: meta (10m)
sample: 03-16 Site: 1
transect (mm): 33.6 width (mm): 0.182 area (mm2): 6.1
vol. filtered: (ml) 100

Species	count	Biovolume	T Biovol (um3/ml)	% Biovol	#/ml	percent
Navicula minima	3	44	132	0.3	2.4	1.9
Dinobryon sp.	3	125	419	1.0	2.7	2.1
Kephyrion sp.	7	63	441	1.1	5.6	4.4
Kephyrion spirale	8	63	504	1.2	6.4	5.1
Glenodinium sp.	9	700	6300	15.3	7.2	5.7
Quadrigula lacustris	11	30	330	0.8	8.8	7.0
Cryptomonas sp.	12	400	4800	11.6	9.6	7.6
Rhodomonas minuta	18	20	360	0.9	14.4	11.4
Chlamydomonas-like	86	325	27950	67.8	69.0	54.7
	157		41236		126.3	
			TSI=	32.5		

Lake:	Castle	Date: 9/17/93	Depth: epi (1m)
sample:	03-19		Site: 2
transect (mm):	33.1	width (mm): 0.182	area (mm2): 6.0
vol. filtered: (ml)	100		

Species	count	Biovolume	T Biovol (um3/ml)	% Biovol	#/ml	percent
Dinobryon sp.	1	125	125	0.4	0.8	0.6
Navicula pupula	1	270	270	0.9	0.8	0.6
Navicula radiosa	2	325	650	2.3	1.6	1.1
Rhodomonas minuta	6	20	120	0.4	4.9	3.4
Glenodinium sp.	7	700	4900	17.2	5.7	4.0
Quadrigula lacustris	13	30	390	1.4	10.6	7.4
Kephyrion spirale	27	63	1701	6.0	22.0	15.4
Chlamydomonas-like	49	325	15925	56.0	39.9	28.0
Kephyrion sp.	69	63	4347	15.3	56.2	39.4
	175		28428		142.6	

TSI= 29.4

Lake:	Castle	Date: 9/17/93	Depth: epi (1m)
sample:	03-20		Site: 2
transect (mm):	16.3	width (mm): 0.182	area (mm2): 3.0
vol. filtered: (ml)	100		

Species	count	Biovolume	T Biovol (um3/ml)	% Biovol	#/ml	percent
Dinobryon sp.	1.2	125	150	0.9	2.0	1.2
Cryptomonas erosa	2	520	1040	6.3	3.3	1.9
Rhodomonas minuta	2	20	40	0.2	3.3	1.9
Glenodinium sp.	3	700	2100	12.8	5.0	2.9
Quadrigula lacustris	10	30	300	1.8	16.5	9.6
Kephyrion spirale	15	63	945	5.8	24.8	14.4
Chlamydomonas-like	28	325	9100	55.5	46.3	26.9
Kephyrion sp.	43	63	2709	16.5	71.2	41.3
	104.2		16384		172.4	

TSI= 24.8

Lake: Castle Date: 9/17/93 Depth: meta (10m)
sample: 03-21 Site: 2
transect (mm): 52.1 width (mm): 0.182 area (mm2): 9.5
vol. filtered: (ml) 100

Species	count	Biovolume	T Biovol (um3/ml)	% Biovol	#/ml	percent
Glenodinium sp.	4	700	2800	5.1	2.1	1.6
Dinobryon sp.	10.7	125	1337.5	2.4	5.5	4.4
Kephyrion sp.	17	63	1071	1.9	8.8	7.0
Cryptomonas sp.	21	400	8400	15.2	10.9	8.6
Kephyrion spirale	22	63	1386	2.5	11.4	9.0
Rhodomonas minuta	23	20	460	0.8	11.9	9.4
Quadrigula lacustris	26	30	780	1.4	13.5	10.7
Chlamydomonas-like	120	325	39000	70.6	62.1	49.2
	243.7		55234.5		126.2	
			TSI=	35.0		

Lake: Castle Date: 9/17/93 Depth: meta (10m)
sample: 03-22 Site: 2
transect (mm): 15.4 width (mm): 0.182 area (mm2): 2.8
vol. filtered: (ml) 100

Species	count	Biovolume	T Biovol (um3/ml)	% Biovol	#/ml	percent
Navicula minima	1	44	44	0.2	1.8	0.7
Navicula pupula	1	270	270	1.0	1.8	0.7
Glenodinium sp.	2	700	1400	5.3	3.5	1.4
Kephyrion sp.	4	63	252	1.0	7.0	2.9
Dinobryon sp.	6.1	125	762.5	2.9	10.7	4.4
Cryptomonas erosa	7	520	3640	13.9	12.3	5.0
Kephyrion spirale	8	63	504	1.9	14.0	5.8
Rhodomonas minuta	19	20	380	1.4	33.3	13.7
Quadrigula lacustris	36	30	1080	4.1	63.1	25.9
Chlamydomonas-like	55	325	17875	68.2	96.3	39.5
	139.1		26207.5		243.6	
			TSI=	28.7		

Lake:	Castle	Date: 9/17/93	Depth: 4M
sample:	03-25		
transect (mm):	25.3	width (mm): 0.182	area (mm2) 4.6
vol. filtered: (ml)	100		

Species	count	Biovolume	T Biovol (um3/ml)	% Biovol	#/ml	percent
Cymbella minuta	1	370	370	1.9	1.1	0.7
Navicula minima	1	44	44	0.2	1.1	0.7
Quadrigula lacustris	5	30	150	0.8	5.3	3.6
Cryptomonas erosa	10	520	5200	26.7	10.7	7.2
Rhodomonas minuta	16	20	320	1.6	17.1	11.6
Kephyrion spirale	25	63	1575	8.1	26.7	18.1
Chlamydomonas-like	26	325	8450	43.3	27.7	18.8
Kephyrion sp.	54	63	3402	17.4	57.6	39.1
	138		19511		147.1	
			TSI=	26.2		

Lake: Castle Date: 9/17/93 Depth: 4M
 sample: 03-26
 transect (mm): 30.8 width (mm): 0.182 area (mm2): 5.6
 vol. filtered: (ml) 100

Species	count	Biovolume	T Biovol (um3/ml)	% Biovol	#/ml	percent
Achnanthes sp.	1	120	120	0.5	0.9	0.6
Anabaena affinis	1	900	900	3.9	0.9	0.6
Navicula cryptocephala	1	185	185	0.8	0.9	0.6
Navicula minima	1	44	44	0.2	0.9	0.6
Navicula sp.	1	150	150	0.6	0.9	0.6
Cryptomonas erosa	3	520	1560	6.7	2.6	1.8
Melosira distans	5	198	990	4.3	4.4	3.0
Rhodomonas minuta	5	20	100	0.4	4.4	3.0
Glenodinium sp.	8	700	5600	24.2	7.0	4.7
Chlamydomonas-like	20	325	6500	28.1	17.5	11.8
Quadrigula lacustris	23	30	690	3.0	20.1	13.6
Kephyrion sp.	69	63	4347	27.3	60.5	40.8
Kephyrion spirale	31	63	1953	8.4	27.1	18.3
	169		23139		148.1	
			TSI=	27.7		

**Phytoplankton Data Sheets for
Coldwater Lake**

Lake: Coldwater Date: 10/02/93 Depth: epi (1m)
sample: 04-01 Site1
transect (mm): 8.7 width (mm): 0.182 area (mm2): 1.6
vol. filtered: (ml) 50

Species	count	Biovolume	T Biovol.	% Biovol.	#/ml	percent
Cryptomonas erosa	1	520	520	6.3	6.2	0.7
Achnanthes minutissima	2	50	100	1.2	12.4	1.4
Cyclotella comta	2	2270	4540	55.1	12.4	1.4
Kephyrion spirale	7	63	441	5.4	43.4	5.0
Chroococcus dispersus	8	22	176	2.1	49.6	5.7
Kephyrion sp.	16	63	1008	12.2	99.2	11.4
Planktosphaeria gelatinosa	104	14	1456	17.7	644.9	74.3
	140		8241		868.1	
			TSI=	19.3		

Lake: Coldwater Date: 10/02/93 Depth: epi (1m)
sample: 04-02 site1
transect (mm): 5.6 width (mm): 0.182 area (mm2): 1.0
vol. filtered: (ml) 50

Species	count	Biovolume	T Biovol	% Biovol	#/ml	percent
Cyclotella comta	1	2270	2270	37.1	9.6	0.8
Glenodinium sp.	1	700	700	11.4	9.6	0.8
Cryptomonas erosa	2	520	1040	17.0	19.3	1.6
Kephyrion sp.	3	63	189	3.1	28.9	2.4
Kephyrion spirale	6	63	378	6.2	57.8	4.9
Planktosphaeria gelatinosa	110	14	1540	25.2	1059.6	89.4
	123		6117		1184.9	
			TSI=	17.0		

Lake: Coldwater Date: 10/02/93 Depth: meta (20m)
 sample: 04-03 site1
 transect (mm): 37.2 width (mm): 0.182 area (mm2): 6.8
 vol. filtered: (ml) 100

Species	count	Biovolume	T Biovol.	% Biovol.	#/ml	percent
Achnanthes minutissima	1	50	50	0.1	0.7	1.0
Synedra ulna	1	1990	1990	2.7	0.7	1.0
Glenodinium sp.	3	700	2100	2.9	2.2	3.0
Rhodomonas minuta	9	20	180	0.2	6.5	9.1
Cryptomonas erosa	17	520	8840	12.1	12.3	17.2
Cyclotella comta	26	2270	59020	81.1	18.9	26.3
Planktosphaeria gelatinosa	42	14	588	0.8	30.5	42.4
	99		72768		71.8	
			TSI=	37.4		

Lake: Coldwater Date: 10/02/93 Depth: meta (20m)
 sample: 04-04 site1
 transect (mm): 31.5 width (mm): 0.182 area (mm2): 5.7
 vol. filtered: (ml) 100

Species	count	Biovolume	T Biovol.	% Biovol.	#/ml	percent
Achnanthes minutissima	1	50	50	0.2	0.9	0.9
Glenodinium sp.	1	700	700	2.2	0.9	0.9
Cyclotella comta	8	2270	18160	56.7	6.9	7.5
Rhodomonas minuta	21	20	420	1.3	18.0	19.8
Cryptomonas erosa	23	520	11960	37.4	19.7	21.7
Planktosphaeria gelatinosa	52	14	728	2.3	44.5	49.1
	106		32018		90.8	
			TSI=	30.4		

Lake:	Coldwater	Date: 10/02/93	Depth: hypo (55m)
sample:	04-05		site1
transect (mm):	118.5	width (mm): 0.182	area (mm2): 21.6
vol. filtered: (ml)	100		

Species	count	Biovolume	T Biovol.	% Biovol.	#/ml	percent
Glenodinium sp.	1	700	700	2.4	0.2	1.9
Kephyrion sp.	1	63	63	0.2	0.2	1.9
Kephyrion spirale	1	63	63	0.2	0.2	1.9
Navicula radiosa	1	325	325	1.1	0.2	1.9
Synedra ulna	1	1990	1990	6.8	0.2	1.9
Planktosphaeria gelatinosa	4	14	56	0.2	0.9	7.7
Cyclotella comta	9	2270	20430	69.6	2.0	17.3
Cryptomonas erosa	10	520	5200	17.7	2.3	19.2
Chroococcus dispersus	24	22	528	1.8	5.5	46.2
	52		29355		11.8	
			TSI=	29.6		

Lake:	Coldwater	Date: 10/02/93	Depth: hypo (55m)
sample:	04-06		site1
transect (mm):	126.9	width (mm): 0.182	area (mm2): 23.1
vol. filtered: (ml)	100		

Species	count	Biovolume	T Biovol.	% Biovol.	#/ml	percent
Navicula cryptocephala	2	185	370	1.1	0.4	6.1
Cyclotella comta	9	2270	20430	63.4	1.9	27.3
Cryptomonas erosa	22	520	11440	35.5	4.7	66.7
	33		32240		7.0	
			TSI=	30.4		

Lake:	Coldwater	Date: 10/02/93	Depth: epi (1m)
sample:	04-07		site2
transect (mm):	7.5	width (mm): 0.182	area (mm2): 1.4
vol. filtered: (ml)	50		

Species	count	Biovolume	T Biovol	% Biovol	#/ml	percent
Achnanthes minutissima	1	50	50	0.4	7.2	0.6
Fragilaria crotonensis	1	840	840	6.6	7.2	0.6
Nitzschia sp.	1	120	120	0.9	7.2	0.6
Kephyrion spirale	3	63	189	1.5	21.6	1.9
Cyclotella comta	4	2270	9080	71.6	28.8	2.6
Kephyrion sp.	8	63	504	4.0	57.5	5.2
Planktosphaeria gelatinosa	136	14	1904	15.0	978.2	88.3
	154		12687		1107.7	
			TSI=	22.7		

Lake:	Coldwater	Date: 10/02/93	Depth: epi (1m)
sample:	04-08		site2
transect (mm):	5.5	width (mm): 0.182	area (mm2): 1.0
vol. filtered: (ml)	50		

Species	count	Biovolume	T Biovol.	% Biovol.	#/ml	percent
Achnanthes minutissima	1	50	50	0.9	9.8	0.7
Cyclotella comta	1	2270	2270	38.7	9.8	0.7
Cryptomonas erosa	2	520	1040	17.8	19.6	1.5
Kephyrion spirale	6	63	378	6.5	58.8	4.4
Kephyrion sp.	7	63	441	7.5	68.7	5.1
Planktosphaeria gelatinosa	120	14	1680	28.7	1177.0	87.6
	137		5859		1343.7	
			TSI=	16.7		

Lake: Coldwater Date: 10/02/93 Depth: meta (20m)
sample: 04-09 site2
transect (mm): 21.8 width (mm): 0.182 area (mm2): 4.0
vol. filtered: (ml) 100

Species	count	Biovolume	T Biovol.	% Biovol.	#/ml	percent
Glenodinium sp.	1	700	700	3.3	1.2	1.0
Kephyrion sp.	1	63	63	0.3	1.2	1.0
Cyclotella comta	6	2270	13620	63.4	7.4	6.1
Cryptomonas erosa	11	520	5720	26.6	13.6	11.1
Chroococcus dispersus	16	22	352	1.6	19.8	16.2
Rhodomonas minuta	17	20	340	1.6	21.0	17.2
Planktosphaeria gelatinosa	48	14	672	3.1	59.4	48.5
	100		21467		123.7	
			TSI=	27.0		

Lake: Coldwater Date: 10/02/93 Depth: meta (20m)
sample: 04-10 site2
transect (mm): 18.5 width (mm): 0.182 area (mm2): 3.4
vol. filtered: (ml) 100

Species	count	Biovolume	T Biovol.	% Biovol.	#/ml	percent
Kephyrion sp.	1	63	63	0.4	1.5	0.9
Kephyrion spirale	1	63	63	0.4	1.5	0.9
Cyclotella comta	3	2270	6810	46.7	4.4	2.6
Cryptomonas erosa	11	520	5720	39.2	16.0	9.5
Rhodomonas minuta	23	20	460	3.2	33.5	19.8
Planktosphaeria gelatinosa	30	14	420	2.9	43.7	25.9
Chroococcus dispersus	48	22	1056	7.2	70.0	41.4
	117		14592		170.6	
			TSI=	23.9		

Lake: Coldwater Date: 10/02/93 Depth: hypo (40m)
 sample: 04-11 site2
 transect (mm): 90.7 width (mm): 0.182 area (mm2): 16.5
 vol. filtered: (ml) 100

Species	count	Biovolume	T Biovol.	% Biovol.	#/ml	percent
Achnanthes minutissima	1	50	50	0.2	0.3	1.1
Cymbella minuta	1	370	370	1.4	0.3	1.1
Kephyrion sp.	1	63	63	0.2	0.3	1.1
Tabellaria flocculosa	1	590	590	2.2	0.3	1.1
Chroococcus dispersus	8	22	176	0.7	2.4	8.9
Cryptomonas erosa	8	520	4160	15.5	2.4	8.9
Cyclotella comta	9	2270	20430	76.2	2.7	10.0
Planktosphaeria gelatinosa	70	14	980	3.7	20.8	77.8
	99		26819		29.4	
			TSI=	28.9		

Lake: Coldwater Date: 10/02/93 Depth: hypo (40m)
 sample: 04-12 site2
 transect (mm): 127.9 width (mm): 0.182 area (mm2): 23.3
 vol. filtered: (ml) 100

Species	count	Biovolume	T Biovol.	% Biovol.	#/ml	percent
Achnanthes marginulata	1	95	95	0.3	0.2	1.0
Kephyrion spirale	1	63	63	0.2	0.2	1.0
Navicula lanceolata	1	580	580	1.9	0.2	1.0
Navicula radiosa	1	325	325	1.1	0.2	1.0
Kephyrion sp.	2	63	126	0.4	0.4	2.1
Nitzschia palea	2	180	360	1.2	0.4	2.1
Chroococcus dispersus	8	22	176	0.6	1.7	8.2
Cyclotella comta	8	2270	18160	60.2	1.7	8.2
Cryptomonas erosa	18	520	9360	31.0	3.8	18.6
Planktosphaeria gelatinosa	67	14	938	3.1	14.1	69.1
	109		30183		23.0	
			TSI=	29.9		

Lake:	Coldwater	Date: 10/02/93	Depth: 4M
sample:	04-13		prod.
transect (mm):	7	width (mm): 0.182	area (mm2) 1.3
vol. filtered: (ml)	50		

Species	count	Biovolume	T Biovol	% Biovol	#/ml	percent
Achnanthes minutissima	2	50	100	1.2	15.4	1.2
Cyclotella comta	2	2270	4540	54.1	15.4	1.2
Kephyrion spirale	7	63	441	5.3	53.9	4.1
Kephyrion sp.	22	63	1386	16.5	169.5	12.9
Planktosphaeria gelatinosa	138	14	1932	23.0	1063.5	80.7
	171		8399		1317.8	
			TSI=	19.5		

Lake: Coldwater Date: 8/4/93 Depth: epi (1m)
 sample: 04-14 Site1
 transect (mm): 6 width (mm): 0.182 area (mm2): 1.1
 vol. filtered: (ml) 100

Species	count	Biovolume	T Biovol.	% Biovol.	#/ml	percent
Achnanthes minutissima	1	50	50	0.6	4.5	0.8
Crucigenia quadrata	1	85	85	1.0	4.5	0.8
Cryptomonas erosa	1	520	520	6.2	4.5	0.8
Cyclotella comta	1	2270	2270	27.2	4.5	0.8
Chroococcus dispersus	4	22	88	1.1	18.0	3.1
Kephyrion spirale	12	63	756	9.1	53.9	9.4
Planktosphaeria gelatinosa	52	14	728	8.7	233.8	40.9
Kephyrion sp.	61	63	3843	46.1	274.2	48.0
	133		8340		597.9	

TSI= 19.4

Lake: Coldwater Date: 8/4/93 Depth: epi (1m)
 sample: 04-15 Site1
 transect (mm): 5.2 width (mm): 0.182 area (mm2): 0.9
 vol. filtered: (ml) 100

Species	count	Biovolume	T Biovol	% Biovol	#/ml	percent
Kephyrion spirale	1	63	63	0.2	5.2	0.5
Cryptomonas erosa	2	520	1040	3.4	10.4	0.9
Crucigenia quadrata	4	85	340	1.1	20.7	1.9
Kephyrion sp.	6	63	378	1.2	31.1	2.8
Dinobryon sp.	7	125	875	2.9	36.3	3.3
Cyclotella comta	11	2270	24970	82.2	57.1	5.2
Chroococcus dispersus	12	22	264	0.9	62.2	5.6
Rhodomonas minuta	14	20	280	0.9	72.6	6.6
Planktosphaeria gelatinosa	156	14	2184	7.2	809.2	73.2
	213		30394		1104.836	

TSI= 29.9

Lake: Coldwater
sample: 04-16
transect (mm): 4.3
vol. filtered: (ml) 100

Date: 8/4/93
width (mm): 0.182

Depth: meta (9m)
Site1
area (mm2): 0.8

Species	count	Biovolume	T Biovol.	% Biovol.	#/ml	percent
Achnanthes minutissima	1	50	50	0.7	6.3	0.7
Synedra ulna	1	1990	1990	28.5	6.3	0.7
Kephyrion spirale	4	63	252	3.6	25.1	2.6
Dinobryon sp.	11	125	1375	19.7	69.0	7.2
Kephyrion sp.	29	63	1827	26.2	181.9	19.1
Planktosphaeria gelatinosa	106	14	1484	21.3	664.9	69.7
	152		6978		953.4	
			TSI=	18.0		

Lake: Coldwater
sample: 04-17
transect (mm): 6.5
vol. filtered: (ml) 100

Date: 8/4/93
width (mm): 0.182

Depth: meta (9m)
Site1
area (mm2): 1.2

Species	count	Biovolume	T Biovol	% Biovol	#/ml	percent
Kephyrion sp.	4	63	252	1.1	16.6	2.4
Dinobryon sp.	6	125	750	3.1	24.9	3.6
Cyclotella comta	9	2270	20430	85.7	37.3	5.4
Chroococcus dispersus	22	22	484	2.0	91.3	13.1
Rhodomonas minuta	25	20	500	2.1	103.7	14.9
Planktosphaeria gelatinosa	102	14	1428	6.0	423.3	60.7
	168		23844		697.1361	
			TSI=	27.9		

Lake:	Coldwater	Date: 8/4/93	Depth: hypo (45m)
sample:	04-18		Site1
transect (mm):	50.7	width (mm): 0.182	area (mm2): 9.2
vol. filtered: (ml)	100		

Species	count	Biovolume	T Biovol.	% Biovol.	#/ml	percent
Cryptomonas erosa	3	520	1560	12.0	1.6	27.3
Rhodomonas minuta	3	20	60	0.5	1.6	27.3
Cyclotella comta	5	2270	11350	87.5	2.7	45.5
	11		12970		5.9	
			TSI=	22.9		

Lake:	Coldwater	Date: 8/4/93	Depth: epi (1m)
sample:	04-20		Site2
transect (mm):	4.7	width (mm): 0.182	area (mm2) 0.9
vol. filtered: (ml)	100		

Species	count	Biovolume	T Biovol.	% Biovol.	#/ml	percent
Achnanthes minutissima	1	50	50	0.5	5.7	0.6
Cryptomonas erosa	1	520	520	5.4	5.7	0.6
Cyclotella comta	1	2270	2270	23.7	5.7	0.6
Dinobryon sp.	1	125	125	1.3	5.7	0.6
Kephyrion spirale	1	63	63	0.7	5.7	0.6
Planktosphaeria gelatinosa	66	14	924	9.7	378.8	41.3
Kephyrion sp.	89	63	5607	58.7	510.8	55.6
	160		9559		918.2	
			TSI=	20.5		

Lake:	Coldwater	Date: 8/4/93	Depth: epi (1m)
sample:	04-21		Site2
transect (mm):	5.4	width (mm): 0.182	area (mm2) 1.0
vol. filtered: (ml)	100		

Species	count	Biovolume	T Biovol	% Biovol	#/ml	percent
Cryptomonas erosa	1	520	520	7.6	5.0	0.5
Kephyrion spirale	1	63	63	0.9	5.0	0.5
Chroococcus dispersus	8	22	176	2.6	40.0	3.8
Kephyrion sp.	67	63	4221	61.8	334.7	32.1
Planktosphaeria gelatinosa	132	14	1848	27.1	659.3	63.2
	209		6828		1043.9	
			TSI=	17.9		

Lake: Coldwater Date: 8/4/93 Depth: meta (7m)
 sample: 04-22 Site2
 transect (mm): 5.6 width (mm): 0.182 area (mm2): 1.0
 vol. filtered: (ml) 100

Species	count	Biovolume	T Biovol.	% Biovol.	#/ml	percent
Cryptomonas erosa	2	520	1040	7.2	9.6	1.5
Dinobryon sp.	3	125	375	2.6	14.4	2.3
Kephyrion sp.	3	63	189	1.3	14.4	2.3
Cyclotella comta	4	2270	9080	62.8	19.3	3.1
Quadrigula lacustris	4	30	120	0.8	19.3	3.1
Gloecystis sp.	8	260	2080	14.4	38.5	6.2
Rhodomonas minuta	14	20	280	1.9	67.4	10.8
Planktosphaeria gelatinosa	92	14	1288	8.9	443.1	70.8
	130		14452		626.1	
			TSI=	23.8		

Lake: Coldwater Date: 8/4/93 Depth: meta (7m)
 sample: 04-23 Site2
 transect (mm): 6.5 width (mm): 0.182 area (mm2): 1.2
 vol. filtered: (ml) 100

Species	count	Biovolume	T Biovol	% Biovol	#/ml	percent
Achnanthes minutissima	2	50	100	4.8	8.3	1.3
Kephyrion sp.	5	63	315	15.1	20.7	3.1
Cyclotella comta	13	2270	29510	1418.8	53.9	8.2
Rhodomonas minuta	19	20	380	18.3	78.8	11.9
Planktosphaeria gelatinosa	120	14	1680	80.8	498.0	75.5
	159		31985		659.8	
			TSI=	30.4		

Lake:	Coldwater	Date: 8/4/93	Depth: hypo (35m)
sample:	04-24		Site2
transect (mm):	54.7	width (mm): 0.182	area (mm2): 10.0
vol. filtered: (ml)	100		

Species	count	Biovolume	T Biovol.	% Biovol.	#/ml	percent
Mastogloia smithii lacustris	1	300	300	2.8	0.5	2.0
Cyclotella comta	2	2270	4540	41.8	1.0	4.0
Kephyrion sp.	3	63	189	1.7	1.5	6.0
Planktosphaeria gelatinosa	7	14	98	0.9	3.5	14.0
Cryptomonas erosa	10	520	5200	47.9	4.9	20.0
Rhodomonas minuta	27	20	540	5.0	13.3	54.0
	50		10867		24.7	
			TSI=	21.5		

Lake:	Coldwater	Date: 8/4/93	Depth: hypo (35m)
sample:	04-25		Site2
transect (mm):	52.2	width (mm): 0.182	area (mm2): 9.5
vol. filtered: (ml)	100		

Species	count	Biovolume	T Biovol	% Biovol	#/ml	percent
Navicula sp.	1	150	150	0.9	0.5	2.0
Kephyrion sp.	2	63	126	0.7	1.0	4.0
Cyclotella comta	5	2270	11350	67.1	2.6	10.0
Cryptomonas erosa	9	520	4680	27.7	4.7	18.0
Planktosphaeria gelatinosa	9	14	126	0.7	4.7	18.0
Rhodomonas minuta	24	20	480	2.8	12.4	48.0
	50		16912		25.8	
			TSI=	25.1		

Lake: Coldwater Date: 8/4/93 Depth: 4M
 sample: 04-26
 transect (mm): 6.5 width (mm): 0.182 area (mm2): 1.2
 vol. filtered: (ml) 100

Species	count	Biovolume	T Biovol	% Biovol	#/ml	percent
Navicula sp.	1	150	150	2.3	4.1	0.5
Kephyrion sp.	22	63	1386	21.2	91.3	11.6
Dinobryon sp.	24	125	3000	45.9	99.6	12.6
Planktosphaeria gelatinosa	143	14	2002	30.6	593.4	75.3
	190		6538		788.4	
			TSI=	17.5		

Lake: Coldwater Date: 8/4/93 Depth: 15M
 sample: 04-27
 transect (mm): 17.5 width (mm): 0.182 area (mm2): 3.2
 vol. filtered: (ml) 100

Species	count	Biovolume	T Biovol	% Biovol	#/ml	percent
Kephyrion spirale	1	63	63	0.2	1.5	1.2
Kephyrion sp.	3	63	189	0.5	4.6	3.6
Cryptomonas erosa	5	520	2600	6.9	7.7	6.0
Rhodomonas minuta	14	20	280	0.7	21.6	16.7
Cyclotella comta	15	2270	34050	90.0	23.1	17.9
Planktosphaeria gelatinosa	46	14	644	1.7	70.9	54.8
	84		37826		129.5	
			TSI=	31.8		

Lake:	Coldwater	Date: 10/9/92	Depth: 1M
sample:	04-28		
transect (mm):	17.5	width (mm): 0.182	area (mm2): 3.2
vol. filtered: (ml)	100		

Species	count	Biovolume	T Biovol	% Biovol	#/ml	percent
Achnanthes linearis	1	132	132	0.4	1.5	0.9
Navicula sp.	1	150	150	0.4	1.5	0.9
Kephyrion spirale	2	63	126	0.3	3.1	1.9
Navicula rhynchocephala	2	295	590	1.6	3.1	1.9
Quadrigula lacustris	3	30	90	0.2	4.6	2.8
Fragilaria sp.	8	200	1600	4.3	12.3	7.5
Kephyrion sp.	12	63	756	2.0	18.5	11.3
Glenodinium sp.	19	700	13300	35.6	29.3	17.9
Rhodomonas minuta	19	20	380	1.0	29.3	17.9
Cryptomonas erosa	39	520	20280	54.2	60.1	36.8
	106		37404		163.4	
			TSI=	31.7		

Lake: Coldwater Date: 10/9/92 Depth: meta (15m)
 sample: 04-29
 transect (mm): 33.2 width (mm): 0.182 area (mm2) 6.0
 vol. filtered: (ml) 100

Species	count	Biovolume	T Biovol	% Biovol	#/ml	percent
Achnanthes minutissima	1	50	50	0.2	0.8	0.8
Cymbella sinuata	1	140	140	0.5	0.8	0.8
Gomphonema sp.	1	200	200	0.7	0.8	0.8
Kephyrion spirale	1	63	63	0.2	0.8	0.8
Navicula rhynchocephala	1	295	295	1.1	0.8	0.8
Cymbella hustedtii	2	400	800	2.9	1.6	1.6
Tabellaria flocculosa	2	590	1180	4.3	1.6	1.6
Navicula sp.	6	150	900	3.3	4.9	4.7
Glenodinium sp.	7	700	4900	17.9	5.7	5.5
Fragilaria crotonensis	9	840	7560	27.6	7.3	7.1
Planktosphaeria gelatinosa	16	14	224	0.8	13.0	12.6
Cryptomonas erosa	19	520	9880	36.0	15.4	15.0
Rhodomonas minuta	61	20	1220	4.5	49.6	48.0
	127		27412		103.2	
			TSI=	29.1		

Lake:	Coldwater	Date: 10/9/92	Depth: hypo (45m)
sample:	04-30		
transect (mm):	89.9	width (mm): 0.182	area (mm2): 16.4
vol. filtered: (ml)	100		

Species	count	Biovolume	T Biovol	% Biovol	#/ml	percent
Cyclotella stelligera	1	55	55	0.1	0.3	1.7
Navicula rhynchocephala	1	295	295	0.8	0.3	1.7
Oocystis sp.	1	75	75	0.2	0.3	1.7
Glenodinium sp.	4	700	2800	7.1	1.2	6.9
Achnanthes minutissima	9	50	450	1.1	2.7	15.5
Cyclotella comta	10	2270	22700	57.7	3.0	17.2
Navicula sp.	10	150	1500	3.8	3.0	17.2
Cryptomonas erosa	22	520	11440	29.1	6.6	37.9
	58		39315		17.4	
			TSI=	32.1		

Lake:	Coldwater	Date: 3/24/93	Depth: epi (1m)
sample:	04-31		Site1
transect (mm):	22.7	width (mm): 0.182	area (mm2) 4.1
vol. filtered: (ml)	100		

Species	count	Biovolume	T Biovol.	% Biovol.	#/ml	percent
Achnanthes minutissima	1	50	50	0.2	1.2	1.0
Cryptomonas erosa	1	520	520	2.4	1.2	1.0
Diatoma tenue elongaum	1	720	720	3.3	1.2	1.0
Fragilaria crotonensis	1	840	840	3.8	1.2	1.0
Navicula rhynchocephala	1	295	295	1.3	1.2	1.0
Navicula sp.	1	150	150	0.7	1.2	1.0
Synedra sp.	2	280	560	2.6	2.4	1.9
Quadrigula lacustris	3	30	90	0.4	3.6	2.9
Cyclotella comta	4	2270	9080	41.4	4.8	3.9
Glenodinium sp.	7	700	4900	22.4	8.3	6.8
Planktosphaeria gelatinosa	8	14	112	0.5	9.5	7.8
Kephyrion sp.	16	63	1008	4.6	19.0	15.5
Kephyrion spirale	57	63	3591	16.4	67.7	55.3
	103		21916		122.4	
			TSI=	27.2		

Lake: Coldwater
sample: 04-32
transect (mm): 9.3
vol. filtered: (ml) 100

Date: 3/24/93
width (mm): 0.182

Depth: meta (23m)
Site1
area (mm2): 1.7

Species	count	Biovolume	T Biovol	% Biovol	#/ml	percent
Cryptomonas erosa	1	520	520	3.2	2.9	0.9
Cyclotella stelligera	1	55	55	0.3	2.9	0.9
Fragilaria crotonensis	1	840	840	5.2	2.9	0.9
Navicula muralis	1	45	45	0.3	2.9	0.9
Synedra sp.	1	280	280	1.7	2.9	0.9
Cyclotella comta	2	2270	4540	28.3	5.8	1.7
Rhodomonas minuta	2	20	40	0.2	5.8	1.7
Glenodinium sp.	8	700	5600	34.9	23.2	6.8
Kephyrion sp.	15	63	945	5.9	43.5	12.8
Kephyrion spirale	41	63	2583	16.1	118.9	35.0
Planktosphaeria gelatinosa	44	14	616	3.8	127.6	37.6
	117		16064		339.3	

TSI= 24.6

Lake:	Coldwater	Date: 3/24/93	Depth: hypo (56.5m)
sample:	04-33		Site1
transect (mm):	8.4	width (mm): 0.182	area (mm2): 1.5
vol. filtered: (ml)	100		

Species	count	Biovolume	T Biovol.	% Biovol.	#/ml	percent
Achnanthes lanceolata	1	180	180	1.0	3.2	0.9
Navicula rhynchocephala	2	295	590	3.4	6.4	1.7
Nitzschia sp.	2	120	240	1.4	6.4	1.7
Cyclotella comta	3	2270	6810	39.6	9.6	2.6
Achnanthes minutissima	4	50	200	1.2	12.8	3.5
Glenodinium sp.	5	700	3500	20.4	16.1	4.3
Planktosphaeria gelatinosa	5	14	70	0.4	16.1	4.3
Kephyrion sp.	15	63	945	5.5	48.2	13.0
Kephyrion spirale	74	63	4662	27.1	237.6	64.3
	111		17197		356.4	
			TSI=	25.2		

Lake:	Coldwater	Date: 3/24/93	Depth: epi (1m)
sample:	04-34		Site2
transect (mm):	14.4	width (mm): 0.182	area (mm2): 2.6
vol. filtered: (ml)	100		

Species	count	Biovolume	T Biovol.	% Biovol.	#/ml	percent
Cryptomonas erosa	1	520	520	2.8	1.9	0.9
Gomphonema olivaceium	1	225	225	1.2	1.9	0.9
Navicula sp.	1	150	150	0.8	1.9	0.9
Nitzschia paleacea	1	98	98	0.5	1.9	0.9
Achnanthes minutissima	2	50	100	0.5	3.7	1.8
Fragilaria crotonensis	2	840	1680	9.1	3.7	1.8
Cyclotella comta	3	2270	6810	37.1	5.6	2.7
Glenodinium sp.	4	700	2800	15.2	7.5	3.6
Kephyrion sp.	26	63	1638	8.9	48.7	23.6
Kephyrion spirale	69	63	4347	23.7	129.2	62.7
	110		18368		206.0	
			TSI=	25.7		

Lake: Coldwater
 sample: 04-35
 transect (mm): 12.8
 vol. filtered: (ml) 100

Date: 3/24/93
 width (mm): 0.182

Depth: meta (23m)
 Site2
 area (mm2): 2.3

Species	count	Biovolume	T Biovol	% Biovol	#/ml	percent
Cryptomonas erosa	1	520	520	2.8	2.1	0.8
Dinobryon sp.	1	125	125	0.7	2.1	0.8
Navicula rhynchocephala	1	295	295	1.6	2.1	0.8
Cyclotella comta	2	2270	4540	24.4	4.2	1.5
Rhodomonas minuta	2	20	40	0.2	4.2	1.5
Synedra sp.	2	280	560	3.0	4.2	1.5
Achnanthes minutissima	3	50	150	0.8	6.3	2.3
Glenodinium sp.	4	700	2800	15.0	8.4	3.0
Tabellaria flocculosa	5	590	2950	15.8	10.5	3.8
Planktosphaeria gelatinosa	8	14	112	0.6	16.9	6.0
Kephyrion sp.	14	63	882	4.7	29.5	10.5
Kephyrion spirale	90	63	5670	30.4	189.7	67.7
	133		18644		280.3	
			TSI=	25.9		

Lake:	Coldwater	Date: 3/24/93	Depth: hypo (40m)
sample:	04-36		Site2
transect (mm):	12.6	width (mm): 0.182	area (mm2): 2.3
vol. filtered: (ml)	100		

Species	count	Biovolume	T Biovol.	% Biovol.	#/ml	percent
Cryptomonas erosa	1	520	520	3.8	2.1	0.8
Cyclotella comta	1	2270	2270	16.8	2.1	0.8
Fragilaria crotonensis	1	840	840	6.2	2.1	0.8
Navicula minima	1	44	44	0.3	2.1	0.8
Nitzschia paleacea	1	98	98	0.7	2.1	0.8
Rhodomonas minuta	1	20	20	0.1	2.1	0.8
Ankistrodesmus falcatus	2	25	50	0.4	4.3	1.6
Achnanthes minutissima	3	50	150	1.1	6.4	2.3
Glenodinium sp.	4	700	2800	20.7	8.6	3.1
Planktosphaeria gelatinosa	8	14	112	0.8	17.1	6.3
Kephyrion sp.	18	63	1134	8.4	38.5	14.1
Kephyrion spirale	87	63	5481	40.5	186.2	68.0
	128		13519		274.0	
			TSI=	23.2		

**Phytoplankton Data Sheets for
Fawn Lake**

Lake:	Fawn	Date: 10/11/92	Depth: 1M
sample:	05-01		
transect (mm):	27.9	width (mm): 0.182	area (mm2) 5.1
vol. filtered: (ml)	100		

Species	count	Biovolume	T Biovol	% Biovol	#/ml	percent
Cyclotella comta	1	2270	2270	5.7	1.0	0.8
Navicula bacillum	1	377	377	0.9	1.0	0.8
Navicula sp.	1	150	150	0.4	1.0	0.8
Gomphonema olivaceium	2	225	450	1.1	1.9	1.5
Navicula radiosa tenella	2	120	240	0.6	1.9	1.5
Achnanthes minutissima	3	50	150	0.4	2.9	2.3
Cymbella affinis	3	1800	5400	13.6	2.9	2.3
Glenodinium sp.	12	700	8400	21.1	11.6	9.0
Fragilaria crotonensis	14	840	11760	29.6	13.5	10.5
Ankistrodesmus falcatus	15	25	375	0.9	14.5	11.3
Cryptomonas erosa	18	520	9360	23.6	17.4	13.5
Chroococcus minumus	57	14	798	2.0	55.1	42.9
	129		39730		124.7	
			TSI=	32.2		

Lake: Fawn
sample: 05-02
transect (mm): 17.7
vol. filtered: (ml) 100

Date: 10/11/92
Depth: meta (10m)
width (mm): 0.182
area (mm2): 3.2

Species	count	Biovolume	T Biovol	% Biovol	#/ml	percent
Achnanthes minutissima	1	50	50	0.2	1.5	1.0
Cyclotella meneghiniana	1	380	380	1.3	1.5	1.0
Gomphonema olivaceum	1	225	225	0.7	1.5	1.0
Navicula bacillum	1	377	377	1.3	1.5	1.0
Navicula pupula	1	270	270	0.9	1.5	1.0
Planktosphaeria gelatinosa	1	14	14	0.0	1.5	1.0
Fragilaria crotonensis	2	840	1680	5.6	3.0	2.0
Rhodomonas minuta	2	20	40	0.1	3.0	2.0
Ankistrodesmus falcatus	3	25	75	0.2	4.6	3.1
Glenodinium sp.	3	700	2100	7.0	4.6	3.1
Navicula radiosa tenella	4	120	480	1.6	6.1	4.1
Rhodomonas minuta	4	20	80	0.3	6.1	4.1
Chroococcus minumus	27	14	378	1.3	41.1	27.6
Cryptomonas erosa	46	520	23920	79.6	70.1	46.9
	97		30069		147.8	
			TSI=	29.8		

Lake:	Fawn	Date: 10/11/92	Depth: hypo (18m)
sample:	05-03		
transect (mm):	18.1	width (mm): 0.182	area (mm2): 3.3
vol. filtered: (ml)	50		

Species	count	Biovolume	T Biovol	% Biovol	#/ml	percent
Cocconeis pediculus	1	520	520	2.0	3.0	1.0
Cyclotella comta	2	2270	4540	17.1	6.0	2.0
Fragilaria crotonensis	2	840	1680	6.3	6.0	2.0
Chroococcus minumus	4	14	56	0.2	11.9	4.0
Planktosphaeria gelatinosa	4	14	56	0.2	11.9	4.0
Cryptomonas erosa	20	520	10400	39.2	59.6	20.0
Chlamydomonas-like	24	325	7800	29.4	71.5	24.0
Sphaerocystis Schroeteri	43	35	1505	5.7	128.2	43.0
	100		26557		298.0	
			TSI=	28.8		

Lake: Fawn Date: 8/5/93 Depth: epi (1m)
 sample: 05-04
 transect (mm): 28.1 width (mm): 0.182 area (mm2): 5.1
 vol. filtered: (ml) 100

Species	count	Biovolume	T Biovol.	% Biovol.	#/ml	percent
<i>Cymbella minuta</i>	1	370	370	0.7	1.0	0.4
<i>Gomphonema subtile</i>	1	150	150	0.3	1.0	0.4
<i>Synedra ulna</i>	1	1990	1990	3.9	1.0	0.4
<i>Gomphonema olivaceum</i>	2	225	450	0.9	1.9	0.8
<i>Navicula radiosa tenella</i>	2	120	240	0.5	1.9	0.8
<i>Rhodomonas minuta</i>	2	20	40	0.1	1.9	0.8
<i>Navicula rhynchocephala</i>	3	295	885	1.7	2.9	1.2
<i>Fragilaria crotonensis</i>	5	840	4200	8.2	4.8	2.0
<i>Nitzschia paleacea</i>	5	98	490	1.0	4.8	2.0
<i>Achnanthes minutissima</i>	6	50	300	0.6	5.8	2.4
<i>Glenodinium</i> sp.	6	700	4200	8.2	5.8	2.4
<i>Navicula moumei</i>	7	235	1645	3.2	6.7	2.7
<i>Planktosphaeria gelatinosa</i>	8	14	112	0.2	7.7	3.1
<i>Ankistrodesmus falcatus</i>	9	25	225	0.4	8.6	3.5
<i>Kephyrion</i> sp.	10	63	630	1.2	9.6	3.9
<i>Cyclotella comta</i>	11	2270	24970	48.9	10.6	4.3
<i>Chroococcus minumus</i>	14	14	196	0.4	13.4	5.5
<i>Cryptomonas erosa</i>	14	520	7280	14.2	13.4	5.5
<i>Kephyrion spirale</i>	28	63	1764	3.5	26.9	11.0
<i>Microcystis aeruginosa</i>	120	8	960	1.9	115.2	47.1
	255		51097		244.8	

TSI= 34.3

Lake: Fawn
sample: 05-05
transect (mm): 16.3
vol. filtered: (ml) 100

Date: 8/5/93
width (mm): 0.182

Depth: epi (1m)
area (mm2): 3.0

Species	count	Biovolume	T Biovol	% Biovol	#/ml	percent
Cocconeis disculus	1	75	75	0.2	1.7	0.6
Crucigenia quadrata	1	85	85	0.2	1.7	0.6
Glenodinium sp.	1	700	700	2.0	1.7	0.6
Rhodomonas minuta	1	20	20	0.1	1.7	0.6
Gomphonema subtile	2	150	300	0.8	3.3	1.3
Nitzschia paleacea	2	98	196	0.6	3.3	1.3
Navicula sp.	3	150	450	1.3	5.0	1.9
Ankistrodesmus falcatus	4	25	100	0.3	6.6	2.5
Fragilaria crotonensis	4	840	3360	9.5	6.6	2.5
Achnanthes minutissima	6	50	300	0.8	9.9	3.8
Cryptomonas erosa	6	520	3120	8.8	9.9	3.8
Chroococcus minumus	8	14	112	0.3	13.2	5.0
Cyclotella comta	9	2270	20430	57.6	14.9	5.7
Planktosphaeria gelatinosa	16	14	224	0.6	26.5	10.1
Kephyrion sp.	24	63	1512	4.3	39.7	15.1
Kephyrion spirale	71	63	4473	12.6	117.5	44.7
	159		35457		263.1	

TSI= 31.2

Lake: Fawn
 sample: 05-06
 transect (mm): 17.5
 vol. filtered: (ml) 100

Date: 8/5/93
 width (mm): 0.182

Depth: meta (10m)
 area (mm2): 3.2

Species	count	Biovolume	T Biovol.	% Biovol.	#/ml	percent
	1	50	50	0.1	1.5	0.6
Achnanthes minutissima	1	1990	1990	2.9	1.5	0.6
Synedra ulna	1	14	28	0.0	3.1	1.2
Chroococcus minumus	2	63	126	0.2	3.1	1.2
Kephyrion spirale	2	235	470	0.7	3.1	1.2
Navicula moumei	2	700	2100	3.1	4.6	1.8
Glenodinium sp.	3	60	240	0.4	6.2	2.4
Chlorella sp.	4	840	3360	5.0	6.2	2.4
Fragilaria crotonensis	4	225	900	1.3	6.2	2.4
Gomphonema olivaceium	4	14	112	0.2	12.3	4.9
Planktosphaeria gelatinosa	8	25	425	0.6	26.2	10.4
Ankistrodesmus falcatus	17	20	440	0.7	33.9	13.4
Rhodomonas minuta	22	2270	54480	80.5	37.0	14.6
Cyclotella comta	24	63	2961	4.4	72.4	28.7
Kephyrion sp.	47		67682		217.3	
	141					

TSI= 36.7

Lake: Fawn
sample: 05-07
transect (mm): 12.8
vol. filtered: (ml) 100

Date: 8/5/93

Depth: meta (10m)

width (mm): 0.182

area (mm2): 2.3

Species	count	Biovolume	T Biovol	% Biovol	#/ml	percent
Fragilaria crotonensis	1	840	840	1.3	2.1	0.6
Navicula moumei	1	235	235	0.4	2.1	0.6
Synedra ulna	1	1990	1990	3.1	2.1	0.6
Gomphonema olivaceum	2	225	450	0.7	4.2	1.2
Chlorella sp.	4	60	240	0.4	8.4	2.3
Glenodinium sp.	6	700	4200	6.6	12.6	3.5
Ankistrodesmus falcatus	8	25	200	0.3	16.9	4.6
Cyclotella comta	16	2270	36320	56.9	33.7	9.2
Cryptomonas erosa	31	520	16120	25.3	65.3	17.9
Kephyrion sp.	31	63	1953	3.1	65.3	17.9
Planktosphaeria gelatinosa	35	14	490	0.8	73.8	20.2
Rhodomonas minuta	37	20	740	1.2	78.0	21.4
	173		63778		364.6	

TSI= 36.2

Lake: Fawn
 sample: 05-08
 transect (mm): 16.5
 vol. filtered: (ml) 100

Date: 8/5/93
 width (mm): 0.182

Depth: hypo (18m)
 area (mm²) 3.0

Species	count	Biovolume	T Biovol.	% Biovol.	#/ml	percent
Achnanthes minutissima	1	50	50	0.1	1.6	0.6
Cymbella angustata	1	195	195	0.5	1.6	0.6
Cymbella muelleri	1	400	400	1.1	1.6	0.6
Fragilaria pinnata	1	60	60	0.2	1.6	0.6
Cymbella minuta	2	370	740	2.0	3.3	1.3
Gomphonema olivaceum	2	225	450	1.2	3.3	1.3
Ankistrodesmus falcatus	4	25	100	0.3	6.5	2.5
Planktosphaeria gelatinosa	4	14	56	0.1	6.5	2.5
Kephyrion sp.	5	63	315	0.8	8.2	3.1
Nitzschia palea	5	180	900	2.4	8.2	3.1
Cyclotella comta	6	2270	13620	36.0	9.8	3.8
Glenodinium sp.	6	700	4200	11.1	9.8	3.8
Chlorella sp.	8	60	480	1.3	13.1	5.0
Rhodomonas minuta	24	20	480	1.3	39.2	15.0
Cryptomonas erosa	26	520	13520	35.8	42.5	16.3
Sphaerocystis Schroeteri	64	35	2240	5.9	104.6	40.0
	160		37806		261.6	

TSI= 31.8

Lake: Fawn
sample: 05-09
transect (mm): 23.4
vol. filtered: (ml) 100

Date: 8/5/93
width (mm): 0.182

Depth: hypo (18m)
area (mm2) 4.3

Species	count	Biovolume	T Biovol	% Biovol	#/ml	percent
Gomphonema olivaceium	1	225	225	0.5	1.2	0.9
Nitzschia palea	1	180	180	0.4	1.2	0.9
Navicula mournei	2	235	470	1.0	2.3	1.8
Glenodinium sp.	5	700	3500	7.2	5.8	4.5
Kephyrion sp.	6	63	378	0.8	6.9	5.4
Cyclotella comta	8	2270	18160	37.4	9.2	7.1
Rhodomonas minuta	17	20	340	0.7	19.6	15.2
Sphaerocystis Schroeteri	25	35	875	1.8	28.8	22.3
Cryptomonas erosa	47	520	24440	50.3	54.2	42.0
	112		48568		129.1	

TSI= 33.9

Lake: Fawn Date: 10/2/93 Depth: epi (1m)
sample: 05-10
transect (mm): 8.2 width (mm): 0.182 area (mm2): 1.5
vol. filtered: (ml) 100

Species	count	Biovolume	T Biovol.	% Biovol.	#/ml	percent
Glenodinium sp.	1	700	700	2.5	3.3	0.6
Kephyrion sp.	3	63	189	0.7	9.9	1.9
Rhodomonas minuta	4	20	80	0.3	13.2	2.5
Cyclotella comta	5	2270	11350	40.4	16.4	3.1
Cryptomonas erosa	8	520	4160	14.8	26.3	4.9
Dinobryon sp.	12	125	1500	5.3	39.5	7.4
Asterionella formosa	20	220	4400	15.7	65.8	12.3
Chroococcus minumus	50	14	700	2.5	164.5	30.9
Ochromonas sp.	59	85	5015	17.9	194.1	36.4
	162		28094		532.9	

TSI= 29.3

Lake: Fawn Date: 10/2/93 Depth: epi (1m)
sample: 05-11
transect (mm): 5.9 width (mm): 0.182 area (mm2): 1.1
vol. filtered: (ml) 100

Species	count	Biovolume	T Biovol	% Biovol	#/ml	percent
Gomphonema olivaceum	1	225	225	1.6	4.6	0.7
Navicula confervacea	1	80	80	0.6	4.6	0.7
Cryptomonas erosa	2	520	1040	7.5	9.1	1.4
Rhodomonas minuta	2	20	40	0.3	9.1	1.4
Sphaerocystis Schroeteri	8	35	280	2.0	36.6	5.4
Dinobryon sp.	9	125	1125	8.1	41.1	6.1
Asterionella formosa	14	220	3080	22.2	64.0	9.5
Chroococcus minumus	20	14	280	2.0	91.4	13.5
Ochromonas sp.	91	85	7735	55.7	416.0	61.5
	148		13885		676.6	

TSI= 23.5

Lake: Fawn
 sample: 05-12
 transect (mm): 13.3
 vol. filtered: (ml) 100

Date: 10/2/93
 width (mm): 0.182

Depth: meta (10m)
 area (mm2): 2.4

Species	count	Biovolume	T Biovol.	% Biovol.	#/ml	percent
Ochromonas sp.	1	85	85	0.3	2.0	0.6
Kephyrion sp.	2	63	126	0.5	4.1	1.2
Cyclotella comta	3	2270	6810	24.5	6.1	1.8
Gomphonema olivaceiu	4	225	900	3.2	8.1	2.4
Fragilaria crotonensis	6	840	5040	18.2	12.2	3.6
Rhodomonas minuta	8	20	160	0.6	16.2	4.8
Cryptomonas erosa	9	520	4680	16.9	18.3	5.4
Asterionella formosa	12	220	2640	9.5	24.3	7.3
Quadrigula lacustris	20	30	600	2.2	40.6	12.1
Dinobryon sp.	45	125	5625	20.3	45.6	13.6
Chroococcus minumus	78	14	1092	3.9	158.2	47.1
	188		27758		335.6	

TSI= 29.2

Lake: Fawn
 sample: 05-13
 transect (mm): 16.3
 vol. filtered: (ml) 100

Date: 10/2/93
 width (mm): 0.182
 Depth: meta (10m)
 area (mm2): 3.0

Species	count	Biovolume	T Biovol	% Biovol	#/ml	percent
Cocconeis pediculus	1	520	520	1.5	1.7	0.5
Gomphonema subtile	1	150	150	0.4	1.7	0.5
Fragilaria crotonensis	4	840	3360	9.5	6.6	2.1
Cyclotella comta	7	2270	15890	45.0	11.6	3.6
Cryptomonas erosa	10	520	5200	14.7	16.5	5.1
Asterionella formosa	13	220	2860	8.1	21.5	6.7
Rhodomonas minuta	13	20	260	0.7	21.5	6.7
Planktosphaeria gelatinosa	16	14	224	0.6	26.5	8.2
Sphaerocystis Schroeteri	16	35	560	1.6	26.5	8.2
Dinobryon sp.	40	125	5000	14.2	35.6	11.1
Chroococcus minumus	92	14	1288	3.6	152.2	47.3
	213		35312		320.2	

TSI= 31.2

Lake: Fawn
 sample: 05-14
 transect (mm): 20.8
 vol. filtered: (ml) 100

Date: 10/2/93

Depth: hypo (18m)

width (mm): 0.182

area (mm2) 3.8

Species	count	Biovolume	T Biovol.	% Biovol.	#/ml	percent
Glenodinium sp.	2	700	1400	3.0	2.6	1.8
Planktospaeria gelatinosa	45	14	630	1.4	58.4	39.5
Cyclotella comta	15	2270	34050	74.2	19.5	13.2
Cryptomonas erosa	18	520	9360	20.4	23.3	15.8
Chroococcus minumus	34	14	476	1.0	44.1	29.8
	114		45916		147.9	
			TSI=	33.4		

Lake: Fawn
 sample: 05-15
 transect (mm): 29.3
 vol. filtered: (ml) 100

Date: 10/2/93

Depth: hypo (18m)

width (mm): 0.182

area (mm2) 5.3

Species	count	Biovolume	T Biovol	% Biovol	#/ml	percent
Cryptomonas ovata	1	1727	1727	2.4	0.9	0.7
Glenodinium sp.	1	700	700	1.0	0.9	0.7
Gomphonema olivaceium	1	225	225	0.3	0.9	0.7
Ankistrodesmus falcatus	7	25	175	0.2	6.4	5.0
Cryptomonas erosa	19	520	9880	13.6	17.5	13.7
Cyclotella comta	26	2270	59020	81.0	23.9	18.7
Planktospaeria gelatinosa	41	14	574	0.8	37.7	29.5
Chroococcus minumus	43	14	602	0.8	39.6	30.9
	139		72903		127.9584	
			TSI=	37.4		

Lake: Fawn
 sample: 05-16
 transect (mm): 3.8
 vol. filtered: (ml) 100

Date: 10/2/93
 width (mm): 0.182

Depth: productivity
 area (mm2) 0.7

Species	count	Biovolume	T Biovol	% Biovol	#/ml	percent
Navicula radiosa	1	325	325	2.2	7.1	0.7
Cyclotella comta	2	2270	4540	30.1	14.2	1.4
Glenodinium sp.	2	700	1400	9.3	14.2	1.4
Dinobryon sp.	5	125	625	4.1	35.5	3.6
Kephyrion sp.	6	63	378	2.5	42.6	4.3
Asterionella formosa	7	220	1540	10.2	49.7	5.0
Chroococcus minumus	52	14	728	4.8	369.1	37.1
Ochromonas sp.	65	85	5525	36.7	461.4	46.4
	140		15061		993.7	

TSI= 24.1

**Phytoplankton Data Sheets for
Hanaford Lake**

Lake: Hanaford Date: 10/11/92 Depth: 1M
 sample: 06-01
 transect (mm): 31.5 width (mm): 0.182 area (mm2) 5.7
 vol. filtered: (ml) 100

Species	count	Biovolume	T Biovol	% Biovol	#/ml	percent
Achnanthes lanceolata	1	180	180	0.1	0.9	0.9
Achnanthes minutissima	1	50	50	0.0	0.9	0.9
Chlamydomonas sp.	1	300	300	0.2	0.9	0.9
Cyclotella glomerata	1	60	60	0.0	0.9	0.9
Tabellaria flocculosa	1	590	590	0.4	0.9	0.9
Navicula cryptocephala	2	185	370	0.3	1.7	1.8
Navicula radiosa	2	325	650	0.5	1.7	1.8
Navicula mutica	3	55	165	0.1	2.6	2.7
Nitzschia palea	6	180	1080	0.8	5.1	5.5
Rhodomonas minuta	6	20	120	0.1	5.1	5.5
Glenodinium sp.	39	700	27300	19.8	33.4	35.5
Cyclotella comta	47	2270	106690	77.6	40.2	42.7
	110		137555		94.2	

TSI= 42.8

Lake: Hanaford
 sample: 06-02
 transect (mm): 12.1
 vol. filtered: (ml) 100

Date: 10/11/92

Depth: meta (8m)

width (mm): 0.182

area (mm2): 2.2

Species	count	Biovolume	T Biovol	% Biovol	#/ml	percent
Navicula moumei	1	235	235	0.4	2.2	1.0
Nitzschia hungarica	1	530	530	0.9	2.2	1.0
Nitzschia palea	1	180	180	0.3	2.2	1.0
Rhodomonas minuta	1	20	20	0.0	2.2	1.0
Navicula radiosa	2	325	650	1.1	4.5	2.0
Chlamydomonas sp.	10	300	3000	5.1	22.3	10.1
Chlamydomonas-like	18	325	5850	10.0	40.1	18.2
Cyclotella comta	20	2270	45400	77.6	44.6	20.2
Ochromonas sp.	21	85	1785	3.1	46.8	21.2
Sphaerocystis Schroeteri	24	35	840	1.4	53.5	24.2
	99		58490		220.7	

TSI= 35.5

Lake: Hanaford
sample: 06-03
transect (mm): 9.8
vol. filtered: (ml) 100

Date: 10/11/92
width (mm): 0.182
area (mm2): 1.8

Species	count	Biovolume	T Biovol	% Biovol	#/ml	percent
Glenodinium sp.	1	700	700	1.1	2.8	0.8
Navicula minima	1	44	44	0.1	2.8	0.8
Navicula pupula	1	270	270	0.4	2.8	0.8
Navicula rhynchocephala	1	295	295	0.4	2.8	0.8
Navicula salinarum	1	476	476	0.7	2.8	0.8
Chlamydomonas sp.	4	300	1200	1.8	11.0	3.1
Cryptomonas erosa	4	520	2080	3.2	11.0	3.1
Achnanthes minutissima	5	50	250	0.4	13.8	3.9
Ochromonas sp.	6	85	510	0.8	16.5	4.7
Chlamydomonas-like	8	325	2600	3.9	22.0	6.3
Nitzschia palea	8	180	1440	2.2	22.0	6.3
Sphaerocystis Schroeteri	20	35	700	1.1	55.0	15.7
Cyclotella comta	24	2270	54480	82.7	66.1	18.9
Rhodomonas minuta	43	20	860	1.3	118.3	33.9
	127		65905		349.5	

TSI= 36.5

Lake: Hanaford
 sample: 06-04
 transect (mm): 17.5
 vol. filtered: (ml) 100

Date: 8/5/93
 width (mm): 0.182

Depth: epi (1m)
 area (mm2): 3.2

Species	count	Biovolume	T Biovol.	% Biovol.	#/ml	percent
Crucigenia quadrata	1	85	85	0.5	1.5	1.0
Cymbella minuta	1	370	370	2.4	1.5	1.0
Navicula pupula	1	270	270	1.7	1.5	1.0
Nitzschia amphibia	1	96	96	0.6	1.5	1.0
Oocystis lacustris	1	308	308	2.0	1.5	1.0
Glenodinium sp.	2	700	1400	8.9	3.1	1.9
Navicula cryptocephala	2	185	370	2.4	3.1	1.9
Navicula mourei	2	235	470	3.0	3.1	1.9
Navicula radiosa	2	325	650	4.2	3.1	1.9
Navicula minima	3	44	132	0.8	4.6	2.9
Rhodomonas minuta	3	20	60	0.4	4.6	2.9
Ankistrodesmus falcatus	4	25	100	0.6	6.2	3.9
Nitzschia palea	4	180	720	4.6	6.2	3.9
Achnanthes minutissima	8	50	400	2.6	12.3	7.8
Cryptomonas erosa	13	520	6760	43.2	20.0	12.6
Kephyrion sp.	55	63	3465	22.1	84.8	53.4
	103		15656		158.8	

TSI= 24.4

Lake: Hanaford
 sample: 06-05
 transect (mm): 45.1
 vol. filtered: (ml) 100

Date: 8/5/93
 width (mm): 0.182

Depth: epi (1m)
 area (mm2) 8.2

Species	count	Biovolume	T Biovol	% Biovol	#/ml	percent
Achnanthes minutissima	1	50	50	1.0	0.6	2.3
Crucigenia quadrata	1	85	85	1.6	0.6	2.3
Glenodinium sp.	1	700	700	13.5	0.6	2.3
Navicula cryptocephala	1	185	185	3.6	0.6	2.3
Navicula minima	1	44	44	0.8	0.6	2.3
Navicula moumei	1	235	235	4.5	0.6	2.3
Navicula muralis	1	45	45	0.9	0.6	2.3
Navicula pupula	1	270	270	5.2	0.6	2.3
Navicula radiosa	1	325	325	6.3	0.6	2.3
Nitzschia amphibia	1	96	96	1.8	0.6	2.3
Nitzschia palea	1	180	180	3.5	0.6	2.3
Oocystis lacustris	1	308	308	5.9	0.6	2.3
Rhodomonas minuta	1	20	20	0.4	0.6	2.3
Ankistrodesmus falcatus	2	25	50	1.0	1.2	4.7
Cryptomonas erosa	2	520	1040	20.0	1.2	4.7
Chlorella-like	3	45	135	2.6	1.8	7.0
Melosira distans	6	198	1188	22.9	3.6	14.0
Planktosphaeria gelatinosa	17	14	238	4.6	10.2	39.5
	43		5194		25.7	

TSI= 15.8

Lake: Hanaford
 sample: 06-07
 transect (mm): 17
 vol. filtered: (ml) 100

Date: 8/5/93
 width (mm): 0.182
 area (mm2): 3.1

Species	count	Biovolume	T Biovol.	% Biovol	#/ml	percent
Crucigenia quadrata	1	85	85	0.8	1.6	0.8
Navicula pupula	1	270	270	2.4	1.6	0.8
Navicula radiosa	1	325	325	2.9	1.6	0.8
Achnanthes minutissima	2	50	100	0.9	3.2	1.5
Glenodinium sp.	2	700	1400	12.5	3.2	1.5
Nitzschia palea	2	180	360	3.2	3.2	1.5
Ankistrodesmus falcatus	8	25	200	1.8	12.7	6.1
Cryptomonas erosa	12	520	6240	55.9	19.0	9.1
Chlorella-like	13	45	585	5.2	20.6	9.8
Planktosphaeria gelatinosa	33	14	462	4.1	52.4	25.0
Rhodomonas minuta	57	20	1140	10.2	90.4	43.2
	132		11167		209.4	

TSI= 21.7

Lake: Hanaford
 sample: 06-08
 transect (mm): 17.7
 vol. filtered: (ml) 100

Date: 8/5/93
 width (mm): 0.182
 area (mm2): 3.2

Species	count	Biovolume	T Biovol	% Biovol	#/ml	percent
Crucigenia quadrata	1	85	85	2.0	1.5	0.9
Navicula minima	1	44	44	1.0	1.5	0.9
Cryptomonas erosa	3	520	1560	36.7	4.6	2.8
Nitzschia palea	3	180	540	12.7	4.6	2.8
Planktosphaeria gelatinosa	4	14	56	1.3	6.1	3.7
Ankistrodesmus falcatus	12	25	300	7.1	18.3	11.2
Rhodomonas minuta	83	20	1660	26.6	126.5	77.6
	107		4245		163.1	

TSI= 14.4

Lake: Hanaford
sample: 06-09
transect (mm): 21.7
vol. filtered: (ml) 100

Date: 8/5/93
width (mm): 0.182

Depth: hypo (14m)
area (mm2): 3.9

Species	count	Biovolume	T Biovol.	% Biovol.	#/ml	percent
Cyclotella comta	1	2270	2270	22.3	1.2	0.9
Cyclotella glomerata	1	60	60	0.6	1.2	0.9
Cymbella minuta	1	370	370	3.6	1.2	0.9
Navicula minima	1	44	44	0.4	1.2	0.9
Nitzschia palea	1	180	180	1.8	1.2	0.9
Oocystis lacustris	1	308	308	3.0	1.2	0.9
Achnanthes minutissima	2	50	100	1.0	2.5	1.9
Crucigenia quadrata	2	85	170	1.7	2.5	1.9
Glenodinium sp.	2	700	1400	13.8	2.5	1.9
Ankistrodesmus falcatus	5	25	125	1.2	6.2	4.7
Cryptomonas erosa	7	520	3640	35.8	8.7	6.6
Planktosphaeria gelatinosa	24	14	336	3.3	29.8	22.6
Rhodomonas minuta	58	20	1160	11.4	72.1	54.7
	106		10163		131.8	

TSI= 21.0

Lake: Hanaford
sample: 06-10
transect (mm): 12.1
vol. filtered: (ml) 100

Date: 8/5/93
width (mm): 0.182

Depth: hypo (14m)
area (mm2): 2.2

Species	count	Biovolume	T Biovol	% Biovol	#/ml	percent
Cyclotella glomerata	2	60	120	2.3	4.5	1.7
Glenodinium sp.	2	700	1400	27.3	4.5	1.7
Ankistrodesmus falcatus	3	25	75	1.5	6.7	2.6
Crucigenia quadrata	3	85	255	5.0	6.7	2.6
Cryptomonas erosa	3	520	1560	30.4	6.7	2.6
Rhodomonas minuta	44	20	880	17.2	98.1	37.6
Planktosphaeria gelatinosa	60	14	840	16.4	133.7	51.3
	117		5130		260.8	

TSI= 15.7

Lake: Hanaford
sample: 06-11
transect (mm): 10.8
vol. filtered: (ml) 100

Date: 10/2/93
width (mm): 0.182

Depth: epi (1m)
area (mm2): 2.0

Species	count	Biovolume	T Biovol.	% Biovol.	#/ml	percent
<i>Cymbella minuta</i>	1	370	370	3.0	2.5	0.9
<i>Nitzschia amphibia</i>	1	96	96	0.8	2.5	0.9
<i>Achnanthes minutissima</i>	2	50	100	0.8	5.0	1.7
<i>Navicula pupula</i>	2	270	540	4.4	5.0	1.7
<i>Ankistrodesmus falcatus</i>	3	25	75	0.6	7.5	2.6
<i>Cyclotella comta</i>	3	2270	6810	55.6	7.5	2.6
<i>Glenodinium</i> sp.	3	700	2100	17.1	7.5	2.6
<i>Kephyrion</i> sp.	4	63	252	2.1	10.0	3.4
<i>Planktosphaeria gelatinosa</i>	4	14	56	0.5	10.0	3.4
<i>Rhodomonas minuta</i>	15	20	300	2.4	37.5	12.9
<i>Chromulina</i> sp.	78	20	1560	12.7	194.8	67.2
	116		12259		289.7	

TSI= 22.5

Lake: Hanaford
 sample: 06-12
 transect (mm): 9.4
 vol. filtered: (ml) 100

Date: 10/2/93
 width (mm): 0.182

Depth: epi (1m)
 area (mm2) 1.7

Species	count	Biovolume	T Biovol	% Biovol	#/ml	percent
Achnanthes minutissima	1	50	50	0.2	2.9	0.8
Ankistrodesmus falcatus	1	25	25	0.1	2.9	0.8
Gomphonema olivaceum	1	225	225	1.0	2.9	0.8
Navicula minima	1	44	44	0.2	2.9	0.8
Cryptomonas erosa	2	520	1040	4.4	5.7	1.7
Glenodinium sp.	2	700	1400	6.0	5.7	1.7
Kephyrion spirale	2	63	126	0.5	5.7	1.7
Rhodomonas minuta	6	20	120	0.5	17.2	5.0
Kephyrion sp.	7	63	441	1.9	20.1	5.9
Cyclotella comta	8	2270	18160	77.6	23.0	6.7
Chromulina sp.	88	20	1760	7.5	252.5	73.9
	119		23391		341.5	

TSI= 27.7

Lake: Hanaford
sample: 06-13
transect (mm): 7.6
vol. filtered: (ml) 100

Date: 10/2/93
width (mm): 0.182

Depth: meta (8m)
area (mm2) 1.4

Species	count	Biovolume	T Biovol.	% Biovol.	#/ml	percent
Gomphonema sp.	1	200	200	1.0	3.5	0.9
Oocystis lacustris	1	308	308	1.5	3.5	0.9
Achnanthes minutissima	2	50	100	0.5	7.1	1.8
Cyclotella comta	8	2270	18160	87.3	28.4	7.2
Ankistrodesmus falcatus	10	25	250	1.2	35.5	9.0
Rhodomonas minuta	19	20	380	1.8	67.4	17.1
Chromulina sp.	70	20	1400	6.7	248.4	63.1
	111		20798		393.9	
			TSI=	26.8		

Lake: Hanaford
sample: 06-14
transect (mm): 6.2
vol. filtered: (ml) 100

Date: 10/2/93
width (mm): 0.182

Depth: meta (8m)
area (mm2) 1.1

Species	count	Biovolume	T Biovol	% Biovol	#/ml	percent
Gyrosigma spencerii	1	450	450	4.8	4.4	1.0
Kephyrion sp.	1	63	63	0.7	4.4	1.0
Navicula minima	1	44	44	0.5	4.4	1.0
Ankistrodesmus falcatus	3	25	75	0.8	13.1	2.9
Cyclotella comta	3	2270	6810	72.9	13.1	2.9
Rhodomonas minuta	10	20	200	2.1	43.5	9.6
Chromulina sp.	85	20	1700	18.2	369.8	81.7
	104		9342		452.4	
			TSI=	20.3		

Lake: Hanaford
sample: 06-15
transect (mm): 13
vol. filtered: (ml) 100

Date: 10/2/93
width (mm): 0.182

Depth: hypo (13m)
area (mm2): 2.4

Species	count	Biovolume	T Biovol.	% Biovol.	#/ml	percent
Nitzschia amphibia	1	96	96	0.7	2.1	0.8
Unident. dinoflagellate	1	500	500	3.6	2.1	0.8
Crucigenia crucifera	2	85	170	1.2	4.1	1.7
Cryptomonas erosa	4	520	2080	14.8	8.3	3.4
Cyclotella comta	4	2270	9080	64.5	8.3	3.4
Ankistrodesmus falcatus	5	25	125	0.9	10.4	4.2
Rhodomonas minuta	13	20	260	1.8	27.0	11.0
Chromulina sp.	88	20	1760	12.5	182.6	74.6
	118		14071		244.8	

TSI= 23.6

Lake: Hanaford
sample: 06-16
transect (mm): 18.6
vol. filtered: (ml) 100

Date: 10/2/93
width (mm): 0.182
area (mm2): 3.4

Species	count	Biovolume	T Biovol	% Biovol	#/ml	percent
Kephyrion sp.	1	63	63	0.2	1.5	0.8
Navicula pupula	1	270	270	1.0	1.5	0.8
Navicula radiosa	1	325	325	1.1	1.5	0.8
Nitzschia amphibia	1	96	96	0.3	1.5	0.8
Unident. pennate diatom	1	175	175	0.6	1.5	0.8
Cyclotella glomerata	2	60	120	0.4	2.9	1.6
Navicula rhynchocephala	2	295	590	2.1	2.9	1.6
Achnanthes minutissima	3	50	150	0.5	4.4	2.4
Nitzschia palea	6	180	1080	3.8	8.7	4.7
Ankistrodesmus falcatus	7	25	175	0.6	10.2	5.5
Chlorella-like	8	45	360	1.3	11.6	6.3
Cyclotella comta	8	2270	18160	64.3	11.6	6.3
Rhodomonas minuta	9	20	180	0.6	13.1	7.1
Cryptomonas erosa	10	520	5200	18.4	14.5	7.9
Chromulina sp.	66	20	1320	4.7	95.7	52.0
	126		28264		182.7	

TSI= 29.3

Lake: Hanaford
 sample: 06-17
 transect (mm): 17
 vol. filtered: (ml) 100

Date: 10/2/93
 width (mm): 0.182
 area (mm2): 3.1
 Depth: productivity

Species	count	Biovolume	T Biovol	% Biovol	#/ml	percent
Achnanthes minutissima	1	50	50	0.2	1.6	0.7
Kephyrion spirale	1	63	63	0.3	1.6	0.7
Navicula minima	1	44	44	0.2	1.6	0.7
Navicula radiosa	1	325	325	1.5	1.6	0.7
Kephyrion sp.	2	63	126	0.6	3.2	1.4
Navicula rhynchocephala	3	295	885	4.0	4.8	2.1
Cryptomonas erosa	4	520	2080	9.5	6.3	2.9
Cyclotella comta	7	2270	15890	72.5	11.1	5.0
Ankistrodesmus falcatus	11	25	275	1.3	17.5	7.9
Rhodomonas minuta	13	20	260	1.2	20.6	9.3
Chromulina sp.	96	20	1920	8.8	152.3	68.6
	140		21918		222.1	

TSI= 27.2

**Phytoplankton Data Sheets for
June Lake**

Lake: June
sample: 07-01
transect (mm): 24.5
vol. filtered: (ml) 100

Date: 5/28/93
width (mm): 0.182

Depth: 1M
area (mm2): 4.5

Species	count	Biovolume	T Biovol	% Biovol	#/ml	percent
Navicula rhynchocephala	1	295	295	0.7	1.1	0.9
Navicula sp.	1	150	150	0.3	1.1	0.9
Rhoicosphenia curvata	1	117	117	0.3	1.1	0.9
Nitzschia fonticola	2	42	84	0.2	2.2	1.7
Hannaea arcus	3	1750	5250	12.1	3.3	2.6
Diatoma vulgare	4	1960	7840	18.1	4.4	3.4
Cymbella minuta	7	370	2590	6.0	7.7	6.0
Achnanthes minutissima	8	50	400	0.9	8.8	6.8
Stauroneis sp.	9	340	3060	7.0	9.9	7.7
Navicula cincta	11	250	2750	6.3	12.1	9.4
Achnanthes lanceolata	14	180	2520	5.8	15.4	12.0
Diatoma hiemale mesodon	14	800	11200	25.8	15.4	12.0
Fragilaria brevistriata	15	165	2475	5.7	16.5	12.8
Nitzschia palea	26	180	4680	10.8	28.6	22.2
	116		43411		127.7	

TSI= 32.9

Lake: June Date: 5/28/93 Depth: 1M
 sample: 07-02
 transect (mm): 17 width (mm): 0.182 area (mm2): 3.1
 vol. filtered: (ml) 100

Species	count	Biovolume	T Biovol	% Biovol	#/ml	percent
Navicula pupula	1	270	270	0.9	1.6	0.9
Diatoma vulgare	2	1960	3920	13.0	3.2	1.9
Gomphonema subtile	2	150	300	1.0	3.2	1.9
Hannaea arcus	2	1750	3500	11.6	3.2	1.9
Synedra ulna	3	1990	5970	19.8	4.8	2.8
Cymbella minuta	4	370	1480	4.9	6.3	3.8
Navicula minima	4	44	176	0.6	6.3	3.8
Achnanthes minutissima	5	50	250	0.8	7.9	4.7
Navicula cincta	7	250	1750	5.8	11.1	6.6
Stauroneis sp.	10	340	3400	11.3	15.9	9.4
Fragilaria brevistriata	11	165	1815	6.0	17.5	10.4
Nitzschia palea	16	180	2880	9.5	25.4	15.1
Achnanthes lanceolata	25	180	4500	14.9	39.7	23.6
	92		30211		146.0	
			TSI=	29.9		

Lake: June
sample: 07-03
transect (mm): 33.5
vol. filtered: (ml) 100

Date: 9/9/93
width (mm): 0.182
area (mm2): 6.1

Species	count	Biovolume	T Biovol	% Biovol	#/ml	percent
Amphora coffeiformes	1	95	95	0.2	0.8	1.0
Eunotia perpusilla	1	300	300	0.8	0.8	1.0
Hannaea arcus	1	1750	1750	4.4	0.8	1.0
Navicula cincta	1	250	250	0.6	0.8	1.0
Navicula lanceolata	1	580	580	1.5	0.8	1.0
Navicula pupula	1	270	270	0.7	0.8	1.0
Navicula radiosa	1	325	325	0.8	0.8	1.0
Nitzschia hungarica	1	530	530	1.3	0.8	1.0
Cymbella minuta	2	370	740	1.9	1.6	2.0
Gomphonema subtile	2	150	300	0.8	1.6	2.0
Navicula sp.	2	150	300	0.8	1.6	2.0
Synedra ulna	3	1990	5970	14.9	2.4	3.0
Stauroneis sp.	4	340	1360	3.4	3.2	4.0
Fragilaria brevistriata	6	165	990	2.5	4.8	6.0
Gomphonema olivaceum	15	225	3375	8.4	12.1	15.0
Achnanthes lanceolata	18	180	3240	8.1	14.5	18.0
Diatoma hiemale mesodon	20	800	16000	40.0	16.1	20.0
Nitzschia palea	20	180	3600	9.0	16.1	20.0
	100		39975		80.5	

TSI= 32.3

Lake: June
sample: 07-04
transect (mm): 33.7
vol. filtered: (ml) 100

Date: 9/9/93
width (mm): 0.182
area (mm2): 6.1

Species	count	Biovolume	T Biovol	% Biovol	#/ml	percent
Navicula radiosa	1	325	325	0.9	0.8	1.0
Navicula rhynchocephala	1	295	295	0.8	0.8	1.0
Nitzschia linearis	1	1524	1524	4.3	0.8	1.0
Synedra ulna	1	1990	1990	5.6	0.8	1.0
Cocconeis placentula	2	460	920	2.6	1.6	2.1
Eunotia curvata	2	550	1100	3.1	1.6	2.1
Gomphonema subtile	2	150	300	0.8	1.6	2.1
Meridion circulare	2	385	770	2.2	1.6	2.1
Navicula cincta	2	250	500	1.4	1.6	2.1
Navicula minima	2	44	88	0.2	1.6	2.1
Navicula pupula	2	270	540	1.5	1.6	2.1
Nitzschia hungarica	2	530	1060	3.0	1.6	2.1
Amphora coffeiformes	3	95	285	0.8	2.4	3.1
Navicula sp.	3	150	450	1.3	2.4	3.1
Stauroneis sp.	4	340	1360	3.8	3.2	4.1
Chroococcus dispersus	6	22	132	0.4	4.8	6.2
Cymbella minuta	6	370	2220	6.2	4.8	6.2
Nitzschia palea	6	180	1080	3.0	4.8	6.2
Achnanthes lanceolata	7	180	1260	3.5	5.6	7.2
Gomphonema olivaceum	9	225	2025	5.7	7.2	9.3
Fragilaria brevistriata	14	165	2310	6.5	11.2	14.4
Diatoma hiemale mesodo	19	800	15200	42.5	15.2	19.6
	97		35734		77.6	

TSI= 31.3

Lake: June Date: 10/17/93 Depth: 1M
 sample: 07-05
 transect (mm): 17.6 width (mm): 0.182 area (mm2): 3.2
 vol. filtered: (ml) 100

Species	count	Biovolume	T Biovol	% Biovol	#/ml	percent
Cymbella mexicana	1	5500	5500	12.5	1.5	0.9
Eunotia tenella	1	180	180	0.4	1.5	0.9
Gomphonema subtile	1	150	150	0.3	1.5	0.9
Navicula minima	1	44	44	0.1	1.5	0.9
Cocconeis placentula	2	460	920	2.1	3.1	1.7
Stauroneis sp.	2	340	680	1.5	3.1	1.7
Navicula pupula	3	270	810	1.8	4.6	2.6
Navicula radiosa	3	325	975	2.2	4.6	2.6
Cymbella minuta	5	370	1850	4.2	7.7	4.3
Synedra rumpens	5	140	700	1.6	7.7	4.3
Achnanthes lanceolata	6	180	1080	2.5	9.2	5.1
Chroococcus dispersus	8	22	176	0.4	12.3	6.8
Fragilaria brevistriata	10	165	1650	3.8	15.3	8.5
Meridion circulare	10	385	3850	8.8	15.3	8.5
Diatoma hiemale mesodon	21	800	16800	38.3	32.2	17.9
Gomphonema olivaceium	38	225	8550	19.5	58.2	32.5
	117		43915		179.3	

TSI= 33.0

Lake: June
sample: 07-06
transect (mm): 14.7
vol. filtered: (ml) 100

Date: 10/17/93
width (mm): 0.182

Depth: 1M
area (mm2) 2.7

Species	count	Biovolume	T Biovol	% Biovol	#/ml	percent
Achnanthes minutissima	1	50	50	0.1	1.8	0.7
Cocconeis placentula	1	460	460	0.9	1.8	0.7
Nitzschia palea	1	180	180	0.3	1.8	0.7
Rhoicosphenia curvata	1	117	117	0.2	1.8	0.7
Synedra rumpens	1	140	140	0.3	1.8	0.7
Cymbella mexicana	2	5500	11000	20.4	3.7	1.3
Cymbella minuta	8	370	2960	5.5	14.7	5.3
Navicula radiosa	8	325	2600	4.8	14.7	5.3
Fragilaria brevistriata	9	165	1485	2.7	16.5	6.0
Achnanthes lanceolata	13	180	2340	4.3	23.9	8.6
Diatoma hiemale mesodon	18	800	14400	26.6	33.0	11.9
Meridion circulare	20	385	7700	14.2	36.7	13.2
Chroococcus dispersus	22	22	484	0.9	40.4	14.6
Gomphonema olivaceum	45	225	10125	18.7	82.6	29.8
	150		54041		275.2	
			TSI=	34.8		

Phytoplankton Data Sheets for
McBride Lake

Lake: McBride
sample: 08-01
transect (mm): 16.4
vol. filtered: (ml) 100

Date: 5/29/93
width (mm): 0.182

Depth: epi (1m)
area (mm2): 3.0

Species	count	Biovolume	T Biovol	% Biovol	#/ml	percent
Ankistrodesmus falcatus	1	25	25	0.0	1.6	0.7
Cymbella minuta	1	370	370	0.4	1.6	0.7
Navicula cryptocephala	1	185	185	0.2	1.6	0.7
Nitzschia filiformis	1	135	135	0.1	1.6	0.7
Diatoma tenue elongaum	2	720	1440	1.6	3.3	1.5
Gomphonema olivaceium	2	225	450	0.5	3.3	1.5
Navicula minima	4	44	176	0.2	6.6	3.0
Nitzschia palea	4	180	720	0.8	6.6	3.0
Achnanthes minutissima	7	50	350	0.4	11.5	5.2
Glenodinium sp.	7	700	4900	5.3	11.5	5.2
Melosira distans	7	198	1386	1.5	11.5	5.2
Fragilaria crotonensis	98	840	82320	89.0	161.2	72.6
	135		92457		222.0	

TSI= 38.4

Lake: McBride
sample: 08-02
transect (mm): 14.4
vol. filtered: (ml) 100

Date: 5/29/93
width (mm): 0.182

Depth: epi (1m)
area (mm2): 2.6

Species	count	Biovolume	T Biovol	% Biovol	#/ml	percent
Anabaena sp.	1	1000	1000	1.2	1.9	0.7
Ankistrodesmus falcatus	1	25	25	0.0	1.9	0.7
Cymbella minuta	1	370	370	0.5	1.9	0.7
Glenodinium sp.	1	700	700	0.9	1.9	0.7
Achnanthes lanceolata	2	180	360	0.4	3.7	1.5
Crucigenia quadrata	2	85	170	0.2	3.7	1.5
Fragilaria pinnata	2	60	120	0.1	3.7	1.5
Navicula cryptocephala	2	185	370	0.5	3.7	1.5
Nitzschia filiformis	2	135	270	0.3	3.7	1.5
Melosira distans	3	198	594	0.7	5.6	2.2
Synedra minuscula	3	490	1470	1.8	5.6	2.2
Gomphonema olivaceiu	4	225	900	1.1	7.5	3.0
Navicula minima	4	44	176	0.2	7.5	3.0
Nitzschia palea	5	180	900	1.1	9.4	3.7
Achnanthes minutissima	14	50	700	0.9	26.2	10.4
Fragilaria crotonensis	87	840	73080	90.0	163.0	64.9
	134		81205		251.0	

TSI= 37.4

Lake: McBride
sample: 08-03
transect (mm): 15.2
vol. filtered: (ml) 100

Date: 5/28/93
width (mm): 0.182

Depth: hypo (1.8m)
area (mm2): 2.8

Species	count	Biovolume	T Biovol	% Biovol	#/ml	percent
Fragilaria pinnata	1	60	60	0.1	1.8	0.7
Navicula cryptocephala	1	185	185	0.2	1.8	0.7
Navicula pupula	1	270	270	0.3	1.8	0.7
Navicula radiosa	1	325	325	0.4	1.8	0.7
Nitzschia filiformis	1	135	135	0.2	1.8	0.7
Achnanthes lanceolata	2	180	360	0.4	3.5	1.5
Cymbella minuta	2	370	740	0.9	3.5	1.5
Gomphonema olivaceum	3	225	675	0.8	5.3	2.2
Navicula minima	7	44	308	0.4	12.4	5.2
Synedra minuscula	7	490	3430	4.3	12.4	5.2
Achnanthes minutissima	12	50	600	0.7	21.3	8.9
Fragilaria crotonensis	87	840	73080	91.2	154.4	64.4
	125		80168		221.8	
			TSI=	37.4		

Lake: McBride
sample: 08-04
transect (mm): 15
vol. filtered: (ml) 100

Date: 5/28/93

Depth: hypo (1.8m)

width (mm): 0.182

area (mm2): 2.7

Species	count	Biovolume	T Biovol	% Biovol	#/ml	percent
Ankistrodesmus falcatus	1	25	25	0.0	1.8	0.8
Cryptomonas erosa	1	520	520	0.6	1.8	0.8
Cymbella minuta	1	370	370	0.5	1.8	0.8
Eunotia perpusilla	1	300	300	0.4	1.8	0.8
Kephyrion sp.	1	63	63	0.1	1.8	0.8
Meridion circulare	1	385	385	0.5	1.8	0.8
Navicula cryptocephala	1	185	185	0.2	1.8	0.8
Nitzschia filiformis	1	135	135	0.2	1.8	0.8
Nitzschia palea	2	180	360	0.4	3.6	1.7
Glenodinium sp.	3	700	2100	2.6	5.4	2.5
Navicula minima	5	44	220	0.3	9.0	4.2
Achnanthes minutissima	7	50	350	0.4	12.6	5.8
Synedra minuscula	10	490	4900	6.0	18.0	8.3
Fragilaria crotonensis	85	840	71400	87.8	152.8	70.8
	120		81313		215.8	

TSI= 37.2

Lake: McBride
 sample: 08-05
 transect (mm): 0.2
 vol. filtered: (ml) 100

Date: 9/9/93
 width (mm): 0.182
 area (mm2): 0.04

Depth: 1M

Species	count	Biovolume	T Biovol	% Biovol	#/ml	percent
Achnanthes minutissima	1	50	50	0.5	135	0.1
Glenodinium sp.	1	700	700	7.2	135	0.1
Navicula minima	1	44	44	0.5	135	0.1
Navicula rhynchocephala	1	295	295	3.0	135	0.1
Cryptomonas erosa	6	520	3120	31.9	809	0.9
Microcystis aeruginosa	695	8	5560	56.9	93730	98.6
	705		9769		95078	
			TSI=	16.3		

Lake: McBride
 sample: 08-06
 transect (mm): 0.15
 vol. filtered: (ml) 100

Date: 9/8/93
 width (mm): 0.182
 area (mm2): 0.03

Depth: 1M

Species	count	Biovolume	T Biovol	% Biovol	#/ml	percent
Glenodinium sp.	1	700	700	8.7	180	0.2
Navicula bacillum	1	377	377	4.7	180	0.2
Navicula cryptocephala	1	185	185	2.3	180	0.2
Cryptomonas erosa	3	520	1560	19.4	539	0.5
Microcystis aeruginosa	650	8	5200	64.8	116881	99.1
	656		8022		117960	
			TSI=	19.1		

Lake: McBride
sample: 08-07
transect (mm): 17.4
vol. filtered: (ml) 100

Date: 10/17/93
width (mm): 0.182

Depth: epi (1m)
area (mm2): 3.2

Species	count	Biovolume	T Biovol	% Biovol	#/ml	percent
Gomphonema olivaceiu	1	225	225	1.4	1.6	0.8
Melosira distans	1	198	198	1.2	1.6	0.8
Navicula pupula	1	270	270	1.6	1.6	0.8
Achnanthes minutissima	2	50	100	0.6	3.1	1.6
Crucigenia tetrapedia	2	85	170	1.0	3.1	1.6
Unident. pennate diatom	2	175	350	2.1	3.1	1.6
Kephyrion spirale	4	63	252	1.5	6.2	3.2
Quadrigula lacustris	4	30	120	0.7	6.2	3.2
Nitzschia palea	7	180	1260	7.7	10.9	5.6
Rhodomonas minuta	8	20	160	1.0	12.4	6.4
Cryptomonas erosa	14	520	7280	44.2	21.7	11.2
Kephyrion sp.	14	63	882	5.4	21.7	11.2
Ankistrodesmus falcatus	23	25	575	3.5	35.7	18.4
Dinobryon sp.	37	125	4625	28.1	57.4	29.6
	120		16467		186.0	
			TSI=	24.8		

Lake: McBride
sample: 08-08
transect (mm): 19.6
vol. filtered: (ml) 100

Date: 10/17/93
width (mm): 0.182

Depth: epi (1m)
area (mm2): 3.6

Species	count	Biovolume	T Biovol	% Biovol	#/ml	percent
<i>Cymbella minuta</i>	1	370	370	2.3	1.4	1.0
<i>Diatoma hiemale mesodon</i>	1	800	800	5.1	1.4	1.0
<i>Melosira distans</i>	1	198	198	1.3	1.4	1.0
<i>Navicula radiosa</i>	1	325	325	2.1	1.4	1.0
<i>Rhodomonas minuta</i>	1	20	20	0.1	1.4	1.0
<i>Spirogyra</i> sp.	1	1000	1000	6.3	1.4	1.0
<i>Achnanthes minutissima</i>	2	50	100	0.6	2.8	2.0
<i>Navicula pupula</i>	2	270	540	3.4	2.8	2.0
<i>Kephyrion spirale</i>	3	63	189	1.2	4.1	3.0
<i>Crucigenia tetrapedia</i>	4	85	340	2.2	5.5	4.0
Unident. pennate diatom	4	175	700	4.4	5.5	4.0
<i>Kephyrion</i> sp.	7	63	441	2.8	9.6	6.9
<i>Nitzschia palea</i>	7	180	1260	8.0	9.6	6.9
<i>Ulothrix</i> sp.	14	80	1120	7.1	19.3	13.9
<i>Cryptomonas erosa</i>	15	520	7800	49.4	20.6	14.9
<i>Ankistrodesmus falcatus</i>	24	25	600	3.8	33.0	23.8
	88		15803		121.1	
			TSI=	24.5		

**Phytoplankton Data Sheets for
Merrill Lake**

Lake: Merrill
 sample: 09-01
 transect (mm): 11.9
 vol. filtered: (ml) 100

Date: 10/17/93

Depth: epi (1m)
 Sta. 1

width (mm): 0.182

area (mm2): 2.2

Species	count	Biovolume	T Biovol	% Biovol	#/ml	percent
Dinobryon sp.	1	125	125	0.5	2.3	0.8
Cryptomonas erosa	2	520	1040	4.1	4.5	1.6
Oocystis lacustris	3	308	924	3.7	6.8	2.4
Tetraedron minimum	4	180	720	2.9	9.1	3.2
Kephyrion spirale	6	63	378	1.5	13.6	4.8
Crucigenia quadrata	18	85	1530	6.1	40.8	14.3
Anabaena sp.	19	1000	19000	75.5	43.1	15.1
Rhodomonas minuta	30	20	600	2.4	68.0	23.8
Chromulina sp.	43	20	860	3.4	97.5	34.1
	126		25177		285.6	
			TSI=	28.4		

Lake:	Merrill	Date: 10/17/93	Depth: epi(1m)
sample:	09-02		Sta. 1
transect (mm):	10.1	width (mm): 0.182	area (mm2) 1.8
vol. filtered: (ml)	100		

Species	count	Biovolume	T Biovol	% Biovol	#/ml	percent
Ceratium hirundinella	1	9800	9800	68.1	2.7	0.7
Cryptomonas erosa	1	520	520	3.6	2.7	0.7
Oocystis lacustris	1	308	308	2.1	2.7	0.7
Dinobryon sp.	2	125	250	1.7	5.3	1.5
Ankistrodesmus falcatus	4	25	100	0.7	10.7	2.9
Kephyrion spirale	4	63	252	1.8	10.7	2.9
Crucigenia quadrata	8	85	680	4.7	21.4	5.8
Pediastrum sp.	17	30	510	3.5	45.4	12.4
Rhodomonas minuta	34	20	680	4.7	90.8	24.8
Chromulina sp.	65	20	1300	9.0	173.6	47.4
	137		14400		365.9	
			TSI=	23.8		

Lake: Merrill
sample: 09-03
transect (mm): 5.4
vol. filtered: (ml) 100

Date: 10/17/93
width (mm): 0.182

Depth: meta (4m)
Sta.1
area (mm2): 1.0

Species	count	Biovolume	T Biovol	% Biovol	#/ml	percent
Cryptomonas erosa	1	520	520	11.8	5.0	0.8
Dinobryon sp.	1	125	125	2.8	5.0	0.8
Kephyrion spirale	1	63	63	1.4	5.0	0.8
Oocystis lacustris	1	308	308	7.0	5.0	0.8
Tetraedron minimum	2	180	360	8.2	10.0	1.6
Ankistrodesmus falcatus	3	25	75	1.7	15.0	2.4
Pediastrum sp.	4	30	120	2.7	20.0	3.1
Oocystis pusilla	5	54	270	6.1	25.0	3.9
Crucigenia quadrata	6	85	510	11.6	30.0	4.7
Rhodomonas minuta	29	20	580	13.1	144.9	22.8
Chromulina sp.	74	20	1480	33.6	369.6	58.3
	127		4411		634.4	
			TSI=	14.7		

Lake: Merrill
sample: 09-04
transect (mm): 8.2
vol. filtered: (ml) 100

Date: 10/17/93
width (mm): 0.182

Depth: meta (4m)
Sta.1
area (mm2) 1.5

Species	count	Biovolume	T Biovol	% Biovol	#/ml	percent
Dinobryon sp.	1	125	125	1.6	3.3	0.8
Kephyrion spirale	1	63	63	0.8	3.3	0.8
Cyclotella comta	2	2270	4540	57.7	6.6	1.7
Tetraedron minimum	2	180	360	4.6	6.6	1.7
Oocystis pusilla	3	54	162	2.1	9.9	2.5
Crucigenia quadrata	5	85	425	5.4	16.4	4.2
Pediastrum sp.	10	30	300	3.8	32.9	8.4
Rhodomonas minuta	37	20	740	9.4	121.7	31.1
Chromulina sp.	58	20	1160	14.7	190.8	48.7
	119		7875		391.4	
			TSI=	19.0		

Lake: Merrill
 sample: 09-05
 transect (mm): 11.3
 vol. filtered: (ml) 100

Date: 10/17/93
 width (mm): 0.182

Depth: hypo (9m)
 Sta.1
 area (mm2): 2.1

Species	count	Biovolume	T Biovol	% Biovol	#/ml	percent
Cyclotella comta	1	2270	2270	32.5	2.4	0.8
Dinobryon sp.	1	125	125	1.8	2.4	0.8
Oocystis pusilla	2	54	108	1.5	4.8	1.5
Kephyrion spirale	3	63	189	2.7	7.2	2.3
Oocystis lacustris	4	308	1232	17.6	9.5	3.0
Pediastrum sp.	4	30	120	1.7	9.5	3.0
Crucigenia quadrata	8	85	680	9.7	19.1	6.1
Ankistrodesmus falcatus	18	25	450	6.4	43.0	13.6
Rhodomonas minuta	30	20	600	8.6	71.6	22.7
Chromulina sp.	61	20	1220	17.4	145.6	46.2
	132		6994		315.1	
			TSI=	18.1		

Lake: Merrill
 sample: 09-06
 transect (mm): 13.9
 vol. filtered: (ml) 100

Date: 10/17/93
 width (mm): 0.182

Depth: hypo (9m)
 Sta.1
 area (mm2): 2.5

Species	count	Biovolume	T Biovol	% Biovol	#/ml	percent
Nitzschia linearis	1	1524	1524	20.1	1.9	0.8
Cryptomonas erosa	2	520	1040	13.7	3.9	1.6
Oocystis lacustris	2	308	616	8.1	3.9	1.6
Oocystis pusilla	2	54	108	1.4	3.9	1.6
Tetraedron minimum	2	180	360	4.7	3.9	1.6
Dinobryon sp.	3	125	375	4.9	5.8	2.3
Ankistrodesmus falcatus	8	25	200	2.6	15.5	6.3
Rhodomonas minuta	18	20	360	4.7	34.9	14.1
Crucigenia quadrata	20	85	1700	22.4	38.8	15.6
Chromulina sp.	65	20	1300	17.1	126.1	50.8
	123		7583		238.7	

TSI= 18.7

Lake: Merrill
 sample: 09-07
 transect (mm): 7.2
 vol. filtered: (ml) 100

Date: 10/17/93

Depth: epi (1m)
Sta. 2

width (mm): 0.182

area (mm2): 1.3

Species	count	Biovolume	T Biovol	% Biovol	#/ml	percent
Ankistrodesmus falcatus	1	25	25	0.7	3.7	0.9
Cryptomonas erosa	1	520	520	13.6	3.7	0.9
Kephyrion spirale	1	63	63	1.6	3.7	0.9
Oocystis lacustris	1	308	308	8.1	3.7	0.9
Pediastrum sp.	8	30	240	6.3	30.0	6.8
Crucigenia quadrata	9	85	765	20.0	33.7	7.7
Rhodomonas minuta	25	20	500	13.1	93.7	21.4
Chromulina sp.	70	20	1400	36.6	262.2	59.8
	116		3821		434.6	

TSI= 13.7

Lake: Merrill
 sample: 09-08
 transect (mm): 7.3
 vol. filtered: (ml) 100

Date: 10/17/93

Depth: epi (1m)
Sta. 2

width (mm): 0.182

area (mm2): 1.3

Species	count	Biovolume	T Biovol	% Biovol	#/ml	percent
Glenodinium sp.	1	700	700	19.6	3.7	0.9
Kephyrion sp.	1	63	63	1.8	3.7	0.9
Kephyrion spirale	1	63	63	1.8	3.7	0.9
Oocystis pusilla	2	54	108	3.0	7.4	1.8
Pediastrum sp.	4	30	120	3.4	14.8	3.6
Crucigenia quadrata	7	85	595	16.7	25.9	6.3
Rhodomonas minuta	40	20	800	22.4	147.8	35.7
Chromulina sp.	56	20	1120	31.4	206.9	50.0
	112		3569		413.8	

TSI= 13.2

Lake: Merrill
sample: 09-09
transect (mm): 7.9
vol. filtered: (ml) 100

Date: 10/17/93
width (mm): 0.182

Depth: meta (4m)
Sta. 2
area (mm2) 1.4

Species	count	Biovolume	T Biovol	% Biovol	#/ml	percent
Cryptomonas erosa	1	520	520	14.6	3.4	0.9
Kephyrion spirale	1	63	63	1.8	3.4	0.9
Ankistrodesmus falcatus	2	25	50	1.4	6.8	1.9
Crucigenia quadrata	5	85	425	11.9	17.1	4.6
Dinobryon sp.	5	125	625	17.5	17.1	4.6
Rhodomonas minuta	32	20	640	18.0	109.3	29.6
Chromulina sp.	62	20	1240	34.8	211.7	57.4
	108		3563		368.7	

TSI= 13.2

Lake: Merrill
sample: 09-10
transect (mm): 7.4
vol. filtered: (ml) 100

Date: 10/17/93
width (mm): 0.182

Depth: meta (4m)
Sta. 2
area (mm2) 1.3

Species	count	Biovolume	T Biovol	% Biovol	#/ml	percent
Asterionella formosa	1	220	220	2.1	3.6	0.7
Cyclotella comta	1	2270	2270	21.2	3.6	0.7
Kephyrion spirale	1	63	63	0.6	3.6	0.7
Navicula cryptocephala	1	185	185	1.7	3.6	0.7
Ankistrodesmus falcatus	2	25	50	0.5	7.3	1.5
Crucigenia quadrata	2	85	170	1.6	7.3	1.5
Cryptomonas erosa	2	520	1040	9.7	7.3	1.5
Scenedesmus abundans	5	50	250	2.3	18.2	3.7
Melosira ambigua	7	589	4123	38.5	25.5	5.1
Chlorella-like	9	45	405	3.8	32.8	6.6
Rhodomonas minuta	21	20	420	3.9	76.5	15.4
Chromulina sp.	76	20	1520	14.2	277.0	55.9
	128		10716		466.6	

TSI= 21.4

Lake: Merrill
 sample: 09-11
 transect (mm): 8
 vol. filtered: (ml) 100

Date: 10/17/93
 width (mm): 0.182

Depth: hypo (11m)
 Sta. 2
 area (mm2): 1.5

Species	count	Biovolume	T Biovol	% Biovol	#/ml	percent
Cyclotella comta	1	2270	2270	44.2	3.4	0.9
Kephyrion spirale	1	63	63	1.2	3.4	0.9
Oocystis lacustris	1	308	308	6.0	3.4	0.9
Crucigenia quadrata	6	85	510	9.9	20.2	5.6
Rhodomonas minuta	39	20	780	15.2	131.5	36.1
Chromulina sp.	60	20	1200	23.4	202.3	55.6
	108		5131		364.1	

TSI= 15.8

Lake: Merrill
 sample: 09-12
 transect (mm): 8.1
 vol. filtered: (ml) 100

Date: 10/17/93
 width (mm): 0.182

Depth: hypo (11m)
 Sta. 2
 area (mm2): 1.5

Species	count	Biovolume	T Biovol	% Biovol	#/ml	percent
Cyclotella comta	1	2270	2270	45.3	3.3	0.9
Dinobryon sp.	1	125	125	2.5	3.3	0.9
Kephyrion spirale	1	63	63	1.3	3.3	0.9
Crucigenia quadrata	3	85	255	5.1	10.0	2.6
Ankistrodesmus falca	4	25	100	2.0	13.3	3.4
Pediastrum sp.	8	30	240	4.8	26.6	6.9
Rhodomonas minuta	41	20	820	16.4	136.5	35.3
Chromulina sp.	57	20	1140	22.7	189.8	49.1
	116		5013		386.3	

TSI= 15.6

Lake: Merrill Date: 9/8/93 Depth: epi (1m)
 sample: 09-13 Sta. 1
 transect (mm): 11.5 width (mm): 0.182 area (mm2) 2.1
 vol. filtered: (ml) 100

Species	count	Biovolume	T Biovol	% Biovol	#/ml	percent
Crucigenia quadrata	1	85	85	0.1	2.3	0.9
Rhodomonas minuta	1	20	20	0.0	2.3	0.9
Asterionella formosa	5	220	1100	1.9	11.7	4.4
Chromulina sp.	6	20	120	0.2	14.1	5.3
Oocystis lacustris	6	308	1848	3.2	14.1	5.3
Cyclotella comta	9	2270	20430	35.1	21.1	8.0
Kephyrion spirale	18	63	1134	1.9	42.2	15.9
Unident. green filament	67	500	33500	57.5	157.1	59.3
	113		58237		265.0	
			TSI=	35.5		

Lake: Merrill Date: 9/8/93 Depth: epi (1m)
 sample: 09-14 Sta. 1
 transect (mm): 13 width (mm): 0.182 area (mm2) 2.4
 vol. filtered: (ml) 100

Species	count	Biovolume	T Biovol	% Biovol	#/ml	percent
Ankistrodesmus falcatus	1	25	25	0.1	2.1	0.9
Asterionella formosa	1	220	220	0.5	2.1	0.9
Rhodomonas minuta	1	20	20	0.0	2.1	0.9
Dinobryon sp.	2	125	250	0.5	4.1	1.9
Chromulina sp.	4	20	80	0.2	8.3	3.7
Cyclotella comta	8	2270	18160	39.2	16.6	7.5
Oocystis lacustris	9	308	2772	6.0	18.7	8.4
Kephyrion spirale	36	63	2268	4.9	74.7	33.6
Unident. green filament	45	500	22500	48.6	93.4	42.1
	107		46295		222.0	
			TSI=	33.5		

Lake: Merrill
 sample: 09-15
 transect (mm): 12.9
 vol. filtered: (ml) 100

Date: 9/8/93
 width (mm): 0.182

Depth: meta (4m)
 Sta. 1
 area (mm2): 2.3

Species	count	Biovolume	T Biovol	% Biovol	#/ml	percent
Dinobryon sp.	1	125	125	0.4	2.1	0.9
Ankistrodesmus falcatus	2	25	50	0.1	4.2	1.9
Pediastrum sp.	3	30	90	0.3	6.3	2.8
Oocystis pusilla	6	54	324	0.9	12.5	5.7
Cyclotella comta	8	2270	18160	52.4	16.7	7.5
Kephyrion spirale	11	63	693	2.0	23.0	10.4
Anabaena sp.	14	1000	14000	40.4	29.3	13.2
Chromulina sp.	18	20	360	1.0	37.6	17.0
Rhodomonas minuta	43	20	860	2.5	89.9	40.6
	106		34662		221.6	
			TSI=	31.0		

Lake: Merrill
sample: 09-16
transect (mm): 17.8
vol. filtered: (ml) 100

Date: 9/8/93
width (mm): 0.182

Depth: meta (4m)
Sta. 1
area (mm2): 3.2

Species	count	Biovolume	T Biovol	% Biovol	#/ml	percent
Anabaena sp.	1	1000	1000	2.2	1.5	0.8
Ankistrodesmus falcatus	1	25	25	0.1	1.5	0.8
Crucigenia quadrata	1	85	85	0.2	1.5	0.8
Eunotia tenella	1	180	180	0.4	1.5	0.8
Navicula cryptocephala	1	185	185	0.4	1.5	0.8
Nitzschia sp.	1	120	120	0.3	1.5	0.8
Glenodinium sp.	2	700	1400	3.0	3.0	1.7
Nitzschia palea	3	180	540	1.2	4.5	2.5
Oocystis lacustris	3	308	924	2.0	4.5	2.5
Navicula minima	4	44	176	0.4	6.1	3.4
Dinobryon sp.	6	125	750	1.6	9.1	5.0
Chromulina sp.	12	20	240	0.5	18.2	10.1
Kephyrion spirale	16	63	1008	2.2	24.2	13.4
Cyclotella comta	17	2270	38590	84.1	25.8	14.3
Rhodomonas minuta	34	20	680	1.5	51.5	28.6
	103		45903		156.1	

TSI= 33.4

Lake: Merrill
sample: 09-17
transect (mm): 13.9
vol. filtered: (ml) 100

Date: 9/8/93
width (mm): 0.182

Depth: hypo (10m)
Sta. 1
area (mm2) 2.5

Species	count	Biovolume	T Biovol	% Biovol	#/ml	percent
Chromulina sp.	1	20	20	0.0	1.9	0.9
Nitzschia palea	1	180	180	0.4	1.9	0.9
Ankistrodesmus falcatus	3	25	75	0.2	5.8	2.7
Pediastrum sp.	4	30	120	0.3	7.8	3.6
Oocystis pusilla	6	54	324	0.7	11.6	5.4
Melosira distans	7	198	1386	3.2	13.6	6.3
Oocystis lacustris	7	308	2156	4.9	13.6	6.3
Asterionella formosa	13	220	2860	6.6	25.2	11.6
Dinobryon sp.	14	125	1750	4.0	27.2	12.5
Cyclotella comta	15	2270	34050	78.1	29.1	13.4
Rhodomonas minuta	35	20	700	1.6	67.9	31.3
	106		43621		205.7	

TSI= 33.0

Lake: Merrill
sample: 09-18
transect (mm): 16.1
vol. filtered: (ml) 100

Date: 9/8/93
width (mm): 0.182

Depth: hypo (10m)
Sta. 1
area (mm2) 2.9

Species	count	Biovolume	T Biovol	% Biovol	#/ml	percent
Navicula cryptocephala	1	185	185	0.3	1.7	0.8
Nitzschia palea	1	180	180	0.3	1.7	0.8
Crucigenia quadrata	2	85	170	0.3	3.4	1.6
Kephyrion spirale	2	63	126	0.2	3.4	1.6
Oocystis lacustris	2	308	616	0.9	3.4	1.6
Anabaena sp.	8	1000	8000	12.0	13.4	6.3
Cryptomonas erosa	8	520	4160	6.2	13.4	6.3
Dinobryon sp.	8	125	1000	1.5	13.4	6.3
Ankistrodesmus falcatus	10	25	250	0.4	16.8	7.8
Melosira distans	12	198	2376	3.6	20.1	9.4
Asterionella formosa	16	220	3520	5.3	26.8	12.5
Cyclotella comta	20	2270	45400	68.0	33.5	15.6
Rhodomonas minuta	38	20	760	1.1	63.7	29.7
	128		66743		214.4	
			TSI=	36.6		

Lake: Merrill
 sample: 09-19
 transect (mm): 15
 vol. filtered: (ml) 100

Date: 9/8/93

Depth: epi (1m)

Sta. 2

width (mm): 0.182

area (mm2): 2.7

Species	count	Biovolume	T Biovol	% Biovol	#/ml	percent
Achnanthes minutissima	1	50	50	0.1	1.8	0.9
Oocystis lacustris	1	308	308	0.5	1.8	0.9
Tetraedron minimum	1	180	180	0.3	1.8	0.9
Ankistrodesmus falcatus	2	25	50	0.1	3.6	1.9
Crucigenia quadrata	2	85	170	0.3	3.6	1.9
Unident. green filament	3	500	1500	2.6	5.4	2.8
Dinobryon sp.	6	125	750	1.3	10.8	5.7
Cyclotella comta	8	2270	18160	31.2	14.4	7.5
Rhodomonas minuta	9	20	180	0.3	16.2	8.5
Chromulina sp.	11	20	220	0.4	19.8	10.4
Kephyrion spirale	27	63	1701	2.9	48.6	25.5
Anabaena sp.	35	1000	35000	60.1	62.9	33.0
	106		58269		190.6	

TSI= 35.5

Lake: Merrill
 sample: 09-20
 transect (mm): 16.1
 vol. filtered: (ml) 100

Date: 9/8/93
 width (mm): 0.182

Depth: epi (1m)
 Sta. 2
 area (mm2) 2.9

Species	count	Biovolume	T Biovol	% Biovol	#/ml	percent
Ankistrodesmus falcatus	2	25	50	0.1	3.4	1.8
Oocystis pusilla	2	54	108	0.2	3.4	1.8
Dinobryon sp.	3	125	375	0.8	5.0	2.7
Pediastrum sp.	4	30	120	0.2	6.7	3.5
Tetraedron minimum	6	180	1080	2.2	10.1	5.3
Chromulina sp.	8	20	160	0.3	13.4	7.1
Rhodomonas minuta	9	20	180	0.4	15.1	8.0
Anabaena sp.	10	1000	10000	20.6	16.8	8.8
Cyclotella comta	13	2270	29510	60.8	21.8	11.5
Oocystis lacustris	14	308	4312	8.9	23.5	12.4
Kephyrion spirale	42	63	2646	5.5	70.4	37.2
	113		48541		189.3	
			TSI=	33.9		

Lake: Memill
sample: 09-21
transect (mm): 22.6
vol. filtered: (ml) 100

Date: 9/8/93
width (mm): 0.182

Depth: meta (4m)
Sta. 2
area (mm2): 4.1

Species	count	Biovolume	T Biovol	% Biovol	#/ml	percent
Cryptomonas erosa	1	520	520	0.8	1.2	0.9
Oocystis lacustris	2	308	616	1.0	2.4	1.9
Asterionella formosa	5	220	1100	1.8	6.0	4.7
Ankistrodesmus falcatus	6	25	150	0.2	7.2	5.7
Oocystis pusilla	13	54	702	1.1	15.5	12.3
Rhodomonas minuta	13	20	260	0.4	15.5	12.3
Chromulina sp.	16	20	320	0.5	19.1	15.1
Cyclotella comta	25	2270	56750	91.5	29.8	23.6
Kephyrion spirale	25	63	1575	2.5	29.8	23.6
	106		61993		126.5	
			TSI=	36.0		

Lake: Merrill
 sample: 09-22
 transect (mm): 20.4
 vol. filtered: (ml) 100

Date: 9/8/93

Depth: meta (4m)

Sta. 2

width (mm): 0.182

area (mm2) 3.7

Species	count	Biovolume	T Biovol	% Biovol	#/ml	percent
Glenodinium sp.	1	700	700	1.6	1.3	0.9
Oocystis lacustris	1	308	308	0.7	1.3	0.9
Crucigenia quadrata	2	85	170	0.4	2.6	1.8
Oocystis pusilla	2	54	108	0.2	2.6	1.8
Nitzschia palea	3	180	540	1.2	4.0	2.7
Cyclotella comta	10	2270	22700	51.3	13.2	8.8
Rhodomonas minuta	12	20	240	0.5	15.9	10.6
Anabaena sp.	17	1000	17000	38.5	22.5	15.0
Chromulina sp.	19	20	380	0.9	25.1	16.8
Ankistrodesmus falcatus	22	25	550	1.2	29.1	19.5
Kephyrion spirale	24	63	1512	3.4	31.7	21.2
	113		44208		149.4	

TSI= 33.1

Lake: Merrill Date: 9/8/93 Depth: hypo (12m)
 sample: 09-23 Sta. 2
 transect (mm): 12.9 width (mm): 0.182 area (mm2) 2.3
 vol. filtered: (ml) 100

Species	count	Biovolume	T Biovol	% Biovol	#/ml	percent
Kephyrion spirale	2	63	126	0.2	4.2	1.7
Oocystis pusilla	2	54	108	0.2	4.2	1.7
Ankistrodesmus falcatus	7	25	175	0.3	14.6	6.1
Cryptomonas erosa	10	520	5200	7.7	20.9	8.7
Anabaena sp.	11	1000	11000	16.4	23.0	9.6
Asterionella formosa	14	220	3080	4.6	29.3	12.2
Rhodomonas minuta	18	20	360	0.5	37.6	15.7
Cyclotella comta	19	2270	43130	64.2	39.7	16.5
Dinobryon sp.	32	125	4000	6.0	66.9	27.8
	115		67179		240.5	

TSI= 36.7

Lake: Merrill Date: 9/8/93 Depth: hypo (12m)
 sample: 09-24 Sta. 1
 transect (mm): 16 width (mm): 0.182 area (mm2) 2.9
 vol. filtered: (ml) 100

Species	count	Biovolume	T Biovol	% Biovol	#/ml	percent
Oocystis pusilla	2	54	108	0.2	3.4	1.8
Kephyrion spirale	3	63	189	0.4	5.1	2.8
Ankistrodesmus falcatus	5	25	125	0.2	8.4	4.6
Cryptomonas erosa	5	520	2600	4.8	8.4	4.6
Pediastrum sp.	6	30	180	0.3	10.1	5.5
Asterionella formosa	18	220	3960	7.4	30.3	16.5
Cyclotella comta	19	2270	43130	80.4	32.0	17.4
Dinobryon sp.	22	125	2750	5.1	37.1	20.2
Rhodomonas minuta	29	20	580	1.1	48.9	26.6
	109		53622		183.8	

TSI= 34.7

Lake: Merrill
sample: 09-25
transect (mm): 33.6
vol. filtered: (ml) 100

Date: 4/17/93
width (mm): 0.182

Depth: epi (1m)
Sta. 1
area (mm2): 6.1

Species	count	Biovolume	T Biovol	% Biovol	#/ml	percent
Navicula minima	1	44	44	0.1	0.8	0.7
Navicula radiosa	2	325	650	1.5	1.6	1.3
Melosira distans	3	198	594	1.4	2.4	2.0
Cyclotella comta	4	2270	9080	21.4	3.2	2.6
Unident. pennate diatom	4	175	700	1.7	3.2	2.6
Cryptomonas erosa	5	520	2600	6.1	4.0	3.3
Asterionella formosa	8	220	1760	4.2	6.4	5.3
Ankistrodesmus falcatus	9	25	225	0.5	7.2	5.9
Crucigenia quadrata	9	85	765	1.8	7.2	5.9
Anabaena sp.	16	1000	16000	37.7	12.8	10.5
Rhodomonas minuta	16	20	320	0.8	12.8	10.5
Synedra rumpens	69	140	9660	22.8	55.4	45.4
	146		42398		117.2	
			TSI=	32.7		

Lake: Merrill
 sample: 09-26
 transect (mm): 18.3
 vol. filtered: (ml) 100

Date: 4/17/93
 width (mm): 0.182

Depth: epi (1m)
 Sta. 1
 area (mm2) 3.3

Species	count	Biovolume	T Biovol	% Biovol	#/ml	percent
Cyclotella comta	1	2270	2270	11.5	1.5	1.0
Nitzschia amphibia	1	96	96	0.5	1.5	1.0
Nitzschia palea	1	180	180	0.9	1.5	1.0
Achnanthes minutissima	3	50	150	0.8	4.4	2.9
Crucigenia quadrata	3	85	255	1.3	4.4	2.9
Tabellaria flocculosa	3	590	1770	8.9	4.4	2.9
Asterionella formosa	20	220	4400	22.2	10.3	6.7
Ankistrodesmus falcatus	11	25	275	1.4	16.2	10.6
Cryptomonas erosa	12	520	6240	31.5	17.7	11.5
Rhodomonas minuta	26	20	520	2.6	38.3	25.0
Synedra rumpens	26	140	3640	18.4	38.3	25.0
	107		19796		138.5	
			TSI=	26.4		

Lake: Merrill
sample: 09-27
transect (mm): 16.8
vol. filtered: (ml) 100

Date: 4/17/93
width (mm): 0.182

Depth: meta (10m)
Sta. 1
area (mm2): 3.1

Species	count	Biovolume	T Biovol	% Biovol	#/ml	percent
Cyclotella comta	1	2270	2270	10.1	1.6	0.9
Unident. pennate diatom	1	175	175	0.8	1.6	0.9
Ankistrodesmus falcatus	4	25	100	0.4	6.4	3.6
Asterionella formosa	4	220	880	3.9	6.4	3.6
Crucigenia quadrata	20	85	1700	7.5	32.1	17.9
Rhodomonas minuta	20	20	400	1.8	32.1	17.9
Cryptomonas erosa	25	520	13000	57.6	40.1	22.3
Synedra rumpens	29	140	4060	18.0	46.6	25.9
	104		22585		167.0	

TSI= 27.5

Lake: Merrill
sample: 09-28
transect (mm): 12.6
vol. filtered: (ml) 100

Date: 4/17/93
width (mm): 0.182

Depth: meta (10m)
Sta. 1
area (mm2): 2.3

Species	count	Biovolume	T Biovol	% Biovol	#/ml	percent
Achnanthes lanceolata	1	180	180	0.8	2.1	1.0
Asterionella formosa	2	220	440	2.0	4.3	2.0
Cyclotella comta	4	2270	9080	41.7	8.6	4.0
Ankistrodesmus falcatus	10	25	250	1.1	21.4	10.0
Synedra rumpens	14	140	1960	9.0	30.0	14.0
Cryptomonas erosa	17	520	8840	40.6	36.4	17.0
Rhodomonas minuta	52	20	1040	4.8	111.3	52.0
	100		21790		214.1	

TSI= 27.2

Lake: Merrill
 sample: 09-29
 transect (mm): 18
 vol. filtered: (ml) 100

Date: 4/17/93
 width (mm): 0.182

Depth: hypo (15m)
 Sta. 1
 area (mm2): 3.3

Species	count	Biovolume	T Biovol	% Biovol	#/ml	percent
Nitzschia amphibia	1	96	96	0.5	1.5	0.9
Crucigenia tetrapedia	2	85	170	0.8	3.0	1.8
Nitzschia palea	2	180	360	1.7	3.0	1.8
Tabellaria flocculosa	2	590	1180	5.7	3.0	1.8
Ankistrodesmus falcatus	3	25	75	0.4	4.5	2.7
Cyclotella comta	3	2270	6810	32.8	4.5	2.7
Crucigenia quadrata	4	85	340	1.6	6.0	3.6
Cryptomonas erosa	13	520	6760	32.5	19.5	11.8
Synedra rumpens	29	140	4060	19.5	43.5	26.4
Rhodomonas minuta	47	20	940	4.5	70.4	42.7
	106		20791		158.8	
			TSI=	26.8		

Lake: Merrill
sample: 09-31
transect (mm): 17.4
vol. filtered: (ml) 100

Date: 4/17/93
width (mm): 0.182

Depth: epi (1m)
Sta. 2
area (mm2) 3.2

Species	count	Biovolume	T Biovol	% Biovol	#/ml	percent
Crucigenia fenestrata	1	85	85	0.5	1.6	1.0
Cyclotella comta	1	2270	2270	12.2	1.6	1.0
Asterionella formosa	3	220	660	3.5	4.7	2.9
Ankistrodesmus falcatus	7	25	175	0.9	10.9	6.8
Crucigenia quadrata	7	85	595	3.2	10.9	6.8
Cryptomonas erosa	20	520	10400	55.8	31.0	19.4
Rhodomonas minuta	26	20	520	2.8	40.3	25.2
Synedra rumpens	28	140	3920	21.0	43.4	27.2
	93		18625		144.2	
			TSI=	25.9		

Lake: Merrill
sample: 09-32
transect (mm): 17.2
vol. filtered: (ml) 100

Date: 4/17/93
width (mm): 0.182

Depth: epi (1m)
Sta. 2
area (mm2) 3.1

Species	count	Biovolume	T Biovol	% Biovol	#/ml	percent
Cyclotella comta	1	2270	2270	11.5	1.6	0.9
Achnanthes minutissima	2	50	100	0.5	3.1	1.7
Ankistrodesmus falcatus	9	25	225	1.1	14.1	7.7
Asterionella formosa	11	220	2420	12.3	17.2	9.4
Cryptomonas erosa	19	520	9880	50.0	29.8	16.2
Synedra rumpens	30	140	4200	21.3	47.0	25.6
Rhodomonas minuta	33	20	660	3.3	51.7	28.2
	105		19755		164.7	
			TSI=	26.3		

Lake: Merrill
sample: 09-33
transect (mm): 15.5
vol. filtered: (ml) 100

Date: 4/17/93
width (mm): 0.182

Depth: meta (10m)
Sta. 2
area (mm2): 2.8

Species	count	Biovolume	T Biovol	% Biovol	#/ml	percent
Achnanthes linearis	1	132	132	0.5	1.7	0.7
Crucigenia fenestrata	1	85	85	0.3	1.7	0.7
Crucigenia tetrapedia	1	85	85	0.3	1.7	0.7
Eunotia tenella	1	180	180	0.6	1.7	0.7
Navicula minima	1	44	44	0.2	1.7	0.7
Cyclotella comta	3	2270	6810	23.7	5.2	2.2
Crucigenia quadrata	4	85	340	1.2	7.0	2.9
Asterionella formosa	5	220	1100	3.8	8.7	3.6
Ankistrodesmus falcatus	12	25	300	1.0	20.9	8.8
Synedra rumpens	26	140	3640	12.6	45.2	19.0
Cryptomonas erosa	29	520	15080	52.4	50.5	21.2
Rhodomonas minuta	49	20	980	3.4	85.3	35.8
	133		28776		231.4	
			TSI=	29.5		

Lake: Merrill
sample: 09-34
transect (mm): 13.3
vol. filtered: (ml) 100

Date: 4/17/93
width (mm): 0.182

Depth: meta (10m)
Sta. 2
area (mm2): 2.4

Species	count	Biovolume	T Biovol	% Biovol	#/ml	percent
Cyclotella comta	3	2270	6810	29.1	6.1	2.7
Asterionella formosa	5	220	1100	4.7	10.1	4.5
Ankistrodesmus falcatus	13	25	325	1.4	26.4	11.8
Synedra rumpens	17	140	2380	10.2	34.5	15.5
Cryptomonas erosa	23	520	11960	51.0	46.6	20.9
Rhodomonas minuta	43	20	860	3.7	87.2	39.1
	104		23435		210.9	
			TSI=	27.8		

Lake: Merrill
sample: 09-35
transect (mm): 28.1
vol. filtered: (ml) 100

Date: 4/17/93
width (mm): 0.182

Depth: hypo (17m)
Sta. 2
area (mm2): 5.1

Species	count	Biovolume	T Biovol	% Biovol	#/ml	percent
Ankistrodesmus falcatus	1	25	25	0.1	1.0	0.9
Cyclotella comta	4	2270	9080	20.3	3.8	3.6
Tabellaria flocculosa	5	590	2950	6.6	4.8	4.5
Crucigenia quadrata	6	85	510	1.1	5.8	5.4
Rhodomonas minuta	16	20	320	0.7	15.4	14.3
Cryptomonas erosa	21	520	10920	24.4	20.2	18.8
Melosira varians	25	650	16250	36.4	24.0	22.3
Synedra rumpens	33	140	4620	10.3	31.7	29.5
	111		44675		106.5	
			TSI=	33.2		

Lake: Merrill
sample: 09-36
transect (mm): 16
vol. filtered: (ml) 100

Date: 4/17/93
width (mm): 0.182

Depth: hypo (17m)
Sta. 2
area (mm2): 2.9

Species	count	Biovolume	T Biovol	% Biovol	#/ml	percent
Ankistrodesmus falcatus	3	25	75	0.3	5.1	2.6
Asterionella formosa	3	220	660	2.5	5.1	2.6
Cyclotella comta	3	2270	6810	25.7	5.1	2.6
Tabellaria flocculosa	13	590	7670	28.9	21.9	11.2
Cryptomonas erosa	15	520	7800	29.4	25.3	12.9
Synedra rumpens	16	140	2240	8.4	27.0	13.8
Rhodomonas minuta	63	20	1260	4.8	106.2	54.3
	116		26515		195.6	
			TSI=	28.8		

**Phytoplankton Data Sheets for
Meta Lake**

Lake: Meta
sample: 10-01
transect (mm): 2.2
vol. filtered: (ml) 50

Date: 6/17/93

Depth: epi (1m)

width (mm): 0.182

area (mm2): 0.4

Species	count	Biovolume	T Biovol	% Biovol	#/ml	percent
Cryptomonas erosa	2	520	1040	6.5	49.0	1.7
Rhodomonas minuta	2	20	40	0.3	49.0	1.7
Synedra rumpens	29	140	4060	25.6	711.1	24.4
Dinobryon sp.	86	125	10750	67.7	2108.8	72.3
	119		15890		2917.9	

TSI= 24.6

Lake: Meta
sample: 10-02
transect (mm): 2.2
vol. filtered: (ml) 50

Date: 6/17/93

Depth: meta (4m)

width (mm): 0.182

area (mm2): 0.4

Species	count	Biovolume	T Biovol	% Biovol	#/ml	percent
Cryptomonas ovata	2	1727	3454	19.0	49.0	1.7
Rhodomonas minuta	7	20	140	0.8	171.6	5.8
Synedra rumpens	37	140	5180	28.5	907.3	30.6
Dinobryon sp.	75	125	9375	51.7	1839.0	62.0
	121		18149		2966.9	

TSI= 25.6

Lake: Meta
sample: 10-03
transect (mm): 8.1
vol. filtered: (ml) 50

Date: 6/17/93
width (mm): 0.182

Depth: hypo (7m)
area (mm²) 1.5

Species	count	Biovolume	T Biovol	% Biovol	#/ml	percent
Dinobryon sp.	5	125	625	3.3	33.3	4.5
Kephyrion sp.	8	63	504	2.6	53.3	7.2
Cryptomonas erosa	11	520	5720	30.1	73.3	9.9
Synedra rumpens	87	140	12180	64.0	579.4	78.4
	111		19029		739.3	
			TSI=	26.0		

Lake: Meta Date: 8/26/93 Depth: epi (1m)
 sample: 10-04
 transect (mm): 36.3 width (mm): 0.182 area (mm2): 6.6
 vol. filtered: (ml) 100

Species	count	Biovolume	T Biovol	% Biovol	#/ml	percent
Kephyrion sp.	1	63	63	0.4	0.7	0.7
Navicula cryptocephala	1	185	185	1.2	0.7	0.7
Cryptomonas erosa	4	520	2080	13.4	1.5	1.4
Rhodomonas minuta	7	20	140	0.9	5.2	4.8
Ankistrodesmus falcatus	15	25	375	2.4	11.1	10.3
Asterionella formosa	38	220	8360	53.9	28.2	26.0
Oocystis pusilla	80	54	4320	27.8	59.4	54.8
	146		15523		107.0	
			TSI=	24.4		

Lake: Meta Date: 8/26/93 Depth: epi (1m)
 sample: 10-05
 transect (mm): 21 width (mm): 0.182 area (mm2): 3.8
 vol. filtered: (ml) 100

Species	count	Biovolume	T Biovol	% Biovol	#/ml	percent
Rhodomonas minuta	1	20	20	0.1	1.3	0.8
Cryptomonas sp.	3	400	1200	7.7	3.9	2.4
Cryptomonas erosa	11	520	5720	36.9	14.1	8.8
Ankistrodesmus falcatus	12	25	300	1.9	15.4	9.6
Asterionella formosa	18	220	3960	25.5	23.1	14.4
Oocystis pusilla	80	54	4320	27.8	102.8	64.0
	125		15520		160.6	
			TSI=	24.4		

Lake: Meta Date: 8/26/93 Depth: meta (5m)
 sample: 10-06
 transect (mm): 17.6 width (mm): 0.182 area (mm2): 3.2
 vol. filtered: (ml) 100

Species	count	Biovolume	T Biovol	% Biovol	#/ml	percent
Navicula radiosa	1	325	325	0.9	1.5	0.8
Synedra rumpens	1	140	140	0.4	1.5	0.8
Ankistrodesmus falcatus	2	25	50	0.1	3.1	1.6
Rhodomonas minuta	2	20	40	0.1	3.1	1.6
Cryptomonas erosa	4	520	2080	6.1	6.1	3.1
Asterionella formosa	5	220	1100	3.2	7.7	3.9
Anabaena sp.	26	1000	26000	75.6	39.8	20.3
Oocystis pusilla	86	54.0	4644	13.5	131.8	67.2
	127		34379		194.6	
			TSI=	31.0		

Lake: Meta Date: 8/26/93 Depth: meta (5m)
 sample: 10-07
 transect (mm): 28.9 width (mm): 0.182 area (mm2): 5.3
 vol. filtered: (ml) 100

Species	count	Biovolume	T Biovol	% Biovol	#/ml	percent
Cryptomonas ovata	1	1727	1727	10.0	0.9	0.8
Rhodomonas minuta	2	20	40	0.2	1.9	1.6
Cryptomonas erosa	11	520	5720	33.0	10.3	8.7
Ankistrodesmus falcatus	14	25	350	2.0	13.1	11.0
Asterionella formosa	25	220	5500	31.7	23.3	19.7
Oocystis pusilla	74	54	3996	23.1	69.1	58.3
	127		17333		118.6	
			TSI=	25.3		

Lake:	Meta	Date: 8/26/93	Depth: hypo (7.5m)
sample:	10-08		
transect (mm):	2.2	width (mm): 0.182	area (mm2): 0.4
vol. filtered: (ml)	25		

Species	count	Biovolume	T Biovol	% Biovol	#/ml	percent
Cryptomonas erosa	105	520	54600	100	5149.3	100

TSI= 34.9

Lake:	Meta	Date: 8/26/93	Depth: hypo (7.5m)
sample:	10-09		
transect (mm):	1.3	width (mm): 0.182	area (mm2): 0.2
vol. filtered: (ml)	25		

Species	count	Biovolume	T Biovol	% Biovol	#/ml	percent
Cryptomonas erosa	100	520	52000	100	8299.2	100

TSI= 34.5

Lake: Meta Date: 10/9/93 Depth: epi (1m)
 sample: 10-10
 transect (mm): 2 width (mm): 0.182 area (mm2): 0.4
 vol. filtered: (ml) 100

Species	count	Biovolume	T Biovol	% Biovol	#/ml	percent
Ochromonas sp.	100	85	8500	100	1348.626	100

TSI= 19.6

Lake: Meta Date: 10/9/93 Depth: epi (1m)
 sample: 10-11
 transect (mm): 2 width (mm): 0.182 area (mm2): 0.4
 vol. filtered: (ml) 100

Species	count	Biovolume	T Biovol	% Biovol	#/ml	percent
Cryptomonas ova	1	1727	1727	10.7	13.5	0.8
Kephyrion sp.	1	63	63	0.4	13.5	0.8
Asterionella form	8	220	1760	10.9	107.9	6.8
Desmidiium sp.	13	350	4550	28.1	175.3	11.0
Ochromonas sp.	95	85	8075	49.9	1281.2	80.5
	118		16175		1591.4	

TSI= 24.7

Lake: Meta
 sample: 10-12
 transect (mm): 2.2
 vol. filtered: (ml) 100

Date: 10/9/93
 width (mm): 0.182
 area (mm2): 0.4
 Depth: meta (4m)

Species	count	Biovolume	T Biovol	% Biovol	#/ml	percent
Ankistrodesmus falcatus	1	25	25	0.3	12.3	0.8
Rhodomonas minuta	1	20	20	0.2	12.3	0.8
Kephyrion sp.	2	63	126	1.3	24.5	1.7
Ochromonas sp.	115	85	9775	98.3	1409.9	96.6
	119		9946		1459.0	
			TSI=	20.8		

Lake: Meta
 sample: 10-13
 transect (mm): 2.5
 vol. filtered: (ml) 100

Date: 10/9/93
 width (mm): 0.182
 area (mm2): 0.5
 Depth: meta (4m)

Species	count	Biovolume	T Biovol	% Biovol	#/ml	percent
Kephyrion sp.	1	63	63	50.0	10.8	1.0
Ochromonas sp.	100	85	8500	6746.0	1078.9	99.0
	101		8563		1089.7	
			TSI=	19.6		

Lake: Meta
sample: 10-14
transect (mm): 22.4
vol. filtered: (ml) 50

Date: 10/9/93
Depth: hypo (7m)
width (mm): 0.182
area (mm2): 4.1

Species	count	Biovolume	T Biovol	% Biovol	#/ml	percent
Ankistrodesmus falcatus	2	25	50	0.3	4.8	1.9
Cryptomonas ovata	5	1727	8635	44.1	12.0	4.9
Kephyrion sp.	7	63	441	2.3	16.9	6.8
Cryptomonas erosa	10	520	5200	26.6	24.1	9.7
Ochromonas sp.	12	85	1020	5.2	28.9	11.7
Kephyrion spirale	67	63	4221	21.6	161.4	65.0
	103		19567		248.1	
			TSI=	26.3		

Lake: Meta
sample: 10-15
transect (mm): 22.4
vol. filtered: (ml) 50

Date: 10/9/93
Depth: hypo (7m)
width (mm): 0.182
area (mm2): 4.1

Species	count	Biovolume	T Biovol	% Biovol	#/ml	percent
Ankistrodesmus falcatus	1	25	25	0.2	2.4	1.0
Kephyrion sp.	1	63	63	0.4	2.4	1.0
Synedra ulna	1	1990	1990	14.2	2.4	1.0
Cryptomonas erosa	11	520	5720	40.7	26.5	10.5
Ochromonas sp.	24	85	2040	14.5	57.8	22.9
Kephyrion spirale	67	63	4221	30.0	161.4	63.8
	105		14059		252.9	
			TSI=	23.6		

**Phytoplankton Data Sheets for
Panhandle Lake**

Lake: Panhandle
 sample: 11-01
 transect (mm): 1.2
 vol. filtered: (ml) 100
 Date: 9/92
 width (mm): 0.182
 Depth: epi (1m)
 area (mm2): 0.2

Species	count	Biovolume	T Biovol	% Biovol	#/ml	percent
<i>Synedra rumpens</i>	3	140	420	7.1	67.4	2.9
<i>Cyclotella stelligera</i>	100	55	5500	92.9	2247.7	97.1
	103		5920		2315.1	
			TSI=	16.8		

Lake: Panhandle
 sample: 11-02
 transect (mm): 0.5
 vol. filtered: (ml) 100
 Date: 9/92
 width (mm): 0.182
 Depth: meta (10m)
 area (mm2): 0.1

Species	count	Biovolume	T Biovol	% Biovol	#/ml	percent
<i>Cryptomonas erosa</i>	1	520	520	7.2	53.9	0.8
<i>Cyclotella stelligera</i>	122	55	6710	92.8	6581.3	99.2
	123		7230		6635.2	
			TSI=	18.3		

Lake: Panhandle
 sample: 11-03
 transect (mm): 9.5
 vol. filtered: (ml) 25
 Date: 9/92
 width (mm): 0.182
 Depth: hypo (18m)
 area (mm2): 1.7

Species	count	Biovolume	T Biovol	% Biovol	#/ml	percent
<i>Kephyrion</i> sp.	2	63	126	0.3	22.7	1.7
<i>Synedra ulna</i>	2	1990	3980	11.0	22.7	1.7
<i>Cryptomonas erosa</i>	55	520	28600	79.2	624.6	45.5
<i>Cyclotella stelligera</i>	62	55	3410	9.4	704.1	51.2
	121		36116		1374.2	
			TSI=	31.4		

Lake: Panhandle Date: 8/14/93 Depth: epi (1m)
sample: 11-04
transect (mm): 8.3 width (mm): 0.182 area (mm2): 1.5
vol. filtered: (ml) 100

Species	count	Biovolume	T Biovol	% Biovol	#/ml	percent
Cymbella minuta	1	370	370	0.5	3.2	0.8
Navicula radiosa	1	325	325	0.5	3.2	0.8
Nitzschia amphibia	1	96	96	0.1	3.2	0.8
Nitzschia linearis	1	1524	1524	2.2	3.2	0.8
Nitzschia palea	1	180	180	0.3	3.2	0.8
Unident. dinoflagellate	1	500	500	0.7	3.2	0.8
Gomphonema olivaceum	2	225	450	0.6	6.5	1.6
Navicula pupula	2	270	540	0.8	6.5	1.6
Navicula minima	4	44	176	0.2	13.0	3.3
Achnanthes minutissima	5	50	250	0.4	16.2	4.1
Cyclotella stelligera	5	55	275	0.4	16.2	4.1
Kephyrion sp.	14	63	882	1.2	45.5	11.4
Fragilaria crotonensis	40	840	33600	47.5	130.0	32.5
Glenodinium sp.	45	700	31500	44.6	146.2	36.6
	123		70668		399.7	
			TSI=	37.1		

Lake: Panhandle Date: 8/14/93 Depth: epi (1m)
sample: 11-05
transect (mm): 7.1 width (mm): 0.182 area (mm2): 1.3
vol. filtered: (ml) 100

Species	count	Biovolume	T Biovol	% Biovol	#/ml	percent
Achnanthes minutissima	1	50	50	0.1	3.8	1.0
Dinobryon sp.	2	125	250	0.3	7.6	1.9
Fragilaria crotonensis	36	840	30240	39.4	136.8	34.3
Glenodinium sp.	66	700	46200	60.2	250.7	62.9
	105		76740		398.9	
			TSI=	37.8		

Lake: Panhandle Date: 8/14/93 Depth: meta (10m)
 sample: 11-06
 transect (mm): 22.5 width (mm): 0.182 area (mm2): 4.1
 vol. filtered: (ml) 100

Species	count	Biovolume	T Biovol	% Biovol	#/ml	percent
Cryptomonas erosa	1	520	520	1.0	1.2	0.9
Kephyrion sp.	1	63	63	0.1	1.2	0.9
Cyclotella stelligera	6	55	330	0.6	7.2	5.3
Glenodinium sp.	6	700	4200	8.0	7.2	5.3
Fragilaria crotonensis	49	840	41160	78.4	58.7	43.4
Dinobryon sp.	50	125	6250	11.9	59.9	44.2
	113		52523		135.5	
			TSI=	34.6		

Lake: Panhandle Date: 8/14/93 Depth: meta (10m)
 sample: 11-07
 transect (mm): 23.7 width (mm): 0.182 area (mm2): 4.3
 vol. filtered: (ml) 100

Species	count	Biovolume	T Biovol	% Biovol	#/ml	percent
Cyclotella stelligera	1	55	55	0.1	1.1	0.9
Glenodinium sp.	1	700	700	1.7	1.1	0.9
Fragilaria crotonensis	39	840	32760	78.7	44.4	36.8
Dinobryon sp.	65	125	8125	19.5	74.0	61.3
	106		41640		120.6	
			TSI=	32.6		

Lake: Panhandle
 sample: 11-08
 transect (mm): 2
 vol. filtered: (ml) 50

Date: 8/14/93

Depth: hypo (18m)

width (mm): 0.182 area (mm2): 0.4

Species	count	Biovolume	T Biovol	% Biovol	#/ml	percent
Fragilaria crotonensis	19	840	15960	38.5	512.5	15.2
Cryptomonas erosa	31	520	16120	38.9	836.1	24.8
Dinobryon sp.	75	125	9375	22.6	2022.9	60.0
	125		41455		3371.6	
			TSI=	32.6		

Lake: Panhandle
 sample: 11-09
 transect (mm): 1.8
 vol. filtered: (ml) 50

Date: 8/14/93

Depth: hypo (18m)

width (mm): 0.182 area (mm2): 0.3

Species	count	Biovolume	T Biovol	% Biovol	#/ml	percent
Synedra rumpens	8	140	1120	4.1	239.8	7.1
Cryptomonas erosa	33	520	17160	62.9	989.0	29.2
Dinobryon sp.	72	125	9000	33.0	2157.8	63.7
	113		27280		3386.6	
			TSI=	29.0		

**Phytoplankton Data Sheets for
Ryan Lake**

Lake: Ryan
sample: 12-01
transect (mm): 4.8
vol. filtered: (ml) 100

Date: 6/17/93
Depth: epi (1m)
width (mm): 0.182
area (mm2): 0.9

Species	count	Biovolume	T Biovol	% Biovol	#/ml	percent
Cryptomonas erosa	1	520	520	11.5	5.6	0.8
Cymbella minuta	1	370	370	8.2	5.6	0.8
Navicula cryptocephala	1	185	185	4.1	5.6	0.8
Achnanthes minutissima	3	50	150	3.3	16.9	2.5
Crucigenia quadrata	4	85	340	7.5	22.5	3.4
Kephyrion sp.	7	63	441	9.7	39.3	5.9
Ankistrodesmus falcatus	101	25	2525	55.7	567.5	85.6
	118		4531		663.1	

TSI= 14.9

Lake: Ryan
sample: 12-02
transect (mm): 2.9
vol. filtered: (ml) 100

Date: 6/17/93
Depth: meta (4m)
width (mm): 0.182
area (mm2): 0.5

Species	count	Biovolume	T Biovol	% Biovol	#/ml	percent
Synedra sp.	1	280	280	3.9	9.3	0.9
Achnanthes minutissima	3	50	150	2.1	27.9	2.6
Crucigenia quadrata	4	85	340	4.8	37.2	3.4
Kephyrion sp.	5	63	315	4.4	46.5	4.3
Cryptomonas erosa	7	520	3640	51.1	65.1	6.0
Ankistrodesmus falcatus	96	25	2400	33.7	892.9	82.8
	116		7125		1078.9	

TSI= 18.2

Lake:	Ryan	Date: 6/17/93	Depth: hypo (6m)
sample:	12-03		
transect (mm):	2	width (mm): 0.182	area (mm2) 0.4
vol. filtered: (ml)	50		

Species	count	Biovolume	T Biovol	% Biovol	#/ml	percent
Crucigenia fenestrata	1	85	85	1.8	27.0	1.0
Cryptomonas erosa	4	520	2080	44.3	107.9	4.0
Kephyrion sp.	4	63	252	5.4	107.9	4.0
Ankistrodesmus falcatus	91	25	2275	48.5	2454.5	91.0
	100		4692		2697.3	
			TSI=	15.1		

Lake: Ryan Date: 8/24/93 Depth: meta (4m)
 sample: 12-04
 transect (mm): 19.2 width (mm): 0.182 area (mm2): 3.5
 vol. filtered: (ml) 100

Species	count	Biovolume	T Biovol	% Biovol	#/ml	percent
Achnanthes minutissima	1	50	50	0.2	1.4	1.0
Ankistrodesmus falcatus	4	25	100	0.4	5.6	4.0
Cryptomonas erosa	46	520	23920	88.1	64.6	46.0
Kephyrion sp.	49	63	3087	11.4	68.8	49.0
	100		27157		140.5	

TSI= 29.0

Lake: Ryan Date: 8/24/93 Depth: meta (4m)
 sample: 12-05
 transect (mm): 22.5 width (mm): 0.182 area (mm2): 4.1
 vol. filtered: (ml) 100

Species	count	Biovolume	T Biovol	% Biovol	#/ml	percent
Dinobryon sp.	1	125	125	0.5	1.2	1.0
Navicula radiosa	1	325	325	1.2	1.2	1.0
Achnanthes minutissima	3	50	150	0.6	3.6	2.9
Ankistrodesmus falcatus	4	25	100	0.4	4.8	3.8
Cryptomonas erosa	43	520	22360	84.9	51.5	41.3
Kephyrion sp.	52	63	3276	12.4	62.3	50.0
	104		26336		124.7	

TSI= 28.7

Lake: Ryan Date: 8/24/93 Depth: epi (1m)
 sample: 12-06
 transect (mm): 26.3 width (mm): 0.182 area (mm2): 4.8
 vol. filtered: (ml) 100

Species	count	Biovolume	T Biovol	% Biovol	#/ml	percent
Unident. pennate diatom	1	175	175	0.4	1.0	0.9
Ceratium hirundinella	2	9800	19600	43.8	2.1	1.9
Crucigenia fenestrata	2	85	170	0.4	2.1	1.9
Dinobryon sp.	2	125	250	0.6	2.1	1.9
Cryptomonas erosa	40	520	20800	46.5	41.0	37.4
Kephyrion sp.	60	63	3780	8.4	61.5	56.1
	107		44775		109.7	
			TSI=	33.2		

Lake: Ryan Date: 8/24/93 Depth: epi (1m)
 sample: 12-07
 transect (mm): 16.7 width (mm): 0.182 area (mm2): 3.0
 vol. filtered: (ml) 100

Species	count	Biovolume	T Biovol	% Biovol	#/ml	percent
Ankistrodesmus falcatus	1	25	25	0.1	1.6	1.0
Dinobryon sp.	1	125	125	0.5	1.6	1.0
Ochromonas sp.	2	85	170	0.6	3.2	2.0
Cryptomonas erosa	46	520	23920	87.3	74.3	46.0
Kephyrion sp.	50	63	3150	11.5	80.8	50.0
	100		27390		161.5	
			TSI=	29.1		

Lake: Ryan
sample: 12-08
transect (mm): 34.1
vol. filtered: (ml) 50

Date: 8/24/93

Depth: hypo (6m)

width (mm): 0.182

area (mm2) 6.2

Species	count	Biovolume	T Biovol	% Biovol	#/ml	percent
Crucigenia fenestrata	1	85	85	0.1	1.6	0.9
Cymbella minuta	1	370	370	0.6	1.6	0.9
Navicula rhynchocephala	1	295	295	0.5	1.6	0.9
Nitzschia palea	1	180	180	0.3	1.6	0.9
Unident. pennate diatom	1	175	175	0.3	1.6	0.9
Navicula radiosa	2	325	650	1.1	3.2	1.8
Achnanthes minutissima	5	50	250	0.4	7.9	4.5
Kephyrion sp.	13	63	819	1.3	20.6	11.8
Cryptomonas ovata	25	1727	43175	69.8	39.5	22.7
Cryptomonas erosa	29	520	15080	24.4	45.9	26.4
Ankistrodesmus falcatus	31	25	775	1.3	49.0	28.2
	110		61854		174.0	
			TSI=	36.0		

Lake: Ryan
sample: 12-09
transect (mm): 2.6
vol. filtered: (ml) 50

Date: 8/24/93

Depth: hypo (6m)

width (mm): 0.182

area (mm2) 0.5

Species	count	Biovolume	T Biovol	% Biovol	#/ml	percent
Cryptomonas ovata	14	1727	24178	33.6	290.5	13.2
Cryptomonas erosa	92	520	47840	66.4	1908.8	86.8
	106		72018		2199.3	
			TSI=	37.3		

Lake: Ryan
sample: 12-10
transect (mm): 11.9
vol. filtered: (ml) 100

Date: 10/9/93

Depth: epi (1m)

width (mm): 0.182

area (mm2): 2.2

Species	count	Biovolume	T Biovol	% Biovol	#/ml	percent
Achnanthes minutissima	1	50	50	0.3	2.3	1.1
Ankistrodesmus falcatus	2	25	50	0.3	4.5	2.2
Cryptomonas ovata	2	1727	3454	21.3	4.5	2.2
Kephyrion sp.	3	63	189	1.2	6.8	3.3
Ulothrix sp.	4	80	320	2.0	9.1	4.4
Cryptomonas erosa	15	520	7800	48.0	34.0	16.5
Ochromonas sp.	16	85	1360	8.4	36.3	17.6
Kephyrion spirale	48	63	3024	18.6	108.8	52.7
	91		16247		206.3	

TSI= 24.7

Lake: Ryan
sample: 12-11
transect (mm): 15.3
vol. filtered: (ml) 100

Date: 10/9/93

Depth: epi (1m)

width (mm): 0.182

area (mm2): 2.8

Species	count	Biovolume	T Biovol	% Biovol	#/ml	percent
Ankistrodesmus falcatus	1	25	25	0.1	1.8	6.7
Cryptomonas ovata	3	1727	5181	23.3	5.3	20.0
Chromulina sp.	11	20	220	1.0	19.4	73.3
Cryptomonas erosa	23	520	11960	53.8	40.5	153.3
Kephyrion sp.	77	63	4851	21.8	135.7	513.3
	115		22237		202.7	

TSI= 27.3

Lake: Ryan Date: 10/9/93 Depth: meta (4m)
 sample: 12-12
 transect (mm): 12.9 width (mm): 0.182 area (mm2) 2.3
 vol. filtered: (ml) 100

Species	count	Biovolume	T Biovol	% Biovol	#/ml	percent
Gyrosigma sp.	1	500	500	2.1	2.1	0.9
Navicula cryptocephala	1	185	185	0.8	2.1	0.9
Cryptomonas ovata	3	1727	5181	21.7	6.3	2.8
Tabellaria flocculosa	3	590	1770	7.4	6.3	2.8
Chromulina sp.	13	20	260	1.1	27.2	12.0
Cryptomonas erosa	23	520	11960	50.1	48.1	21.3
Kephyrion sp.	64	63	4032	16.9	133.8	59.3
	108		23888		225.8	
			TSI=	27.9		

Lake: Ryan Date: 10/9/93 Depth: meta (4m)
 sample: 12-13
 transect (mm): 12 width (mm): 0.182 area (mm2) 2.2
 vol. filtered: (ml) 100

Species	count	Biovolume	T Biovol	% Biovol	#/ml	percent
Ankistrodesmus falcatus	1	25	25	0.1	2.2	1.0
Crucigenia quadrata	1	85	85	0.5	2.2	1.0
Nitzschia palea	1	180	180	1.0	2.2	1.0
Kephyrion sp.	6	63	378	2.2	13.5	5.9
Ochromonas sp.	15	85	1275	7.3	33.7	14.7
Cryptomonas erosa	23	520	11960	68.9	51.7	22.5
Kephyrion spirale	55	63	3465	20.0	123.6	53.9
	102		17368		229.3	
			TSI=	25.3		

Lake: Ryan
sample: 12-14
transect (mm): 17
vol. filtered: (ml) 50

Date: 10/9/93
width (mm): 0.182
area (mm2): 3.1
Depth: hypo (6m)

Species	count	Biovolume	T Biovol	% Biovol	#/ml	percent
Ankistrodesmus falcatus	1	25	25	0.2	3.2	1.0
Navicula cryptocephala	1	185	185	1.3	3.2	1.0
Nitzschia palea	1	180	180	1.3	3.2	1.0
Ochromonas sp.	7	85	595	4.3	22.2	6.7
Cryptomonas erosa	17	520	8840	64.0	53.9	16.3
Chromulina sp.	20	20	400	2.9	63.5	19.2
Kephyrion sp.	57	63	3591	26.0	180.9	54.8
	104		13816		330.0	
			TSI=	23.4		

Lake: Ryan
sample: 12-15
transect (mm): 20.8
vol. filtered: (ml) 50

Date: 10/9/93
width (mm): 0.182
area (mm2): 3.8
Depth: hypo (6m)

Species	count	Biovolume	T Biovol	% Biovol	#/ml	percent
Nitzschia palea	1	180	180	0.9	2.6	0.9
Ankistrodesmus falcatus	2	25	50	0.2	5.2	1.8
Kephyrion sp.	2	63	126	0.6	5.2	1.8
Ochromonas sp.	20	85	1700	8.2	51.9	17.7
Cryptomonas erosa	29	520	15080	72.3	75.2	25.7
Kephyrion spirale	59	63	3717	17.8	153.0	52.2
	113		20853		293.1	
			TSI=	26.8		

**Phytoplankton Data Sheets for
Spirit Lake**

Lake: Spirit
sample: 13-01
transect (mm): 29.6
vol. filtered: (ml) 100

Date: Sum '93

Depth: epi (1m)

width (mm): 0.182

area (mm²) 5.4

Species	count	Biovolume	T Biovol	% Biovol	#/ml	percent
Cryptomonas erosa	1	520	520	0.4	0.9	0.6
Kephyrion spirale	1	63	63	0.0	0.9	0.6
Nitzschia amphibia	1	96	96	0.1	0.9	0.6
Nitzschia palea	1	180	180	0.1	0.9	0.6
Synedra rumpens	1	140	140	0.1	0.9	0.6
Asterionella formosa	2	220	440	0.3	1.8	1.2
Gomphonema olivaceum	2	225	450	0.3	1.8	1.2
Tetraedron sp.	2	27	54	0.0	1.8	1.2
Navicula minima	3	44	132	0.1	2.7	1.8
Achnanthes minutissima	5	50	250	0.2	4.6	3.0
Ankistrodesmus falcatus	5	25	125	0.1	4.6	3.0
Unident. dinoflagellate	12	500	6000	4.3	10.9	7.3
Kephyrion sp.	30	63	1890	1.3	27.3	18.2
Cyclotella comta	33	2270	74910	53.2	30.1	20.0
Fragilaria crotonensis	66	840	55440	39.4	60.1	40.0
	165		140690		150.4	

TSI= 43.0

Lake: Spirit
sample: 13-02
transect (mm): 35.6
vol. filtered: (ml) 100

Date: Sum '93
width (mm): 0.182

Depth: epi (1m)
area (mm2): 6.5

Species	count	Biovolume	T Biovol	% Biovol	#/ml	percent
Diatoma sp.	1	500	500	0.4	0.8	0.6
Navicula rhynchocephala	1	295	295	0.3	0.8	0.6
Nitzschia palea	1	180	180	0.2	0.8	0.6
Cryptomonas erosa	2	520	1040	0.9	1.5	1.3
Achnanthes minutissima	3	50	150	0.1	2.3	1.9
Asterionella formosa	3	220	660	0.6	2.3	1.9
Navicula minima	3	44	132	0.1	2.3	1.9
Tetraedron sp.	4	27	108	0.1	3.0	2.5
Ankistrodesmus falcatus	18	25	450	0.4	13.6	11.3
Cyclotella comta	27	2270	61290	53.6	20.5	16.9
Kephyrion sp.	41	63	2583	2.3	31.1	25.6
Fragilaria crotonensis	56	840	47040	41.1	42.4	35.0
	160		114428		121.2	

TSI= 41.2

Phytoplankton Data Sheets for
St. Helens Lake

Lake: St. Helens Date: 9/92 Depth: epi (1m)
 sample: 14-01
 transect (mm): 17.4 width (mm): 0.182 area (mm2) 3.2
 vol. filtered: (ml) 100

Species	count	Biovolume	T Biovol	% Biovol	#/ml	percent
Cryptomonas erosa	2	520	1040	13.7	3.1	1.8
Crucigenia quadrata	3	85	255	3.4	4.7	2.8
Rhodomonas minuta	3	20	60	0.8	4.7	2.8
Ankistrodesmus falcatus	4	25	100	1.3	6.2	3.7
Kephyrion sp.	97	63	6111	80.8	150.4	89.0
	109		7566		169.0	

TSI= 18.7

Lake: St. Helens Date: 9/92 Depth: meta
 sample: 14-02
 transect (mm): 31 width (mm): 0.182 area (mm2) 5.6
 vol. filtered: (ml) 100

Species	count	Biovolume	T Biovol	% Biovol	#/ml	percent
Crucigenia fenestrata	1	85	85	1.6	0.9	0.9
Cryptomonas erosa	1	520	520	9.5	0.9	0.9
Cryptomonas ovata	1	1727	1727	31.5	0.9	0.9
Synedra rumpens	1	140	140	2.6	0.9	0.9
Crucigenia quadrata	5	85	425	7.8	4.4	4.7
Oocystis pusilla	11	54	594	10.8	9.6	10.3
Rhodomonas minuta	37	20	740	13.5	32.2	34.6
Ankistrodesmus falcatus	50	25	1250	22.8	43.5	46.7
	107		5481		93.1	

TSI= 16.2

Lake:	St. Helens	Date: 9/92	Depth: hypo
sample:	14-03		
transect (mm):	52.2	width (mm): 0.182	area (mm2): 9.5
vol. filtered: (ml)	100		

Species	count	Biovolume	T Biovol	% Biovol	#/ml	percent
Ankistrodesmus falcatus	3	25	75	3.3	1.6	23.1
Cryptomonas erosa	4	520	2080	91.4	2.1	30.8
Rhodomonas minuta	6	20	120	5.3	3.1	46.2
	13		2275		6.7	
			TSI=	10.3		

Lake: St. Helens Date: 8/10/93 Depth: epi (1m)
 sample: 14-04
 transect (mm): 12.5 width (mm): 0.182 area (mm2) 2.3
 vol. filtered: (ml) 100

Species	count	Biovolume	T Biovol	% Biovol	#/ml	percent
Achnanthes minutissima	1	50	50	1.6	2.2	1.0
Synedra rumpens	1	140	140	4.6	2.2	1.0
Synedra sp.	1	280	280	9.2	2.2	1.0
Oocystis pusilla	4	54	216	7.1	8.6	4.0
Quadrigula lacustris	4	30	120	4.0	8.6	4.0
Ankistrodesmus falcatus	89	25	2225	73.4	192.0	89.0
	100		3031		215.8	
			TSI=	12.1		

Lake: St. Helens Date: 8/10/93 Depth: epi (1m)
 sample: 14-05
 transect (mm): 7 width (mm): 0.182 area (mm2) 1.3
 vol. filtered: (ml) 100

Species	count	Biovolume	T Biovol	% Biovol	#/ml	percent
Ankistrodesmus falcatus	100	25	2500	100	385.3218	100
			TSI=	10.9		

Lake: St. Helens Date: 8/10/93 Depth: meta (15m)
sample: 14-06
transect (mm): 30.9 width (mm): 0.182 area (mm2): 5.6
vol. filtered: (ml) 100

Species	count	Biovolume	T Biovol	% Biovol	#/ml	percent
Navicula rhynchocephala	1	295	295	5.4	0.9	1.0
Crucigenia fenestrata	3	85	255	4.7	2.6	3.0
Cryptomonas erosa	4	520	2080	38.3	3.5	4.0
Quadrigula lacustris	4	30	120	2.2	3.5	4.0
Crucigenia quadrata	5	85	425	7.8	4.4	5.0
Oocystis pusilla	8	54	432	8.0	7.0	7.9
Rhodomonas minuta	15	20	300	5.5	13.1	14.9
Ankistrodesmus falcatus	61	25	1525	28.1	53.2	60.4
	101		5432		88.2	

TSI= 16.2

Lake: St. Helens Date: 8/10/93 Depth: meta (15m)
sample: 14-07
transect (mm): 24.5 width (mm): 0.182 area (mm2): 4.5
vol. filtered: (ml) 100

Species	count	Biovolume	T Biovol	% Biovol	#/ml	percent
Cryptomonas erosa	1	520	520	12.5	1.1	0.9
Synedra rumpens	3	140	420	10.1	3.3	2.7
Rhodomonas minuta	6	20	120	2.9	6.6	5.3
Oocystis pusilla	18	54	972	23.4	19.8	15.9
Ankistrodesmus falcatus	85	25	2125	51.1	93.6	75.2
	113		4157		124.4	

TSI= 14.2

Lake: St. Helens
 sample: 14-08
 transect (mm): 54.1
 vol. filtered: (ml) 100

Date: 8/10/93

Depth: hypo (75m)

width (mm): 0.182

area (mm2): 9.8

Species	count	Biovolume	T Biovol	% Biovol	#/ml	percent
Kephyrion sp.	1	63	63	1.2	0.5	8.3
Nitzschia amphibia	1	96	96	1.8	0.5	8.3
Cryptomonas erosa	10	520	5200	97.0	5.0	83.3
	12		5359		6.0	
			TSI=	16.1		

**Phytoplankton Data Sheets for
Venus Lake**

Lake: Venus
 sample: 15-01
 transect (mm): 28.2
 vol. filtered: (ml) 100

Date: 9/92
 width (mm): 0.182
 area (mm2): 5.1

Depth: epi

Species	count	Biovolume	T Biovol	% Biovol	#/ml	percent
Cryptomonas erosa	1	520	520	5.3	1.0	1.0
Fragilaria crotenensis	5	840	4200	42.9	4.8	5.0
Crucigenia fenestrata	11	85	935	9.5	10.5	10.9
Ankistrodesmus falcatus	16	25	400	4.1	15.3	15.8
Cyclotella stelligera	68	55	3740	38.2	65.0	67.3
	101		9795		96.6	

TSI= 20.7

Lake: Venus
 sample: 15-02
 transect (mm): 0.8
 vol. filtered: (ml) 100

Date: 9/92
 width (mm): 0.182
 area (mm2): 0.1

Depth: meta

Species	count	Biovolume	T Biovol	% Biovol	#/ml	percent
Cryptomonas erosa	1	520	520	6.6	33.7	0.9
Fragilaria crotonensis	2	840	1680	21.4	67.4	1.9
Cyclotella stelligera	103	55	5665	72.0	3472.7	97.2
	106		7865		3573.9	

TSI= 19.0

Lake: Venus
 sample: 15-03
 transect (mm): 2.6
 vol. filtered: (ml) 100

Date: 9/92
 width (mm): 0.182
 area (mm2): 0.5

Depth: hypo

Species	count	Biovolume	T Biovol	% Biovol	#/ml	percent
Ankistrodesmus falcatus	2	25	50	0.8	20.7	1.8
Crucigenia quadrata	2	85	170	2.8	20.7	1.8
Cyclotella stelligera	105	55	5775	96.3	1089.3	96.3
	109		5995		1130.8	

TSI= 16.9

Lake: Venus
sample: 15-04
transect (mm): 52.1
vol. filtered: (ml) 100

Date: 8/10/93
width (mm): 0.182

Depth: epi (1m)
area (mm2): 9.5

Species	count	Biovolume	T Biovol	% Biovol	#/ml	percent
Ankistrodesmus falcatus	1	25	25	1.0	0.5	5.3
Cyclotella stelligera	1	55	55	2.2	0.5	5.3
Navicula minima	1	44	44	1.8	0.5	5.3
Nitzschia palea	1	180	180	7.3	7.8	5.3
Unident. pennate diatom	1	175	175	7.1	29.5	5.3
Crucigenia fenestrata	2	85	170	6.9	1.0	10.5
Cryptomonas erosa	2	520	1040	42.1	1.0	10.5
Achnanthes minutissima	2	50	100	4.1	15.0	10.5
Crucigenia quadrata	8	85	680	27.5	4.1	42.1
	19		2469		60.1	
TSI=				10.8		

Lake: Venus
sample: 15-05
transect (mm): 54.3
vol. filtered: (ml) 100

Date: 8/10/93
width (mm): 0.182

Depth: epi (1m)
area (mm2): 9.9

Species	count	Biovolume	T Biovol	% Biovol	#/ml	percent
Cyclotella stelligera	1	55	55	1.9	0.5	3.8
Fragilaria crotonensis	1	840	840	29.3	0.5	3.8
Gomphonema olivaceum	1	225	225	7.8	0.5	3.8
Nitzschia palea	1	180	180	6.3	0.5	3.8
Ankistrodesmus falcatus	5	25	125	4.4	2.5	19.2
Crucigenia fenestrata	17	85	1445	50.3	8.4	65.4
	26		2870		12.9	
TSI=				11.8		

Lake: Venus Date: 8/10/93 Depth: meta (12m)
 sample: 15-06
 transect (mm): 28.8 width (mm): 0.182 area (mm²): 5.2
 vol. filtered: (ml) 100

Species	count	Biovolume	T Biovol	% Biovol	#/ml	percent
Cyclotella stelligera	1	55	55	0.6	0.9	0.9
Oocystis pusilla	2	54	108	1.2	1.9	1.8
Crucigenia quadrata	4	85	340	3.8	3.7	3.6
Ankistrodesmus falcatus	8	25	200	2.3	7.5	7.2
Crucigenia fenestrata	96	85	8160	92.1	89.9	86.5
	111		8863		103.9	
			TSI=	19.9		

Lake: Venus Date: 8/10/93 Depth: meta (12m)
 sample: 15-07
 transect (mm): 22.9 width (mm): 0.182 area (mm²): 4.2
 vol. filtered: (ml) 100

Species	count	Biovolume	T Biovol	% Biovol	#/ml	percent
Ankistrodesmus falcatus	45	25	1125	17.1	53.0	41.3
Crucigenia fenestrata	64	85	5440	82.9	75.4	58.7
	109		6565		128.4	
			TSI=	17.6		

Lake: Venus
sample: 15-08
transect (mm): 14.3
vol. filtered: (ml) 100

Date: 8/10/93

Depth: hypo (38m)

width (mm): 0.182

area (mm2): 2.6

Species	count	Biovolume	T Biovol	% Biovol	#/ml	percent
Fragilaria crotonensis	1	840	840	2.2	1.9	0.7
Unident. pennate diatom	1	175	175	0.5	1.9	0.7
Crucigenia fenestrata	8	85	680	1.8	15.1	6.0
Kephyrion sp.	9	63	567	1.5	17.0	6.7
Dinobryon sp.	11	125	1375	3.6	20.7	8.2
Cyclotella stelligera	16	55	880	2.3	30.2	11.9
Ankistrodesmus falcatus	24	25	600	1.6	45.3	17.9
Cryptomonas erosa	64	520	33280	86.7	120.7	47.8
	134		38397		252.7	
			TSI=	31.9		

Lake: Venus
sample: 15-09
transect (mm): 9.7
vol. filtered: (ml) 100

Date: 8/10/93

Depth: hypo (38m)

width (mm): 0.182

area (mm2): 1.8

Species	count	Biovolume	T Biovol	% Biovol	#/ml	percent
Crucigenia fenestrata	2	85	170	0.4	5.6	1.6
Ankistrodesmus falcatus	5	25	125	0.3	13.9	4.1
Kephyrion sp.	8	63	504	1.3	22.2	6.6
Dinobryon sp.	16	125	2000	5.1	44.5	13.1
Cyclotella stelligera	24	55	1320	3.4	66.7	19.7
Cryptomonas erosa	67	520	34840	89.4	186.3	54.9
	122		38959		339.2	
			TSI=	32.0		

Phytoplankton Data Sheets for
Quality Assurance
(Precision of the Algal Identification and Enumeration)

Lake: Blue
 sample: 01-02QA
 transect (mm): 9.1
 vol. filtered: (ml) 100

Date: 7/17/93
 width (mm): 0.182
 area (mm2) 1.7
 Depth: 10M

Species	count	Biovolume	T Biovol	% Biovol	#/ml	percent
Dinobryon sp.	1	125	125	1.7	3.0	1.0
Synedra rumpens	1	140	140	1.9	3.0	1.0
Cryptomonas erosa	2	520	1040	14.1	5.9	1.9
Glenodinium sp.	6	700	4200	57.0	17.8	5.8
Rhodomonas minuta	93	20	1860	25.3	275.7	90.3
	103		7365		305.3	
				TSI=	18.4	

Lake: Boot
 sample: 02-02QA
 transect (mm): 9.6
 vol. filtered: (ml) 50

Date: 9/92
 width (mm): 0.182
 area (mm2) 1.7
 Depth: meta

Species	count	Biovolume	T Biovol	% Biovol	#/ml	percent
Cryptomonas erosa	2	520	1040	2.2	11.2	1.8
Kephyrion spirale	6	63	378	0.8	33.7	5.3
Kephyrion sp.	14	63	882	1.9	78.7	12.4
Dinobryon sp.	45	125	5625	12.1	252.9	39.8
Fragilaria crotonensis	46	840	38640	83.0	258.5	40.7
	113		46565		635.0	
				TSI=	33.5	

Lake: Boot Date: 8/15/93 Depth: meta (7m)
sample: 02-06QA
transect (mm): 3.4 width (mm): 0.182 area (mm2) 0.6
vol. filtered: (ml) 100

Species	count	Biovolume	T Biovol	% Biovol	#/ml	percent
Cryptomonas erosa	1	520	520	2.0	7.9	0.8
Synedra rumpens	1	140	140	0.5	7.9	0.8
Fragilaria crotonensis	15	840	12600	48.5	119.0	11.9
Kephyrion sp.	15	63	945	3.6	119.0	11.9
Dinobryon sp.	94	125	11750	45.3	745.7	74.6
	126		25955		999.6	
			TSI=	28.6		

Lake: Castle Date: 9/17/93 Depth: epi (1m)
sample: 03-13QA
transect (mm): 24.3 width (mm): 0.182 area (mm2) 4.4
vol. filtered: (ml) 100

Species	count	Biovolume	T Biovol	% Biovol	#/ml	percent
Ochromonas sp.	1	85	85	0.9	1.1	0.8
Cryptomonas erosa	8	520	4160	43.4	8.9	6.6
Ankistrodesmus falcatus	9	25	225	2.3	10.0	7.4
Dinobryon sp.	10	125	1250	13.0	11.1	8.3
Kephyrion spirale	12	63	756	7.9	13.3	9.9
Planktosphaeria gelatin	18	14	252	2.6	20.0	14.9
Rhodomonas minuta	26	20	520	5.4	28.9	21.5
Kephyrion sp.	37	63	2331	24.3	41.1	30.6
	121		9579		134.3	
			TSI=	20.5		

Lake: Castle Date: 9/17/93 Depth: meta (10m)
 sample: 03-21QA Site2
 transect (mm): 19 width (mm): 0.182 area (mm2): 3.5
 vol. filtered: (ml) 100

Species	count	Biovolume	T Biovol	% Biovol	#/ml	percent
Kephyrion sp.	6	63	378	2.5	8.5	5.4
Kephyrion spirale	7	63	441	2.9	9.9	6.3
Ankistrodesmus falcatus	12	25	300	2.0	17.0	10.7
Cryptomonas erosa	12	520	6240	41.5	17.0	10.7
Rhodomonas minuta	16	20	320	2.1	22.7	14.3
Dinobryon sp.	59	125	7375	49.0	83.8	52.7
	112		15054		159.0	
			TSI=	24.1		

Lake: Coldwater Date: 8/4/93 Depth: meta (7m)
 sample: 04-22QA
 transect (mm): 4.9 width (mm): 0.182 area (mm2): 0.9
 vol. filtered: (ml) 100

Species	count	Biovolume	T Biovol	% Biovol	#/ml	percent
Cryptomonas erosa	1	520	520	2.1	5.5	0.7
Gloecystis sp.	1	260	260	1.1	5.5	0.7
Dinobryon sp.	6	125	750	3.1	33.0	3.9
Kephyrion sp.	7	63	441	1.8	38.5	4.6
Cyclotella comta	9	2270	20430	84.1	49.5	5.9
Rhodomonas minuta	13	20	260	1.1	71.6	8.5
Planktosphaeria gelatino	116	14	1624	6.7	638.5	75.8
	153		24285		842.2	
			TSI=	28.1		

Lake: Fawn
 sample: 05-11QA
 transect (mm): 5.3
 vol. filtered: (ml) 100

Date: 10/2/93
 width (mm): 0.182

Depth: epi (1m)
 area (mm2): 1.0

Species	count	Biovolume	T Biovol	% Biovol	#/ml	percent
Cyclotella comta	1	2270	2270	11.7	5.1	0.5
Kephyrion sp.	1	63	63	0.3	5.1	0.5
Cryptomonas erosa	2	520	1040	5.4	10.2	1.0
Asterionella formosa	29	220	6380	32.9	147.6	15.2
Dinobryon sp.	29	125	3625	18.7	147.6	15.2
Ochromonas sp.	59	85	5015	25.9	300.3	30.9
Chroococcus minumus	70	14	980	5.1	356.2	36.6
	191		19373		972.0	
			TSI=	26.2		

Lake: Fawn
 sample: 05-16QA
 transect (mm): 1.6
 vol. filtered: (ml) 100

Date: 10/2/93
 width (mm): 0.182

Depth: productivity
 area (mm2): 0.3

Species	count	Biovolume	T Biovol	% Biovol	#/ml	percent
Kephyrion sp.	3	63	189	1.8	50.6	2.7
Asterionella formosa	10	220	2200	20.5	168.6	8.9
Chroococcus minumus	12	14	168	1.6	202.3	10.7
Dinobryon sp.	20	125	2500	23.3	337.2	17.9
Ochromonas sp.	67	85	5695	53.0	1129.5	59.8
	112		10752		1888.1	
			TSI=	21.4		

Lake: Hanaford
 sample: 06-10QA
 transect (mm): 26
 vol. filtered: (ml) 100

Date: 10/11/92
 width (mm): 0.182

Depth: hypo (14m)
 area (mm2): 4.7

Species	count	Biovolume	T Biovol	% Biovol	#/ml	percent
Cyclotella comta	1	2270	2270	30.2	1.0	1.0
Glenodinium sp.	1	700	700	9.3	1.0	1.0
Gomphonema olivaceum	1	225	225	3.0	1.0	1.0
Ankistrodesmus falcatus	2	25	50	0.7	2.1	1.9
Dinobryon sp.	3	125	375	5.0	3.1	2.9
Cryptomonas erosa	4	520	2080	27.7	4.1	3.9
Rhodomonas minuta	91	20	1820	24.2	94.4	88.3
	103		7520		106.9	
			TSI=	18.6		

Lake: McBride
 sample: 08-04QA
 transect (mm): 17.8
 vol. filtered: (ml) 100

Date: 5/28/93
 width (mm): 0.182

Depth: hypo (1.8m)
 area (mm2): 3.2

Species	count	Biovolume	T Biovol	% Biovol	#/ml	percent
Cymbella minuta	1	370	370	0.4	1.5	0.8
Achnanthes minutissima	2	50	100	0.1	3.0	1.6
Synedra minuscula	6	490	2940	2.8	9.1	4.8
Anabaena sp.	24	1000	24000	22.7	36.4	19.0
Fragilaria crotonensis	93	840	78120	74.0	140.9	73.8
	126		105530		190.9	
			TSI=	40.5		

Lake: Merrill
 sample: 09-07QA1
 transect (mm): 8.6
 vol. filtered: (ml) 100

Date: 10/17/93
 width (mm): 0.182

Depth: epi (1m)
 Sta. 2
 area (mm2) 1.6

Species	count	Biovolume	T Biovol	% Biovol	#/ml	percent
Crucigenia quadrata	1	85	85	1.2	3.1	0.9
Cryptomonas erosa	1	520	520	7.2	3.1	0.9
Planktosphaeria gelatinosa	1	14	14	0.2	3.1	0.9
Cyclotella comta	2	2270	4540	63.0	6.3	1.9
Kephyrion spirale	2	63	126	1.7	6.3	1.9
Rhodomonas minuta	32	20	640	8.9	100.4	29.9
Chromulina sp.	64	20	1280	17.8	200.7	59.8
	103		7205		323.0	

TSI= 18.3

Lake: Merrill
 sample: 09-07QA2
 transect (mm): 7.1
 vol. filtered: (ml) 100

Date: 10/17/93
 width (mm): 0.182

Depth: epi (1m)
 Sta. 2
 area (mm2) 1.3

Species	count	Biovolume	T Biovol	% Biovol	#/ml	percent
Cryptomonas erosa	1	520	520	7.2	3.8	0.9
Kephyrion spirale	1	63	63	0.9	3.8	0.9
Tetraedron minimum	1	180	180	2.5	3.8	0.9
Ankistrodesmus falcatus	2	25	50	0.7	7.6	1.8
Crucigenia quadrata	10	85	850	11.8	38.0	9.1
Rhodomonas minuta	31	20	620	8.6	117.8	28.2
Chromulina sp.	64	20	1280	17.8	243.1	58.2
	110		3563		417.9	

TSI= 13.2

Lake: Meta
 sample: 10-02QA
 transect (mm): 3.2
 vol. filtered: (ml) 50

Date: 6/17/93
 width (mm): 0.182

Depth: meta (4m)
 area (mm2): 0.6

Species	count	Biovolume	T Biovol	% Biovol	#/ml	percent
Cryptomonas erosa	1	520	520	2.7	16.9	0.8
Rhodomonas minuta	3	20	60	0.3	50.6	2.5
Asterionella formosa	41	220	9020	47.5	691.2	34.2
Dinobryon sp.	75	125	9375	49.4	1264.3	62.5
	120		18975		2022.9	
			TSI=	26.0		

Lake: Ryan
 sample: 12-03QA
 transect (mm): 1.8
 vol. filtered: (ml) 50

Date: 6/17/93
 width (mm): 0.182

Depth: hypo (6m)
 area (mm2): 0.3

Species	count	Biovolume	T Biovol	% Biovol	#/ml	percent
Kephyrion sp.	2	63	126	1.8	59.9	1.9
Cryptomonas erosa	9	520	4680	65.2	269.7	8.5
Ankistrodesmus falcatus	95	25	2375	33.1	2847.1	89.6
	106		7181		3176.8	
			TSI=	18.3		

Lake: St. Helens Date: 8/10/93 Depth: epi (1m)
 sample: 14-04QA
 transect (mm): 9.8 width (mm): 0.182 area (mm2): 1.8
 vol. filtered: (ml) 100

Species	count	Biovolume	T Biovol	% Biovol	#/ml	percent
Dinobryon sp.	1	125	125	3.7	2.8	1.0
Crucigenia quadrata	2	85	170	5.0	5.5	2.0
Oocystis lacustris	2	308	616	18.0	5.5	2.0
Rhodomonas minuta	2	20	40	1.2	5.5	2.0
Oocystis pusilla	4	54	216	6.3	11.0	4.0
Ankistrodesmus falcatus	90	25	2250	65.8	247.7	89.1
	101		3417		278.0	
			TSI=	12.9		

Lake: St. Helens Date: 8/10/93 Depth: meta (15m)
 sample: 14-06QA
 transect (mm): 33.1 width (mm): 0.182 area (mm2): 6.0
 vol. filtered: (ml) 100

Species	count	Biovolume	T Biovol	% Biovol	#/ml	percent
Chromulina sp.	1	20	20	0.1	0.8	0.9
Achnanthes minutissima	1	50	50	0.4	0.8	0.9
Gomphonema olivaceum	1	225	225	1.6	0.8	0.9
Crucigenia quadrata	1	85	85	0.6	0.8	0.9
Navicula minima	2	44	88	0.6	1.6	1.8
Crucigenia fenestrata	2	85	170	1.2	1.6	1.8
Synedra ulna	2	1990	3980	29.1	1.6	1.8
Cryptomonas erosa	4	520	2080	15.2	3.3	3.6
Tabellaria flocculosa	7	590	4130	30.2	5.7	6.3
Rhodomonas minuta	15	20	300	2.2	12.2	13.5
Oocystis pusilla	23	54	1242	9.1	18.7	20.7
Ankistrodesmus falcatus	52	25	1300	9.5	42.4	46.8
	111		13670		90.3	
			TSI=	23.3		

Appendix B

Taxonomic List of Phytoplankton for Lakes in the Mt. St. Helens Study Area

Blue Lake

Phylum (division)	Sub-phylum	Order	Family	Genus and species
Chlorophyta	Chlorophyceae	Chlorococcales	Oocystaceae	Quadrigula lacustris
			Scenedesmaceae	Crucigenia quadrata
		Volvocales	Chlamydomonadaceae	Chlamydomonas-like
Chrysophyta	Bacillariophyceae	Centrales	Coscinodiscaceae	Melosira distans
		Pennales	Achnanthaceae	Achnanthes minutissima
			Fragilariaceae	Diatoma sp.
			Naviculaceae	Navicula lanceolata
				Navicula radiosa
			Nitzschiaceae	Nitzschia palea
	Chrysophyceae	Chromulinales	Chrysococcaceae	Kephyrion sp.
				Kephyrion spirale
Cryptophyta			Cryptochrysidaceae	Rhodomonas minuta
			Cryptomonadaceae	Cryptomonas erosa
Cyanophyta		Chroococcales	Chroococcaceae	Chroococcus dispersus
Pyrrhophyta		Dinokontae	Glenodiniaceae	Glenodinium sp.

Boot Lake

Phylum (division)	Sub-phylum	Order	Family	Genus and species
Chlorophyta	Chlorophyceae	Chlorococcales	Chlorococcaceae	Chlorococcum sp.
			Palmellaceae	Sphaerocystis Schroeteri
		Volvocales	Chlamydomonadaceae	Chlamydomonas sp.
Chrysophyta	Bacillariophyceae	Centrales	Coscinodiscaceae	Cyclotella comta
		Pennales	Achnantheaceae	Achnanthes lanceolata
				Achnanthes sp.
			Cymbellaceae	Amphora sp.
				Cymbella minuta
			Eunotiaceae	Eunotia tenella
			Fragilariaceae	Fragilaria crotonensis
				Fragilaria sp.
				Synedra sp.
				Synedra ulna
			Gomphonemaceae	Gomphonema sp.
			Naviculaceae	Navicula minima
				Navicula rhynchocephala
				Navicula radiosa tenella
				Navicula sp.
				Pinnularia sudetica
				Pinnularia sp.
	Chrysophyceae	Chromulinales	Nitzschiaceae	Nitzschia palea
			Chrysococcaceae	Kephyrion sp.
				Kephyrion spirale
Cryptophyta			Ochromonadaceae	Ochromonas sp.
Cyanophyta			Cryptomonadaceae	Cryptomonas erosa
Pyrrophyta		Chroococcales	Chroococcaceae	Chroococcus dispersus
		Dinokontae	Glenodiniaceae	Glenodinium sp.

Coldwater Lake Phylum (division)	Sub-phylum	Order	Family	Genus and species
Chlorophyta	Chlorophyceae	Chlorococcales	Chlorococcaceae	Planktosphaeria gelatinosa
			Oocystaceae	Ankistrodesmus falcatus
				Oocystis sp.
				Quadrigula lacustris
			Scenedesmaceae	Crucigenia quadrata
			Gloecystaceae	Gloecystis sp.
Chrysophyta	Bacillariophyceae	Tetrasporale	Coscinodiscaceae	Cyclotella comta
		Centrales		Cyclotella stelligera
				Achnanthes lanceolata
				Achnanthes minutissima
		Pennales	Achnanthaceae	Cymbella hustedtii
			Cymbellaceae	Cymbella minuta
				Cymbella sinuata
				Diatoma hiemale mesodon
				Fragilaria crotonensis
				Fragilaria sp.
				Synedra sp.
				Synedra ulna
				Tabellaria flocculosa
			Gomphonemaceae	Gomphonema olivaceum
				Gomphonema sp.
			Naviculaceae	Navicula cryptocephala
				Navicula lanceolata
				Navicula minima
				Navicula muralis
				Navicula radiosa
				Navicula rhynchocephala
				Navicula sp.
				Mastogloia smithii
			Nitzschiaceae	Nitzschia palea
				Nitzschia sp.
	Chrysophyceae	Chromulinales	Chrysococcaceae	Kephyrion sp.
				Kephyrion spirale
		Ochromadales	Dinobryaceae	Dinobryon sp.
Cryptophyta			Cryptochrysidaceae	Rhodomonas minuta
			Cryptomonadaceae	Cryptomonas erosa
Cyanophyta		Chroococcales	Chroococcaceae	Chroococcus dispersus
Pyrrhophyta		Dinokontae	Glenodiniaceae	Glenodinium sp.

Phylum (division)	Sub-phylum	Order	Family	Genus and species
Chlorophyta	Chlorophyceae	Chlorococcales	Chlorococcaceae	<i>Planktospaeria gelatinosa</i>
			Oocystaceae	<i>Ankistrodesmus falcatus</i>
				<i>Chlorella</i> sp.
				<i>Quadrigula lacustris</i>
			Palmellaceae	<i>Sphaerocystis schroeteri</i>
			Scenedesmaceae	<i>Crucigenia quadrata</i>
			Chlamydomonadaceae	<i>Chlamydomonas</i> -like
				<i>Cyclotella comta</i>
				<i>Achnanthes minutissima</i>
Chrysophyta	Bacillariophyceae	Volvocales	Coscinodiscaceae	<i>Cocconeis disculus</i>
			Achnanthaceae	<i>Cocconeis pediculus</i>
				<i>Cymbella affinis</i>
				<i>Cymbella minuta</i>
			Eunotiaceae	<i>Eunotia pectinalis minor</i>
			Fragilariaceae	<i>Asterionella formosa</i>
				<i>Fragilaria crotonensis</i>
				<i>Fragilaria</i> sp.
				<i>Synedra ulna</i>
			Gomphonemaceae	<i>Gomphonema olivaceum</i>
				<i>Gomphonema</i> sp.
			Naviculaceae	<i>Navicula bacillum</i>
				<i>Navicula mourei</i>
				<i>Navicula pupula</i>
				<i>Navicula radiosa</i>
				<i>Navicula rhynchocephala</i>
				<i>Navicula radiosa tenella</i>
				<i>Navicula</i> sp.
				<i>Nitzschia palea</i>
			Cryptophyta	
	<i>Kephyrion spirale</i>			
Ochromomadales	<i>Dinobryon</i> sp.			
	<i>Ochromonas</i> sp.			
	Dinobryaceae	<i>Rhodomonas minuta</i>		
	Ochromonadaceae	<i>Cryptomonas erosa</i>		
	Cryptochrysidaceae	<i>Cryptomonas ovata</i>		
	Cryptomonadaceae			

Fawn Lake (cont.)

Phylum (division)	Sub-phylum	Order	Family	Genus and species
Cyanophyta		Chroococcales	Chroococcaceae	Chroococcus minimus Microcystis aeruginosa
Pyrrhophyta		Dinokontae	Glenodiniaceae	Glenodinium sp.

Hanaford Lake				
Phylum (division)	Sub-phylum	Order	Family	Genus and species
Chlorophyta	Chlorophyceae	Chlorococcales	Chlorococcaceae	Planktospaeria gelatinosa
			Oocystaceae	Ankistrodesmus falcatus
				Chlorella-like
				Oocystis lacustris
			Palmellaceae	Sphaerocystis Schroeteri
			Scenedesmaceae	Crucigenia quadrata
				Crucigenia crucifera
		Volvocales	Chlamydomonadaceae	Chlamydomonas sp.
				Chlamydomonas-like
Chrysophyta	Bacillariophyceae	Centrales	Coscinodiscaceae	Cyclotella comta
				Cyclotella glomerata
				Melosira distans
		Pennales	Achnanthaceae	Achnanthes lanceolata
				Achnanthes minutissima
			Cymbellaceae	Cymbella minuta
			Fragilariaceae	Tabellaria flocculosa
			Gomphonemaceae	Gomphonema olivaceum
				Gomphonema sp.
			Naviculaceae	Gyrosigma spencerii
				Navicula cryptocephala
				Navicula minima
				Navicula mournei
				Navicula pupula
				Navicula radiosa
				Navicula rhynchocephala
				Navicula sp.
			Nitzschiaceae	Nitzschia amphibia
				Nitzschia hungarica
				Nitzschia palea
				Nitzschia sp.
	Chrysophyceae	Chromulinales	Chromulinaceae	Chromulina sp.
			Chrysococcaceae	Kephyrion sp.
				Kephyrion spirale
		Ochromonadales	Ochromonadaceae	Ochromonas sp.
Cryptophyta			Cryptochrysidaceae	Rhodomonas minuta
			Cryptomonadaceae	Cryptomonas erosa
Pyrrhophyta				Unident. dinoflagellate
		Dinokontae	Glenodiniaceae	Glenodinium sp.

June Lake

Phylum (division)	Sub-phylum	Order	Family	Genus and species
Chrysophyta	Bacillariophyceae	Pennales	Achnantheaceae	Achnanthes lanceolata Achnanthes minutissima Cocconeis pediculus Rhoicosphenia curvata
			Cymbellaceae	Amphora sp. Cymbella minuta Cymbella mexicana
			Eunotiaceae	Eunotia pectinalis minor Eunotia tenella Eunotia curvata
			Fragilariaceae	Diatoma hiemale mesodon Diatoma vulgare Fragilaria brevistriata Synedra rumpens Synedra ulna Meridion circulare
			Gomphonemaceae	Gomphonema olivaceum Gomphonema sp.
			Naviculaceae	Navicula cincta Navicula lanceolata Navicula minima Navicula pupula Navicula radiosa Navicula rhynchocephala Navicula sp. Stauroneis sp.
			Nitzschiaceae	Nitzschia fonticola Nitzschia hungarica Nitzschia linearis Nitzschia palea Hantzschia amphioxys
				Chroococcus dispersus
Cyanophyta		Chroococcales	Chroococcaceae	

McBride Lake

Phylum (division)	Sub-phylum	Order	Family	Genus and species
Chlorophyta	Chlorophyceae	Chlorococcales	Oocystaceae	Ankistrodesmus falcatus Quadrigula lacustris
			Scenedesmaceae	Crucigenia quadrata Crucigenia tetrapedia
		Ulotrichales	Ulotrichaceae	Ulothrix sp.
		Zygnematales	Zygnemataceae	Spyrogyra sp.
Chrysophyta	Bacillariophyceae	Centrales	Coscinodiscaceae	Melosira distans
		Pennales	Achnanthaceae	Achnanthes lanceolata Achnanthes minutissima
			Cymbellaceae	Cymbella minuta
			Eunotiaceae	Eunotia pectinalis
			Fragilariaceae	Diatoma hiemale mesodon Diatoma tenue Fragillaria crotonensis Fragilaria sp. Synedra sp.
			Gomphonemaceae	Gomphonema olivaceum
			Naviculaceae	Navicula bacillum Navicula cryptocephala Navicula minima Navicula pupula Navicula radiosa Navicula rhynchocephala Navicula sp.
			Nitzschiaceae	Nitzschia palea Nitzschia sp.
	Chrysophyceae	Chromulinales	Chrysococcaceae	Kephyrion sp. Kephyrion spirale
		Ochromomadales	Dinobryaceae	Dinobryon sp.
Cryptophyta			Cryptochrysidaceae	Rhodomonas minuta
			Cryptomonadaceae	Cryptomonas erosa
Cyanophyta		Chroococcales	Chroococcaceae	Microcystis aeruginosa
		Nostocales	Nostocaceae	Anabaena sp.
Pyrrhophyta		Dinokontae	Glenodiniaceae	Glenodinium sp.

Merrill Lake

Phylum (division)	Sub-phylum	Order	Family	Genus and species
Chlorophyta	Chlorophyceae	Chlorococcales	Chlorococcaceae Oocystaceae	Unident. green filament
				Tetraedron minimum
				Ankistrodesmus falcatus
				Chlorella-like
				Chlorella sp.
				Oocystis lacustris
				Oocystis pusilla
				Pediastrum sp.
				Crucigenia fenestrata
				Crucigenia quadrata
Chrysophyta	Bacillariophyceae	Centrales	Coccinodiscaceae	Crucigenia tetrapedia
				Crucigenia rectangularis
				Crucigenia irregularis
				Crucigenia crucifera
				Scenedesmus abundans
		Volvocales	Chlamydomonadaceae	Chlamydomonas sp.
				Chlamydomonas-like
				Cyclotella comta
				Cyclotella glomerata
				Cyclotella stelligera
				Melosira ambigua
				Melosira distans
				Melosira varians
				Achnanthes lanceolata
				Achnanthes minutissima
		Pennales	Achnanthaceae	Achnanthes sp.
				Cocconeis disculus
				Cocconeis pediculus
			Cymbellaceae	Amphora sp.
				Cymbella affinis
				Cymbella hustedtii
				Cymbella minuta
				Cymbella mexicana
				Cymbella sinuata
			Eunotiaceae	Eunotia tenella

Merrill Lake (cont.)

Phylum (division)	Sub-phylum	Order	Family	Genus and species
			Fragilariaceae	Asterionella formosa Synedra rumpens Tabellaria flocculosa Navicula cryptocephala Navicula minima Navicula radiosa
			Nitzschiaceae	Nitzschia amphibia Nitzschia linearis Nitzschia palea Nitzschia sp.
	Chrysophyceae	Chromulinales	Chromulinaceae Chrysococcaceae	Chromulina sp. Kephyrion sp. Kephyrion spirale
		Ochromomadales	Dinobryaceae	Dinobryon sp.
Cryptophyta			Cryptochrysidaceae	Rhodomonas minuta
			Cryptomonadaceae	Cryptomonas erosa
Cyanophyta		Chroococcales	Chroococcaceae	Chroococcus dispersus Chroococcus minimus
		Nostocales	Nostocaceae	Anabaena sp.
Pyrrophyta		Dinokontae	Glenodiniaceae Ceratiaceae	Glenodinium sp. Ceratium hirundinella

Meta Lake

Phylum (division)	Sub-phylum	Order	Family	Genus and species
Chlorophyta	Chlorophyceae	Chlorococcales	Oocystaceae	Ankistrodesmus falcatus Oocystis pusilla
Chrysophyta	Bacillariophyceae	Zygnematales	Desmidiaceae	Desmidium sp.
		Pennales	Fragilariaceae	Asterionella formosa
			Naviculaceae	Synedra rumpens Synedra ulna Navicula cryptocephala Navicula radiosa
		Chromulinales	Chrysococcaceae	Kephyrion sp. Kephyrion spirale
Cryptophyta		Ochromomadales	Dinobryaceae	Dinobryon sp.
			Ochromonadaceae	Ochromonas sp.
			Cryptochrysidaceae	Rhodomonas minuta
			Cryptomonadaceae	Cryptomonas erosa Cryptomonas ovata
Cyanophyta		Nostocales	Nostocaceae	Anabaena sp.

Panhandle Lake

Phylum (division)	Sub-phylum	Order	Family	Genus and species	
Chrysophyta	Bacillariophyceae	Centrales Pennales	Coscinodiscaceae	Cyclotella stelligera	
			Achnanthaceae	Achnanthes minutissima	
			Cymbellaceae	Cymbella minuta	
			Fragilariaceae	Fragilaria crotonensis	
				Synedra rumpens	
				Synedra ulna	
			Gomphonemaceae	Gomphonema olivaceum	
				Naviculaceae	Navicula minima
			Navicula pupula		
			Navicula radiosa		
Nitzschiaceae	Nitzschia amphibia				
	Nitzschia linearis				
Cryptophyta Pyrrhophyta	Chrysophyceae	Chromulinales Ochromomadales	Chrysococcaceae	Kephyrion sp.	
			Dinobryaceae	Dinobryon sp.	
			Cryptomonadaceae	Cryptomonas erosa	
				Unident. dinoflagellate	
			Dinokontae	Glenodiniaceae	Glenodinium sp.

Ryan Lake

Phylum (division)	Sub-phylum	Order	Family	Genus and species
Chlorophyta	Chlorophyceae	Chlorococcales	Oocystaceae	Ankistrodesmus falcatus
			Scenedesmaceae	Crucigenia fenestrata
				Crucigenia quadrata
		Ulotrichales	Ulotrichaceae	Ulothrix sp.
Chrysophyta	Bacillariophyceae	Pennales	Achnanthaceae	Achnanthes minutissima
				Amphora sp.
			Cymbellaceae	Cymbella minuta
			Fragilariaceae	Synedra sp.
				Tabellaria flocculosa
				Gyrosigma spencerii
				Navicula cryptocephala
				Navicula radiosa
				Navicula rhynchocephala
				Nitzschia palea
	Chrysophyceae	Chromulinales	Nitzschiaceae	Chromulina sp.
			Chromulinaceae	Kephyrion sp.
			Chrysococcaceae	Kephyrion spirale
		Ochromomadales	Dinobryaceae	Dinobryon sp.
			Ochromonadaceae	Ochromonas sp.
Cryptophyta			Cryptomonadaceae	Cryptomonas erosa
				Cryptomonas ovata
Pyrrhophyta		Dinokontae	Ceratiaceae	Ceratium hirundinella

Spirit Lake

Phylum (division)	Sub-phylum	Order	Family	Genus and species
Chlorophyta	Chlorophyceae	Chlorococcales	Chlorococcaceae	Tetraedron sp.
			Oocystaceae	Ankistrodesmus falcatus
Chrysophyta	Bacillariophyceae	Centrales	Coscinodiscaceae	Cyclotella comta
		Pennales	Achnanthaceae	Achnanthes minutissima
			Fragilariaceae	Asterionella formosa
				Diatoma sp.
				Fragilaria crotonensis
				Synedra rumpens
			Gomphonemaceae	Gomphonema olivaceum
			Naviculaceae	Navicula minima
				Navicula rhychocephala
			Nitzschiaceae	Nitzschia amphibia
				Nitzschia palea
	Chrysophyceae	Chromulinales	Chrysococcaceae	Kephyrion sp.
				Kephyrion spirale
Cryptophyta			Cryptomonadaceae	Cryptomonas erosa
Pyrrhophyta				Unident. dinoflagellate

St. Helens Lake

Phylum (division)	Sub-phylum	Order	Family	Genus and species
Chlorophyta	Chlorophyceae	Chlorococcales	Oocystaceae	Ankistrodesmus falcatus Oocystis lacustris Oocystis pusilla Quadrigula lacustris
			Scenedesmaceae	Crucigenia fenestrata Crucigenia quadrata
Chrysophyta	Bacillariophyceae	Pennales	Achnanthaceae	Achnanthes minutissima
			Fragilariaceae	Synedra rumpens Synedra sp.
			Naviculaceae	Navicula rhynchocephala
			Nitzschiaceae	Nitzschia amphibia
	Chrysophyceae	Chromulinales	Chrysococcaceae	Kephyrion sp.
Cryptophyta			Cryptochrysidaceae	Rhodomonas minuta
			Cryptomonadaceae	Cryptomonas erosa Cryptomonas ovata

Venus Lake

Phylum (division)	Sub-phylum	Order	Family	Genus and species
Chlorophyta	Chlorophyceae	Chlorococcales	Oocystaceae	Ankistrodesmus falcatus Oocystis pusilla
			Scenedesmaceae	Crucigenia fenestrata Crucigenia quadrata
Chrysophyta	Bacillariophyceae	Centrales Pennales	Coscinodiscaceae Achnantheaceae Fragilariaceae Gomphonemaceae Naviculaceae Nitzschiaceae	Cyclotella stelligera Achnanthes minutissima Fragilaria crotonensis Gomphonema olivaceum Navicula minima Nitzschia palea
	Chrysophyceae	Chromulinales Ochromomadales	Chrysococcaceae Dinobryaceae Cryptomonadaceae	Kephyrion sp. Dinobryon sp. Cryptomonas erosa
Cryptophyta				

Castle Lake

Phylum (division)	Sub-phylum	Order	Family	Genus and species
Chlorophyta	Chlorophyceae	Chlorococcales	Oocystaceae	Quadrigula lacustris
		Volvocales	Chlamydomonadaceae	Chlamydomonas-like
Chrysophyta	Bacillariophyceae	Centrales	Coscinodiscaceae	Melosira distans
		Pennales	Achnanthaceae	Achnanthes minutissima
				Achnanthes sp.
			Eunotiaceae	Eunotia pectinalis minor
			Fragilariaceae	Diatoma tenue
				Fragilaria crotonensis
			Naviculaceae	Navicula minima
				Navicula pupula
				Navicula radiosa
				Navicula rhynchocephala
				Navicula sp.
			Nitzschiaceae	Nitzschia palea
				Nitzschia sp.
	Chrysophyceae	Chromulinales	Chrysococcaceae	Kephyrion sp.
				Kephyrion spirale
		Ochromomadales	Dinobryaceae	Dinobryon sp.
Cryptophyta			Cryptochrysidaceae	Rhodomonas minuta
			Cryptomonadaceae	Cryptomonas erosa
Cyanophyta		Nostocales	Nostocaceae	Anabaena sp.
Pyrrhophyta		Dinokontae	Glenodiniaceae	Glenodinium sp.

Appendix C

Phytoplankton Data Sheets for Quality Assurance from Aquatic Analysts

PHYTOPLANKTON SAMPLE ANALYSIS

SAMPLE: 01-01

SAMPLE DATE:

TOTAL DENSITY (#/ml): 9

TOTAL BIOVOLUME (cu.µM/ml): 2168

TROPIC STATE INDEX: 8.3

DIVERSITY INDEX: 3.41

	SPECIES	DENSITY	PCT	BIOVOL	PCT
--	-----	-----	---	-----	---
1	Kephyrion sp.	1.6	17.2	100	4.6
2	Sphaerocystis schroeteri	1.6	17.2	311	14.4
3	Hemidinium sp.	1.3	13.8	381	17.6
4	Oocystis pusilla	1.0	10.3	171	7.9
5	Dinobryon sertularia	0.6	6.9	495	22.9
6	Achnanthes minutissima	0.6	6.9	32	1.5
7	Eunotia perpusilla	0.6	6.9	191	8.8
8	Synedra rumpens	0.3	3.4	44	2.1
9	Navicula pupula	0.3	3.4	86	4.0
10	Eunotia sp.	0.3	3.4	143	6.6
11	Nitzschia capitellata	0.3	3.4	114	5.3
12	Gomphonema angustatum	0.3	3.4	57	2.6
13	Achnanthes linearis	0.3	3.4	42	1.9

AQUATIC ANALYSTS

ZZ01

PHYTOPLANKTON SAMPLE ANALYSIS

SAMPLE: 02-05

SAMPLE DATE:

TOTAL DENSITY (#/ml): 325

TOTAL BIOVOLUME (cu.µM/ml): 63609

TROPHIC STATE INDEX: 30.1

DIVERSITY INDEX: 1.73

	SPECIES	DENSITY	PCT	BIOVOL	PCT
1	Dinobryon sertularia	226	69.4	39778	62.5
2	Synedra rumpens	45	13.9	7135	11.2
3	Glenodinium sp.	12	3.7	8419	13.2
4	Unidentified flagellate	9	2.8	180	0.3
5	Sphaerocystis Schroeteri	6	1.9	842	1.3
6	Hemidinium sp.	6	1.9	1804	2.8
7	Tetraedron minimum	3	0.9	541	0.9
8	Nitzschia frustulum	3	0.9	361	0.6
9	Cyclotella meneghiniana	3	0.9	1143	1.8
10	Nitzschia paleacea	3	0.9	295	0.5
11	Synedra socia	3	0.9	992	1.6
12	Chlamydomonas sp.	3	0.9	977	1.5
13	Mallomonas sp.	3	0.9	1143	1.8

AQUATIC ANALYSTS

ZZ02

PHYTOPLANKTON SAMPLE ANALYSIS

SAMPLE: 03-15

SAMPLE DATE:

TOTAL DENSITY (#/ml): 78

TOTAL BIOVOLUME (cu.µM/ml): 16478

TROPHIC STATE INDEX: 20.6

DIVERSITY INDEX: 2.38

	SPECIES	DENSITY	PCT	BIOVOL	PCT
--	-----	-----	-----	-----	-----
1	Dinobryon sertularia	28.7	36.9	3817	23.2
2	Rhodomonas minuta	24.9	32.0	498	3.0
3	Cryptomonas erosa	6.8	8.7	3530	21.4
4	Sphaerocystis Schroeteri	6.8	8.7	1689	10.3
5	Ankistrodesmus falcatus	3.0	3.9	226	1.4
6	Kephyrion sp.	3.0	3.9	190	1.2
7	Gymnodinium sp.	2.3	2.9	6109	37.1
8	Achnanthes minutissima	0.8	1.0	38	0.2
9	Pseudopedinella sp.	0.8	1.0	113	0.7
10	Closteriopsis longissima	0.8	1.0	268	1.6

AQUATIC ANALYSTS

ZZ03

PHYTOPLANKTON SAMPLE ANALYSIS

SAMPLE: 04-08

SAMPLE DATE:

TOTAL DENSITY (#/ml): 182

TOTAL BIOVOLUME (cu.µM/ml): 207522

TROPIC STATE INDEX: 38.5

DIVERSITY INDEX: 1.77

	SPECIES	DENSITY	PCT	BIOVOL	PCT
1	Gloeocystis sp.	121	66.7	151536	73.0
2	Cyclotella comta	19	10.5	43313	20.9
3	Kephyrion obliquum	14	7.6	2012	1.0
4	Cryptomonas erosa	12	6.7	6314	3.0
5	Kephyrion sp.	3	1.9	219	0.1
6	Kephyrion sp.	3	1.9	219	0.1
7	Rhodomonas minuta	3	1.9	69	0.0
8	Chroococcus minimus	3	1.9	389	0.2
9	Synedra ulna	2	1.0	3452	1.7

AQUATIC ANALYSTS

ZZ04

PHYTOPLANKTON SAMPLE ANALYSIS

SAMPLE: 05-09

SAMPLE DATE:

TOTAL DENSITY (#/ml): 141

TOTAL BIOVOLUME (cu.um/ml): 24840

TROPHIC STATE INDEX: 23.5

DIVERSITY INDEX: 1.28

	SPECIES	DENSITY	PCT	BIOVOL	PCT
--	-----	-----	-----	-----	-----
1	Rhodomonas minuta	103	73.3	2067	8.3
2	Cryptomonas erosa	22	15.8	11604	46.7
3	Nitzschia acicularis	8	5.8	2302	9.3
4	Cyclotella comta	4	2.5	7998	32.2
5	Sphaerocystis Schroeteri	2	1.7	658	2.6
6	Tetraedron minimum	1	0.8	211	0.9

AQUATIC ANALYSTS

ZZ05

PHYTOPLANKTON SAMPLE ANALYSIS

SAMPLE: 06-12

SAMPLE DATE:

TOTAL DENSITY (#/ml): 441

TOTAL BIOVOLUME (cu.µM/ml): 133819

TROPHIC STATE INDEX: 35.4

DIVERSITY INDEX: 1.06

	SPECIES	DENSITY	PCT	BIOVOL	PCT
--	-----	----	----	-----	----
1	Chlamydomonas-like	353	80.2	114854	85.8
2	Rhodomonas minuta	54	12.2	1077	0.8
3	Ankistrodesmus falcatus	17	3.8	841	0.6
4	Cyclotella comta	7	1.5	15280	11.4
5	Chlamydomonas sp.	3	0.8	1094	0.8
6	Pseudopedinella sp.	3	0.8	505	0.4
7	Achnanthes minutissima	3	0.8	168	0.1

AQUATIC ANALYSTS

ZZ06

PHYTOPLANKTON SAMPLE ANALYSIS

SAMPLE: 07-03

SAMPLE DATE:

TOTAL DENSITY (#/ml): 71

TOTAL BIOVOLUME (cu.µm/ml): 22986

TROPIC STATE INDEX: 22.9

DIVERSITY INDEX: 4.53

	SPECIES	DENSITY	PCT	BIOVOL	PCT
--	-----	----	----	-----	----
1	Fragilaria construens venter	7.6	10.7	487	2.1
2	Diatoma hiemale mesodon	6.8	9.5	6077	26.4
3	Achnanthes lanceolata	5.9	8.3	1068	4.6
4	Chlamydomonas-like	5.1	7.1	1653	7.2
5	Cymbella minuta	5.1	7.1	1882	8.2
6	Fragilaria vaucheria	3.4	4.8	977	4.2
7	Nitzschia paleacea	3.4	4.8	332	1.4
8	Gomphonema angustatum	3.4	4.8	610	2.7
9	Ankistrodesmus falcatus	2.5	3.6	64	0.3
10	Rhodomonas minuta	2.5	3.6	51	0.2
11	Achnanthes linearis	2.5	3.6	336	1.5
12	Achnanthes minutissima	2.5	3.6	127	0.6
13	Glenodinium sp.	1.7	2.4	1187	5.2
14	Navicula minima	1.7	2.4	75	0.3
15	Nitzschia sp.	1.7	2.4	203	0.9
16	Chlamydomonas sp.	1.7	2.4	551	2.4
17	Nitzschia dissipata	1.7	2.4	456	2.0
18	Cocconeis placentula	0.8	1.2	390	1.7
19	Gomphonema sp.	0.8	1.2	170	0.7
20	Nitzschia sp.	0.8	1.2	102	0.4
21	Eunotia pectinalis	0.8	1.2	610	2.7
22	Ochromonas sp.	0.8	1.2	72	0.3
23	Navicula cryptocephala veneta	0.8	1.2	81	0.4
24	Unident. pennate diatom	0.8	1.2	148	0.6
25	Hannaea arcus	0.8	1.2	1484	6.5
26	Nitzschia fonticola	0.8	1.2	36	0.2
27	Eunotia perpusilla	0.8	1.2	254	1.1
28	Diatoma vulgare	0.8	1.2	1662	7.2
29	Gomphonema sp.	0.8	1.2	170	0.7
30	Eunotia sp.	0.8	1.2	381	1.7
31	Nitzschia linearis	0.8	1.2	1292	5.6

AQUATIC ANALYSTS

ZZ07

PHYTOPLANKTON SAMPLE ANALYSIS

266

SAMPLE: 08-03

SAMPLE DATE:

TOTAL DENSITY (#/ml): 188

TOTAL BIOVOLUME (cu.µM/ml): 65411

TROPHIC STATE INDEX: 30.3

DIVERSITY INDEX: 2.63

	SPECIES	DENSITY	PCT	BIOVOL	PCT
1	Synedra radians	102	54.1	36562	55.9
2	Chrysococcus rufescens	24	12.8	2048	3.1
3	Fragilaria crotonensis	9	4.6	18797	28.7
4	Rhodomonas minuta	7	3.7	138	0.2
5	Achnanthes minutissima	7	3.7	344	0.5
6	Achnanthes linearis	7	3.7	909	1.4
7	Synedra rumpens	7	3.7	964	1.5
8	Cymbella minuta	5	2.8	1911	2.9
9	Ankistrodesmus falcatus	3	1.8	86	0.1
10	Synedra famelica	2	0.9	861	1.3
11	Crucigenia tetrapedia	2	0.9	146	0.2
12	Selenastrum minutum	2	0.9	34	0.1
13	Fragilaria vaucheria	2	0.9	496	0.8
14	Achnanthes lanceolata	2	0.9	310	0.5
15	Pediastrum tetras	2	0.9	207	0.3
16	Nitzschia fonticola	2	0.9	72	0.1
17	Navicula sp.	2	0.9	258	0.4
18	Fragilaria construens venter	2	0.9	165	0.3
19	Ulothrix sp.	2	0.9	1102	1.7

AQUATIC ANALYSTS

ZZ08

PHYTOPLANKTON SAMPLE ANALYSIS

SAMPLE: 09-15

SAMPLE DATE:

TOTAL DENSITY (#/ml): 220

TOTAL BIOVOLUME (cu.µM/ml): 66059

TROPIC STATE INDEX: 30.3

DIVERSITY INDEX: 2.37

	SPECIES	DENSITY	PCT	BIOVOL	PCT
1	Rhodomonas minuta	102	46.4	2039	3.1
2	Chromulina sp.	57	25.9	1137	1.7
3	Cyclotella comta	24	10.7	53414	80.9
4	Ankistrodesmus falcatus	8	3.6	196	0.3
5	Sphaerocystis schroeteri	6	2.7	1921	2.9
6	Oocystis pusilla	4	1.8	847	1.3
7	Crucigenia quadrata	4	1.8	333	0.5
8	Botryococcus braunii	2	0.9	4235	6.4
9	Scenedesmus quadricauda	2	0.9	510	0.8
10	Anomoeoneis serians	2	0.9	588	0.9
11	Oocystis parva	2	0.9	78	0.1
12	Fragilaria construens venter	2	0.9	94	0.1
13	Nitzschia dissipata	2	0.9	527	0.8
14	Selenastrum minutum	2	0.9	39	0.1
15	Achnanthes minutissima	2	0.9	98	0.1

AQUATIC ANALYSTS

ZZ09

PHYTOPLANKTON SAMPLE ANALYSIS

SAMPLE: 09-16

SAMPLE DATE:

TOTAL DENSITY (#/ml): 230

TOTAL BIOVOLUME (cu.µM/ml): 76558

TROPIC STATE INDEX: 31.4

DIVERSITY INDEX: 2.21

	SPECIES	DENSITY	PCT	BIOVOL	PCT
1	Rhodomonas minuta	103	45.0	2069	2.7
2	Chromulina sp.	66	28.8	1324	1.7
3	Cyclotella comta	29	12.6	65747	85.9
4	Oocystis pusilla	10	4.5	1564	2.0
5	Asterionella formosa	4	1.8	1821	2.4
6	Crucigenia quadrata	2	0.9	176	0.2
7	Navicula sp.	2	0.9	310	0.4
8	Cryptomonas erosa	2	0.9	1076	1.4
9	Glenodinium sp.	2	0.9	1448	1.9
10	Sphaerocystis schroeteri	2	0.9	290	0.4
11	Dinobryon bavaricum	2	0.9	248	0.3
12	Oocystis parva	2	0.9	83	0.1
13	Cymbella angustata	2	0.9	403	0.5

AQUATIC ANALYSTS

ZZ10

PHYTOPLANKTON SAMPLE ANALYSIS

SAMPLE: 10-10

SAMPLE DATE:

TOTAL DENSITY (#/ml): 677

TOTAL BIOVOLUME (cu.µM/ml): 32545

TROPIC STATE INDEX: 25.3

DIVERSITY INDEX: 0.58

	SPECIES	DENSITY	PCT	BIOVOL	PCT
1	Ochromonas-like	624	92.3	28101	86.3
2	Rhodomonas minuta	24	3.6	486	1.5
3	Sphaerocystis Schroeteri	7	1.0	1336	4.1
4	Achnanthes minutissima	3	0.5	173	0.5
5	Kephyrion sp.	3	0.5	219	0.7
6	Nitzschia acicularis	3	0.5	971	3.0
7	Nitzschia paleacea	3	0.5	340	1.0
8	Ankistrodesmus falcatus	3	0.5	87	0.3
9	Scenedesmus acuminatus	3	0.5	833	2.6

AQUATIC ANALYSTS

ZZ11

PHYTOPLANKTON SAMPLE ANALYSIS

SAMPLE: 11-04

SAMPLE DATE:

TOTAL DENSITY (#/ml): 169

TOTAL BIOVOLUME (cu.µm/ml): 53392

TROPIC STATE INDEX: 28.8

DIVERSITY INDEX: 2.09

	SPECIES	DENSITY	PCT	BIOVOL	PCT
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1	Synedra rumpens	71	41.9	9929	18.6
2	Glenodinium sp.	49	29.0	34371	64.4
3	Dinobryon sertularia	33	19.4	5028	9.4
4	Cymbella minuta	4	2.2	1346	2.5
5	Hemidinium sp.	4	2.2	1091	2.0
6	Unidentified flagellate	2	1.1	36	0.1
7	Cyclotella stelligera	2	1.1	100	0.2
8	Gomphonema sp.	2	1.1	364	0.7
9	Cryptomonas erosa	2	1.1	946	1.8
10	Achnanthes minutissima	2	1.1	182	0.3

AQUATIC ANALYSTS

ZZ12

PHYTOPLANKTON SAMPLE ANALYSIS

SAMPLE: 12-09

SAMPLE DATE:

TOTAL DENSITY (#/ml): 1641

TOTAL BIOVOLUME (cu.uM/ml): 820388

TROPIC STATE INDEX: 48.4

DIVERSITY INDEX: 0.45

	SPECIES	DENSITY	PCT	BIOVOL	PCT
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1	Cryptomonas erosa	1535	93.6	798366	97.3
2	Rhodomonas minuta	58	3.5	1151	0.1
3	Nitzschia sp.	19	1.2	2303	0.3
4	Ankistrodesmus falcatus	19	1.2	480	0.1
5	Trachelomonas volvocina	10	0.6	18088	2.2

AQUATIC ANALYSTS

ZZ13

PHYTOPLANKTON SAMPLE ANALYSIS

SAMPLE: 13-02

SAMPLE DATE:

TOTAL DENSITY (#/ml): 85

TOTAL BIOVOLUME (cu.µM/ml): 71147

TROPIC STATE INDEX: 30.9

DIVERSITY INDEX: 2.04

	SPECIES	DENSITY	PCT	BIOVOL	PCT
1	Ankistrodesmus falcatus	33.4	39.4	1145	1.6
2	Cyclotella comta	24.9	29.4	56484	79.4
3	Asterionella formosa	19.4	22.9	7014	9.9
4	Rhodomonas minuta	1.6	1.8	31	0.0
5	Cryptomonas erosa	1.6	1.8	809	1.1
6	Fragilaria crotonensis	1.6	1.8	5225	7.3
7	Dinobryon sertularia	0.8	0.9	93	0.1
8	Nitzschia frustulum	0.8	0.9	93	0.1
9	Chlamydomonas sp.	0.8	0.9	253	0.4

AQUATIC ANALYSTS

ZZ14

PHYTOPLANKTON SAMPLE ANALYSIS

SAMPLE: 14-04

SAMPLE DATE:

TOTAL DENSITY (#/ml): 157

TOTAL BIOVOLUME (cu.µm/ml): 12441

TROPIC STATE INDEX: 18.7

DIVERSITY INDEX: 1.97

	SPECIES	DENSITY	PCT	BIOVOL	PCT
1	Ankistrodesmus falcatus	106	67.3	3384	27.2
2	Sphaerocystis Schroeteri	11	6.9	2176	17.5
3	Hemidinium sp.	9	5.9	2799	22.5
4	Chromulina sp.	8	5.0	156	1.3
5	Unidentified flagellate	5	3.0	93	0.8
6	Crucigenia quadrata	3	2.0	264	2.1
7	Synedra rumpens	3	2.0	435	3.5
8	Rhodomonas minuta	3	2.0	62	0.5
9	Eunotia incisa	3	2.0	1779	14.3
10	Oocystis pusilla	2	1.0	336	2.7
11	Achnanthes minutissima	2	1.0	78	0.6
12	Cymbella minuta	2	1.0	575	4.6
13	Cymbella angustata	2	1.0	303	2.4

AQUATIC ANALYSTS

ZZ15

PHYTOPLANKTON SAMPLE ANALYSIS

SAMPLE: 15-06

SAMPLE DATE:

TOTAL DENSITY (#/ml): 113

TOTAL BIOVOLUME (cu.µm/ml): 13220

TROPIC STATE INDEX: 19.2

DIVERSITY INDEX: 3.04

	SPECIES	DENSITY	PCT	BIOVOL	PCT
1	Crucigenia sp.	27	23.6	2696	20.4
2	Ankistrodesmus falcatus	19	17.3	691	5.2
3	Crucigenia quadrata	15	13.6	1398	10.6
4	Sphaerocystis Schroeteri	15	13.6	4450	33.7
5	Cyclotella stelligera	11	10.0	620	4.7
6	Chromulina sp.	10	9.1	205	1.6
7	Cryptomonas erosa	4	3.6	2132	16.1
8	Unidentified flagellate	4	3.6	82	0.6
9	Crucigenia crucifera	2	1.8	174	1.3
10	Oocystis pusilla	2	1.8	443	3.3
11	Synedra rumpens	1	0.9	144	1.1
12	Tetraedron minimum	1	0.9	185	1.4

AQUATIC ANALYSTS

ZZ16