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Particulate Matter Dynamics and Phytoplankton Seasonality in a Reservoir Embayment Ecosystem (THES

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Environmental Sciences Division
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PARTICULATE MATTER DYNAMICS AND PHYTOPLANKTON SEASONALITY IN A RESERVOIR EMBAYMENT ECOSYSTEM*

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*Submitted as a thesis by Clell J. Ford to the Graduate Council of the University of Tennessee in partial fulfillment of the requirements for the degree of Master of Science.

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ABSTRACT

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Phytoplankton losses from the water column and the relationships among seasonal change, algal community structure, and the fate of particle-associated materials were investigated in the Walker Branch embayment of Melton Hill Reservoir, Anderson county Tennessee. Sinking and ascent rates of phytoplankton were measured using settling columns, and *in situ* particle removal by sinking was estimated using the naturally-occurring radionuclides Beryllium-7 and Lead-210. Changes in autochthonous phytoplankton assemblage composition, concentration and production reflected the seasonal aspects of suspended particle flux. Beryllium-7 removal rates corresponded with those of the predominant form of particulate matter, and differed greatly from removal rates of Lead-210. The rapid association of particle-reactive materials with the predominant form of particulate matter following input events suggests that the seasonality of particulate matter is a central factor in the sorption, residence time and ultimate fate of particle-associated materials within aquatic ecosystems.

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I. INTRODUCTION

1.1 THE ROLE OF SUSPENDED PARTICULATE MATTER IN AQUATIC ECOSYSTEMS

Suspended particles are essential sources of organic matter and nutrients for filter-feeding planktonic organisms in pelagic food webs (Crumpton and Wetzel, 1982; Hunt, 1983; Cornett and Ophel, 1986; Güde, 1986; Moloney et al., 1986; Santschi et al., 1986; Stewart and Wetzel, 1986). Additionally, sorption interactions between dissolved substances and suspended particles are important pathways for the transport, transformation, and storage of particle-associated materials in freshwater and marine systems (Cushing, 1967a, 1967b; Olsen et al., 1982; Rust, 1982; Pedros-Alio and Brock, 1983; Santschi, 1984; Chesney et al., 1985; Shimp and Pfaender, 1985; Parks et al., 1986). An improved comprehension of the relationships between organic matter and nutrients, sorption interactions, and transport pathways requires an understanding of the composition and dynamics of suspended particulate matter.

Suspended particle dynamics play an important role in ecosystem-level processes in regard to nutrient availability, primary and bacterial productivity, planktonic foodweb transfers, and the fate of particle-reactive materials (e.g., nutrients and hydrophobic contaminants; Sanders, 1967; Absolom et al., 1983; Aardema et al., 1983; Lovell and Konopka, 1985). Factors similarly important to these processes include the vertical location of particles within the water column, and particle metabolism, size, and sorption characteristics (Kefford and Marshall, 1986; Hermansson and Marshall, 1985).

Generally, the sorption capacity (the extent of ionic exchange with the surrounding environment) of suspended particles is directly related to their surface area to volume ratio (SA:V). This relationship is modified by factors such as microbial colonization and particle (i.e., cell) metabolism (Malone 1980; Kimmel, 1983; Reynolds, 1984b). Particle-associated nutrients and organic matter are affected by vertical flux and biotransformation of particles within the mixed layer, processes which also influence the resource limitations of other planktonic organisms (Smayda, 1970; Lastein, 1976; Titman and Kilham, 1976; Paerl, 1977; Bienfang, 1980; Sommer, 1984; Johnson and Smith, 1986).

The temporal and spatial heterogeneity of suspended particle concentration, size composition, and distribution reflects the environmental variability observed in aquatic ecosystems (Cassie, 1959a, 1959b, 1961; George and Heaney, 1978; Adams et al., 1983; Harris et al., 1983; Trimbee and Harris, 1983; McQueen et al., 1986). In systems dominated by autochthonous organic matter, this variability affects the adaptations of plankton, the movement characteristics of the bulk of particulate matter, and foodweb interactions on both temporal and spatial scales (Hutchinson, 1961; Odum, 1969; Tilman et al., 1982; Reynolds et al., 1984). In ecosystems dominated by allochthonous organic matter, such as rivers or intertidal zones, the relatively constant physical dynamics of the environment may be the predominant factor influencing planktonic movement, morphological forms, and foodweb interactions on temporal and spatial scales (Soballe and Bachmann, 1984; Paine and Levin, 1981).

1.2 PHYTOPLANKTON ASSEMBLAGES AND SEASONAL CHANGE

The seasonal dynamics of phytoplankton assemblages have been documented for a variety of aquatic ecosystems (Jassby and Goldman, 1974; Lewis, 1978a, 1978b, 1986; Crumpton and Wetzel, 1982; Chranowski, 1985; Sommer, 1985; Harris and Trimbee, 1986). Phytoplankton seasonality has the largest effect on suspended particle dynamics in systems dominated by autochthonous rather than allochthonous particle production (Adams et al., 1983; Sommer, 1984).

Several studies have examined seasonal changes in phytoplankton species composition relative to particle dynamics (e.g., Reynolds, 1984b), and numerous studies have quantified the relationships between suspended sediments and particle-reactive materials (see review by Olsen et al., 1982). However, the relationships between phytoplankton productivity, autochthonous suspended particle dynamics, and particle-reactive materials are not well documented. In pelagic systems, where phytoplankton photosynthesis is the primary source of suspended particles, the dynamics of phytoplankton production and phytoplankton loss due to sinking should play direct roles in the vertical flux, transport and fate of particle associated-materials (Goldman and Kimmel, 1978; Olsen et al., 1982; Fisher et al., 1987).

1.3 ESTIMATES OF PARTICLE LOSS

Commonly used approaches for estimating rates of particulate matter loss in aquatic systems include sediment cores, sediment traps, settling columns, or combinations of these techniques (Bloesch and Evans, 1982; Hakansson and Jansson, 1983). Sediment core measurements permit estimates of net particulate matter accumulation in bottom sediments over long temporal scales and large spatial scales. Sediment trap measurements estimate total particle flux for intermediate time and distance scales. Settling column measurements provide estimates of seston loss from discrete parcels of water over short time scales, and also allow the measurement of associated variables (e.g., the sinking rates of chlorophyll, phaeopigments, particulate nutrients, and individual phytoplankton groups) simultaneously. All of these techniques are restricted in application to particular temporal and spatial scales, all are sensitive to sediment resuspension problems, and none estimates the dynamics and transport pathways of particle-associated materials from initial sorption onto suspended particles to final removal by sedimentation.

Naturally-occurring, particle-reactive radionuclides, however, provide a means of directly estimating both particle losses and the losses of particle-associated materials from the mixed layer (Bloesch and Evans, 1982; Talbot and Andren, 1984; Olsen et al., 1985; Hawley et al., 1986). Estimates of particle loss determined using naturally-occurring radionuclides are independent of the methods discussed (Bloesch and Evans, 1982; Olsen et al., 1985). However, loss estimates based upon the radionuclide method are limited by their dependence upon the correct sequence of meterological events, and they require expensive, time consuming techniques (Olsen et al., 1985).

In this study, I used both settling column measurements in the laboratory and determination of the loss rates of particle-associated radionuclides in the field to investigate particulate matter dynamics in a reservoir embayment. This pairing combines daily estimates with those of weekly duration, temporal scales at which population- and assemblage-level processes are observed (Harris and Trimbee, 1984; Reynolds et al., 1984; Trimbee and Harris, 1984).

1.4 RESEARCH OBJECTIVES

The objectives of my research were to:

1. Quantify the dynamics of phytoplankton and other particulate matter within the water column during a growing season.
2. Examine the influence of phytoplankton dynamics on the loss of particulate matter and particle-reactive materials within a lake water column.
3. Compare loss rates estimated from laboratory settling column measurements with those derived from *in situ* measurements using naturally-occurring radionuclides.

II. MATERIALS AND METHODS

2.1 STUDY AREA AND SAMPLING STRATEGY

Walker Branch embayment (WBE) was formed in 1963 by the impoundment of the Clinch River to form Melton Hill Reservoir. The movement of particles in WBE are controlled by horizontal and vertical fluxes of water within Melton Hill Reservoir, thermal stratification of the embayment water column, and inflow from the embayment watershed. Two major streams flow into the embayment: Walker Branch, which is intermittent, and an unnamed northeastern tributary, which is perennial (Fig. 1). WBE is physically connected to Melton Hill Reservoir by a 200-m long, 20- to 30-m wide and 8- to 10-m deep channel. During summer stratification, this relative isolation of the embayment from the reservoir allows the WBE water column to develop physical-chemical characteristics distinct from those observed in Melton Hill adjacent to the embayment.

WBE was sampled on 39 dates between April 2 and October 30, 1986 (Appendix A, p. 87). The main sampling station was selected on the basis of available hydrologic and geomorphic information and was located approximately at the center of the embayment (Fig. 1). This site was chosen as the most likely to be representative of the biogeochemical processes affecting suspended particle dynamics within the embayment.

2.2 *IN SITU* MEASUREMENTS

Samples were obtained from the water column by pumping water to fill a 4-L container from each sampling depth. During thermal stratification, samples were taken from three portions of the water column: (1) within the mixed layer (epilimnion) at the algal biomass maximum as determined by *in vivo* fluorescence (IVF), dissolved oxygen peaks and temperature profiles; (2) within the metalimnion at the thermocline, as indicated by decreases in water temperature of greater than one °C per meter depth; and (3) within the hypolimnion at the dissolved oxygen and IVF minima. Determination of sample depth when the water column was not thermally stratified followed the same

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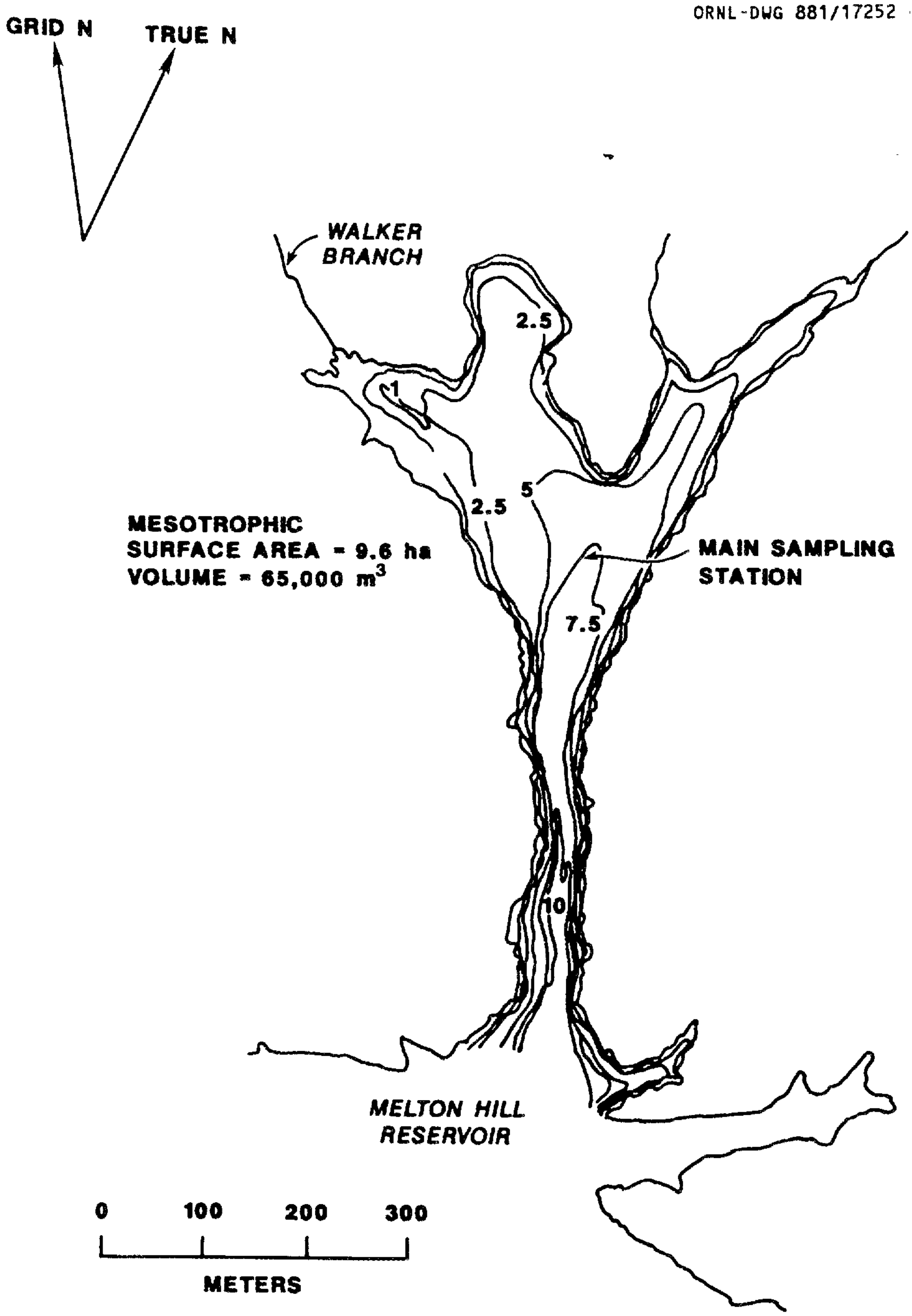

Fig. 1. Map of Walker Branch embayment (after Dahlman et al., 1977). Depth isopleths are in meters.

criteria for dissolved oxygen and relative IVF peaks as above. Samples were stored on board in ice chests and returned to the laboratory within 2 h.

Vertical profiles were determined for (1) IVF using a weighted hose connected to a submersible pump and a Turner Designs fluorometer with flow-through cuvette (Lorenzen 1966); (2) photosynthetically active radiation (PAR, wavelengths 400 to 700 nm in $\mu E \cdot m^{-2} \cdot sec^{-1}$) using a LiCor 4 pi submersible quantum sensor; and (3) water temperature (°C), pH, dissolved oxygen ($mg \cdot L^{-1}$), conductivity ($mmho \cdot cm^{-1}$), and oxidation-reduction potential (ORP, in mV) using a Hydrolab 4020 water quality system. Relative water transparency was determined with a Secchi disc. The square of the Brunt-Väisälä frequency ($N^2 x10^{-4} sec^{-2}$), a measure of water column stability, was calculated for each sample site and date. See Appendix B, page 105 for a list of equations used for all calculations.

2.3 CHLOROPHYLL AND NUTRIENT CONCENTRATIONS

Samples for measurement of chlorophyll concentrations were filtered in duplicate onto Whatman 934-AH glass fiber filters, and the filters were stored frozen until extractions were performed. Duplicate samples were extracted in a 1:1 solution of dimethylsulfoxide (DMSO) and 90% acetone (Shoaf and Lium 1976). Chlorophyll and phaeopigment concentrations were determined fluorometrically for the extracted samples using an Aminco fluorometer with a blue excitation filter (CS5-60), a red emission filter (CS2-64), a red sensitive photomultiplier and a blue excitation lamp (GE F4T5-B, excitation intensity 4 $W \cdot m^{-2}$). Chlorophyll fluorescence was calibrated against chlorophyll absorbance, determined spectrophotometrically, to develop the appropriate equations (Appendix B, p. 105; Strickland and Parsons, 1972; Stainton et al., 1977). Mean and standard error values for all chlorophyll-phaeopigment concentrations (in $\mu g \cdot L^{-1}$) are listed in Appendix C, p. 107.

Particulate nutrients were determined in duplicate, after sample filtration onto precombusted (500 °C) Whatman 934-AH filters. Filters were freeze-dried and stored dessicated until analysis. Analysis for particulate carbon and nitrogen was conducted by combustion gas chromotography (Sharp, 1974) using Perkin-Elmer 240B elemental analyser. Particulate phosphorus samples were ignited in a muffle furnace at 550 °C for 1 h to combust all organic matter. The samples were then heated at 104 °C for 2 h with 1N HCl to extract the phosphorus and convert it to orthophosphate. After cooling, mixed molybdate reagent was added to each sample and orthophosphate was determined by spectrophotometric absorbance at 885 nm (Stainton et al., 1977). Mean concentrations (in $\mu g \cdot L^{-1}$) and standard errors for all particulate nutrients are listed in Appendix C, page 107.

Unfiltered water samples for determination of total nitrogen and total phosphorus concentrations were placed in acid-washed plastic bottles. Total dissolved nutrient samples were filtered through Millipore 0.45-mm pore-size filters and placed in acid-washed plastic bottles. All samples were frozen until analysis. Dissolved nutrient samples were analysed for dissolved organic carbon (DOC), NH_4-N, NO_3 + NO_2-N, soluble reactive phosphorus (SRP), and silicon dioxide (SiO_2). All analyses were conducted by standard spectrophotometric techniques using a Technicon Autoanalyzer (Strickland and Parsons, 1972; Stainton et al., 1977).

2.4 PHYTOPLANKTON ASSEMBLAGE COMPOSITION

The taxonomic composition of the phytoplankton assemblage was determined for each sampling date by microscopic examination of samples. Reference samples were removed directly from sample containers; those from the ascending and descending assemblage studies were removed from combined samples of replicate settling columns. Algal samples were placed in 100-mL screw-cap jars, preserved with 1 to 2 mL of Lugol's solution, and stored in the dark until analysis (Wetzel and Likens, 1979).

Preserved samples were prepared for examination by allowing the cells to settle for at least 6 h in 10-cm settling chambers (Wetzel and Likens, 1979). Identification and enumeration of phytoplankton was performed using a Zeiss inverted microscope at 400X total magnification. Phytoplankton were identified to division and genus whenever possible, using several algal keys (Bourelly, 1968, 1970, 1972; Prescott, 1962, 1978; Smith, 1950). Taxonomic classifications were standardized according to Bourelly (1968, 1970, 1972).

Total numbers of cells•L^{-1} for individual taxonomic groups were obtained by direct cell counts. These totals were standardized relative to algal unit volume, estimated geometrically from ocular micrometer measurements. They are reported as biovolume•L^{-1}, the average volume of an algal group, divided by the biovolume of the smallest group; these values are comparable between all samples for all dates associated with this project, but may or may not be comparable with other reported values. Mean cell size for the total assemblage was estimated by dividing total biovolume values by the total number of cells counted for a particular date.

Phytoplankton assemblage diversity was calculated using the Shannon diversity index (H; Margalef, 1958; Shannon and Weaver 1963; Brower and Zar, 1984; Appendix B, p. 105). The rate of community composition change based on data from samples collected ten or fewer days apart, was calculated using Lewis' Summed Difference (SD) index (Lewis 1978a; Appendix B, p. 105).

2.5 PHYTOPLANKTON PRODUCTIVITY

Phytoplankton productivity was measured using the radiocarbon uptake method (Steeman-Nielson, 1956 as modified by Goldman, 1963; and Vollenweider, 1974). Samples were placed in acid-washed, glass-stoppered, 125-mL Pyrex bottles and inoculated with 0.5 mL of 4 μ Ci•mL^{-1} ^{14}C-labeled sodium bicarbonate (56.5 mCi•mmol specific activity). Samples were suspended at the depth of collection and incubated for approximately 4 h at midday. After the incubation period, samples were removed from the lake and placed immediately in the dark to prevent further photosynthetic carbon fixation.

Samples were transported back to the lab, filtered onto Whatman 934-AH filters, and dessicated. Sample alkalinity was determined by acid (0.01N H_2SO_4) titration. Dissolved inorganic carbon available for photosynthesis was estimated from pH and alkalinity determinations (Saunders et al., 1962). Aquasol scintillation fluor was added to the dessicated samples. ^{14}C activity was determined by liquid scintillation spectrometry, using a Packard Tricarb 4640 liquid scintillation counter. Automatic external standardization, calibrated with quenched standards for NaOH $^{14}CO_3$ was used for quench correction.

2.6 SETTLING COLUMN MEASUREMENTS

Water samples for the settling column measurements of particulate matter dynamics were pumped into 8-L containers from the mixed-layer depth having maximum algal biomass (usually 2 to 3 m deep), as indicated by vertical profiles of IVF, water temperature, dissolved oxygen, and PAR. Particulate matter sinking and ascent rates were determined using eight replicate settling columns, constructed following the design of Bienfang (1981; Fig. 2).

Prior to sample incubation, the settling column water jackets were adjusted to the sample collection temperature. Once the water-jacket temperature reached equilibrium, the sample was thoroughly mixed by inverting it several times, and then poured into the settling columns. Initial reference biomass samples were obtained in duplicate at this time. A separate, unsettled sample of water was maintained as a reference under temperature and light conditions similar to those of the incubation to determine changes in biomass variables not related to sinking during the incubation period. When the incubation was complete (about 1.5h), duplicate final reference samples were collected, the settling columns were drained slowly (less than 50 $mL \cdot min^{-1}$), and water samples were collected from ascending and descending portions of each settling column. Chlorophyll and phaeopigment concentrations were determined in duplicate for each settling column; the standard errors from these determinations are used to indicate the standard error of particular settling columns for particular dates (Appendix C, p. 107).

The settling column method facilitates the determination of sinking and ascent rates (in $m \cdot d^{-1}$, Fig. 2), for several variables at the same time. Additional calculations for removal rate ($mass \cdot d^{-1}$, Appendix B, p. 105) and net particle flux [NPF=log(ascending concentration/descending concentration), Appendix B, p. 105] were

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SPECIFICATIONS:

L_B: 0.112 m.

L_T: 0.365 m.

V_b: 0.220 L.

V_s: 0.085 L.

V_t: 0.850 L.

CALCULATIONS:

$$S.R. = \frac{V_s b_s - V_s db}{V_t db} \times \frac{L_T}{t}$$

$$A.R. = \frac{V_b b_b - (1 - t \bullet SR/L_B) V_b}{V_t db} \times \frac{L_T}{t}$$

$db = (b_o + b_t)/2$

b_s: settled biomass

b_b: ascending biomass

b_o: initial unsettled biomass

b_t: final unsettled biomass

S.R.: sinking rate ($m \bullet d^{-1}$)

A.R.: ascent rate ($m \bullet d^{-1}$)

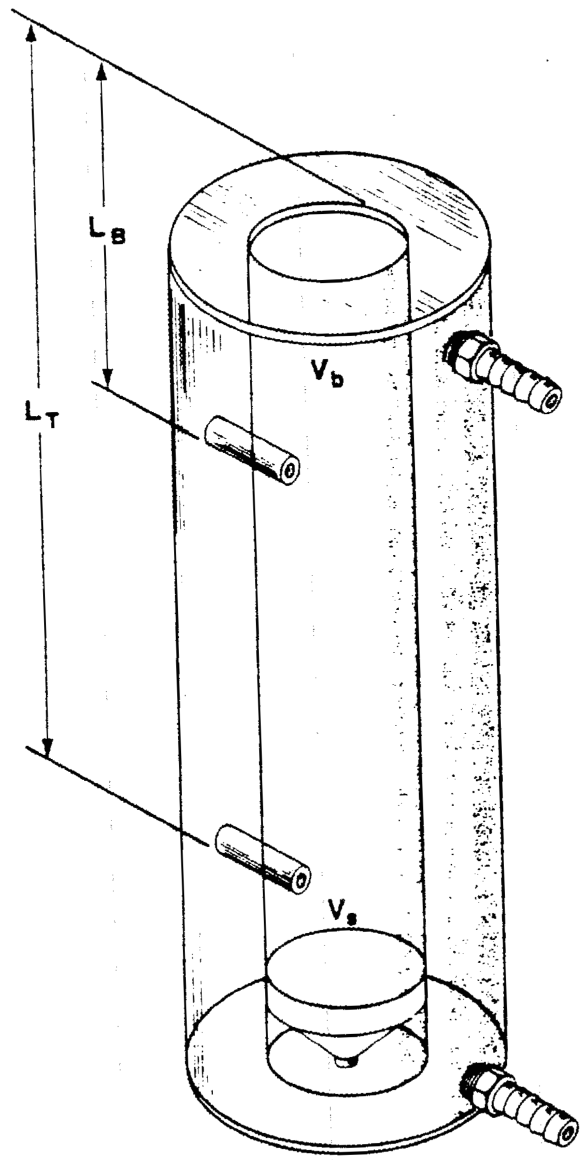

Fig. 2. Laboratory settling column used for seston flux rate measurements. Settling column design and calculations follow those of Bienfang (1981). All biomass variables are corrected for settling column volume.

performed for all particulate matter concentration variables; NPF yields a value between -2 and +2, which reflects the relative magnitude and direction of particle flux within the settling column. Flux indices were estimated each week for chlorophyll, phaeopigment, particulate carbon, particulate nitrogen, and particulate phosphorus. In order to estimate the error due to differences in replicate settling columns, the mean and standard error of chlorophyll and phaeopigment concentrations in replicate settling columns were determined.

Sinking and ascent indices associated with the algal assemblage were also measured using the settling columns. Taxonomic composition, diversity, and rate of change were determined for ascending and descending segments of the assemblage. Estimates of population, division, and assemblage net algal flux within the settling columns [NAF=log(ascending biovolume/descending biovolume), Appendix B, p. 105] were also calculated.

2.7 PARTICLE-ASSOCIATED RADIONUCLIDE DETERMINATIONS

The dynamics of the naturally-occurring, particle-reactive radionuclides, Beryllium-7 and excess Lead-210, were examined using the methods described by Olsen et al. (1985). Both of these radionuclides rapidly associate with atmospheric aerosols and are deposited in a dissolved form during precipitation events. ^{7}Be (53.3-d half-life) is formed continuously by cosmic-ray spallation of oxygen and nitrogen atoms in the trophosphere. ^{7}Be has a high particle-to-water distribution coefficient (K_d=particle-associated ^{7}Be concentration/dissolved ^{7}Be concentration, $K_d = 7 \cdot 10^4$), and once deposited on the water surface, rapidly sorbs to suspended particulate matter.

Lead-210 is one of the long-lived (22.3 year half-life) daughter products of the naturally-occurring ^{238}U-^{226}Ra-^{222}Rn decay series. Though most of this decay sequence occurs below the earth's surface and supports background quantities of ^{210}Pb, ^{222}Rn is an inert gas, and some of it emanates into the atmosphere before its decay to ^{210}Pb. The ^{210}Pb found in the atmosphere is considered to be in excess of the supported quantity; therefore, the removal rates presented here are presumed to be those of excess ^{210}Pb. As with ^{7}Be, ^{210}Pb is primarily removed from the atmosphere by washout, it has a particle-water distribution coefficient similar to that of ^{7}Be, and thus it also sorbs rapidly to suspended particulate matter. Because of the relatively long-lived nature of ^{210}Pb, the small (1.5 $mBq \cdot cm^{-2} \cdot year$, 37 $pCi \cdot L^{-1}$ = 1 $Bq \cdot L^{-1}$) flux of excess ^{210}Pb to the sediments is enough to maintain a sediment inventory of excess ^{210}Pb approximately 400 times that of atmospheric inputs, and thus provide a second source for excess ^{210}Pb in aquatic systems; this sediment storage is estimated to be 555 $Bq \cdot cm^{-2}$ by Olsen et al. (1985).

Particle-associated radionuclide removal rates were determined by measuring the decrease in radionuclide activity in water samples from the mixed layer. Measurements were made over several days following a single, heavy precipitation event. Water samples for particle-associated radionuclide determinations were collected using a high-volume, high-velocity pump. The samples were transported to the laboratory in 250-L plastic drums and pumped into a holding tank. One-liter aliquots were removed prior to pumping for determination of total suspended solids ($mg \cdot L^{-1}$). Total suspended solids samples were filtered onto pre-weighed Whatman 934-AH glass fiber filters, dried for 2 h in a drying oven set at 104 °C, cooled in a dessicator and then reweighed. The rest of the sample was drained into a flow-through centrifuge for removal of particulate matter.

After centrifugation, the collected particulate matter was rinsed with distilled water into acid-washed, plastic containers. Centrifuge effluent containing only dissolved radionuclides, was pumped into another holding tank, and chemically processed to precipitate the dissolved ^{7}Be and excess ^{210}Pb. Centrifuge effluent was first acidified to pH 2 with concentrated HNO_3, and inoculated with 40 mL of 20% $FeCl_3$ and 0.1 g of stable Be (in chloride form). The stable Be serves as a tracer in measuring the relative efficiency of ^{7}Be detection; no tracer was used for excess ^{210}Pb determinations. After a 4 to 8 h equilibration period, NH_4OH was added to increase the pH to approximately 10, and to coprecipitate $Fe(OH)_3$, Be and Pb. The supernatant water was drained off and the precipitated ^{7}Be and excess ^{210}Pb were collected through a drain in the bottom of the holding tank.

The suspended matter and $Fe(OH)_3$ precipitate samples were gamma counted using Lithium-drifted germanium detectors in combination with a computer-based multichannel analyzer system (Nuclear Data Inc., Model 6700). Detector resolution in the ^{7}Be photopeak region (478-keV) is 1.4-keV, adequate for resolving the ^{7}Be photopeak from other photopeaks in the region (Larson and Cutshall, 1981; Olsen et al., 1985). The method for determination of excess ^{210}Pb (46.5-keV photopeak) does not require either chemical separation of ^{210}Pb, or the addition of tracers to determine yield efficiency (Cutshall et al., 1983). Removal rates for particle-associated ^{7}Be, particle-associated excess ^{210}Pb, and total suspended particles were calculated by least-squares regression of natural log-transformed data and are expressed as the percentage of particle-associated radionuclide lost from the mixed layer per day. Water-column residence times (in days) for the radionuclides were calculated from the loss rate data.

2.8 STATISTICAL ANALYSES

T-tests for paired comparisons were performed to compare water column physical-chemical variables between the WBE sampling site and a station in Melton Hill Reservoir (MHR), adjacent to the embayment (Clinch River Mile 33.0, Fig. 1). The mean of sample differences (D) between pairs of physical-chemical variables for the two test sites were compared to a null hypothesis of D=0 (Sokal and Rohlf, 1981). The paired-comparisons test was applied to ascending, descending and reference phytoplankton assemblage variables derived from settling column studies. Significant values of the t statistic were calculated for the mean of sample differences for biovolume, diversity (H) and rate of assemblage change (SD) variables between reference-ascending, reference-descending, and ascending-descending pairings.

Simple statistics (mean and standard error) were calculated from replicate field samples; chlorophyll, phaeopigment and particulate nutrient samples were used to estimate sampling error. Sampling error for an individual settling column was determined from replicate chlorophyll-phaeopigment samples. Flux indices for chlorophyll and phaeopigments were determined using mean values of each settling column sample, and results from replicate settling columns were used to determine means and standard errors for chlorophyll and phaeopigment movement indices. Samples from replicate settling columns were combined and duplicate samples were obtained from this composite for particulate nutrient concentration means from which particulate nutrient flux indices were calculated.

Two-way analysis of variance (ANOVA) was used to determine the significance of change over time and depth for physical-chemical variables, total and dissolved nutrients, and particulate matter concentrations and fluxes, using the methods of Sokal and Rohlf (1981). In addition to these two-way ANOVAs, one-way ANOVAs were performed for variance over time for samples taken from the mixed-layer biomass maximum.

Pearson product-moment correlation coefficients were calculated for pairings of particulate matter variables with depth and with date (PROC CORR, SAS Institute Inc., 1985a). Correlations were calculated for pairings between particular variables and (1) time, (2) depth, and (3) time for samples taken from the mixed-layer biomass maximum. Significant deviation from the null hypothesis (H_o: rho=0) was tested by t-test, not adjusted for number of observations.

Multiple regressions were performed on criterion (dependent) variables, using predictor (independent or regressor) variables. As suggested by Sokal and Rohlf (1981), and using an approach similar to that of Downing et al. (in press), multivariate regressions were performed on several combinations of standard-deviation transformed particulate matter data to determine the contribution of a predictor variable to the coefficient of multiple determination (R^2) for a particular criterion variable. Standardized partial regression coefficients (r^2), partial correlation coefficients were calculated for particulate matter variables using interactive matrix-language procedures (PROC IML, SAS Institute Inc., 1985c; A. R. Johnson, personal communication). Partial r^2 were tested for the significance of their contribution to the regression by an F-test (H_o: rho^2=0).

Predictor variables, ranked according to partial r^2s (from larges to smallest) were included in the stepwise regression analysis only if their partial r^2 ranked within a set number (ten for chlorophyll, phaeopigments and algal indices, twelve for particulate nutrients) of variables contributing to R^2 for a regression equation.

Stepwise procedures were performed to determine the multivariate regression equation which both maximized R^2 and minimized the number of predictor variables contributing significantly to the rate of change of a given criterion variable (maximum R^2 improvement, PROC STEPWISE, SAS Institute Inc., 1985b). Following the methods outlined in Neter and Wasserman (1974), the optimal multivariate regression equation was determined relative to a combination of significant R^2 (Sokal and Rohlf, 1981) and optimal values of Mallows C_p statistic, a measure of the total squared error (Mallows, 1964; Daniel and Woods, 1980). Mallows suggests that when values of C_p approach the number of variables in the equation, the multivariate regression equations contain unbiased partial regression coefficients.

All data processing and statistical analyses were performed using the Statistical Analysis Systems package of computer programs (SAS Institute Inc., 1985a, 1985b, 1985c).

III. RESULTS

3.1 THE WALKER BRANCH EMBAYMENT ENVIRONMENT

3.1.1 Physical Conditions

Vertical profiles for water temperature, pH, dissolved oxygen, ORP and PAR, as well as data for Secchi depths and N^2 (the square of the Brunt-Väisälä frequency) were compared between WBE (main sampling site) and Melton Hill Reservoir (MHR, CRM 33.0). Results of paired comparisons t-tests indicate that physical-conditions in WBE were significantly different from those observed in the adjacent portion of MHR (Table 1). The mean of sample differences for temperature, N^2 and PAR were not significantly different ($P>0.05$) from zero. However, the mean of sample differences for all other physical variables (pH, dissolved oxygen, conductivity, ORP, and Secchi depth) were significantly different ($P<0.05$) from zero.

Complete water column mixing in early spring was replaced by thermal stratification in WBE in late May, as indicated by depth-time profiles of water temperature and dissolved oxygen (Fig. 3, Fig. 4) and by plots of N^2 over time (Fig. 5). Thermal stratification intensified from May through mid July, decreased throughout August, increasing again in September and then declined from late September into October when isothermal conditions were reestablished. Significant changes in these physical-chemical variables over both time and depth (Table 2), as well as associations between these physical-chemical variables and either depth or time (Table 3) were similar to that of other reservoir embayments in the Southeastern U.S. Within the water column mixed layer, several physical-chemical variables changed significantly with time (Table 4, Table 5). Secchi depth transparency increased significantly, though mixed layer PAR and euphotic zone depth ($x = 5.45$ m) did not change appreciably during this study (Table 2, Table 3, Fig. 5).

Table 1. Paired comparisons t-tests of physical-chemical variables between Walker Branch embayment and Melton Hill Reservoir. These are t-tests of whether the means of sample differences are significantly different from the null hypothesis of zero. Data were collected on 6 different dates: June 10, June 26, July 1, July 10, July 30 and September 18, 1986.

Variable[a]	df[b]	t_s	$P > \|t\|$
Temperature (°C)	61	-1.1967	0.2360
pH	52	-5.1395	< 0.0001
Dissolved oxygen ($mg \cdot L^{-1}$)	61	-8.3543	< 0.0001
Conductivity ($mmho \cdot cm^{-1}$)	61	5.3526	< 0.0001
ORP (mV)	61	5.3340	< 0.0001
Secchi depth (m)	5	-3.4865	0.0008
N^2 ($x10^4 sec^2$)	4	0.2774	0.2774
PAR ($\mu E \cdot m^{-2} \cdot sec^{-1}$)	9	-1.624	0.1387

[a]Temperature, pH, dissolved oxygen, conductivity, ORP and PAR data are all derived from depth profiles while Secchi depth and N^2 are relative to the water column.

[b]Degrees of freedom.

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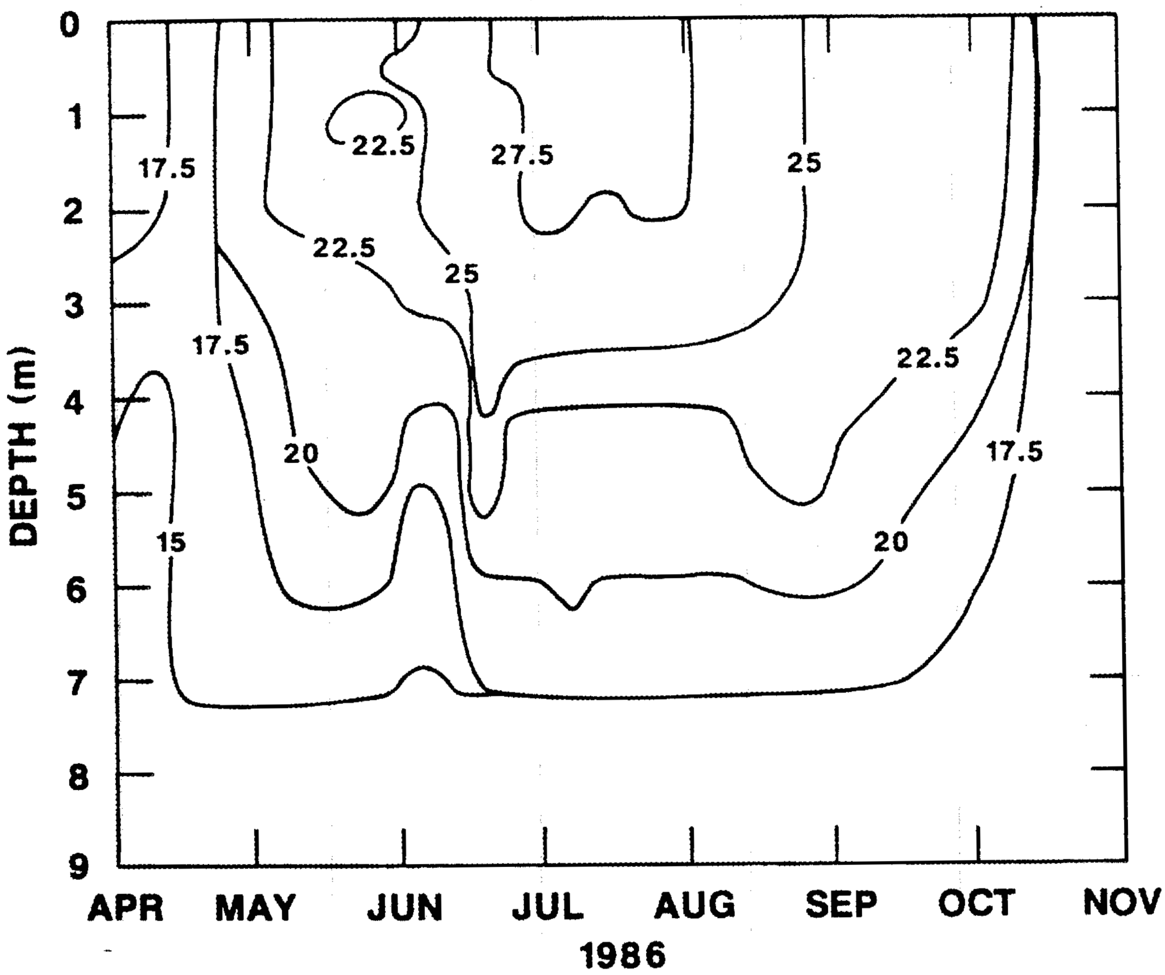

Fig. 3. Depth-Time plot of water temperature (°C), Walker Branch embayment, 1986. Isopleths are to the nearest 2.5 degrees.

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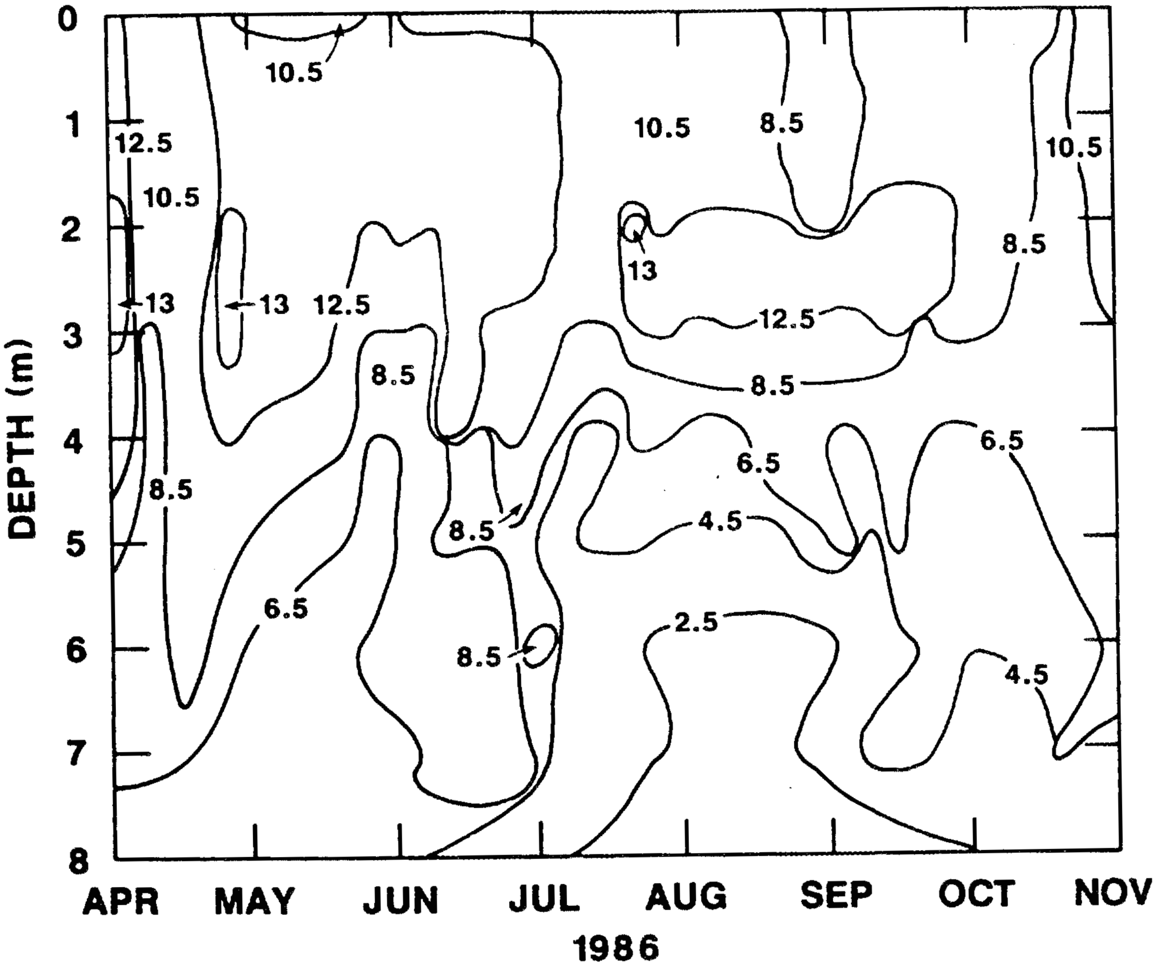

Fig. 4. Depth-Time plot of dissolved oxygen (mg•L^{-1}), Walker Branch embayment, 1986. Isopleths are to the nearest 2.5 units.

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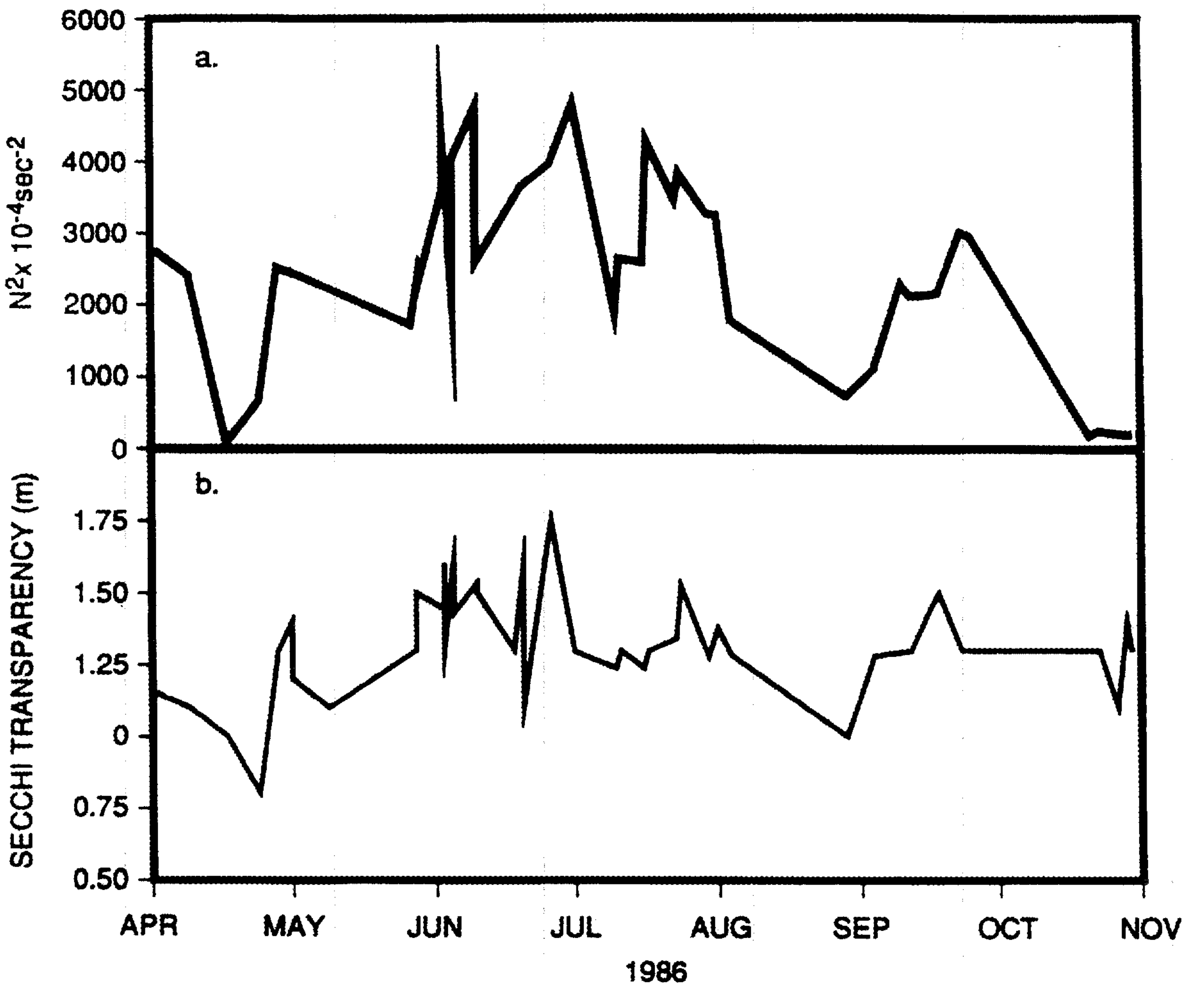

Fig. 5. Water column stability and transparency over time, Walker Branch embayment, 1986. (a) water column stability ($N^2x10^{-4}sec^{-2}$). (b) Secchi transparency (meters).

Table 2. Two-way analyses of variance due to time and depth for unequal sample size physical-chemical, nutrient and particulate matter data. Because there was no more than one observation per cell, no interaction term was calculated. Data were collected from Walker Branch embayment (main sampling site) on 39 dates between April 2 and October 30, 1986.

Variable[a]	d.f.[b] Date	Depth	Error	M.S.[c] Date	Depth	F Date	Depth	P > F Date	Depth
Temperature (°C)	37	12	456	103.51	124.71	37.908	45.6753	< 0.0001	< 0.0001
pH	28	11	319	0.6098	2.4947	9.6167	39.337	< 0.0001	< 0.0001
Dissolved oxygen ($mg \cdot L^{-1}$)	36	12	444	14.710	135.56	31.801	293.07	< 0.0001	< 0.0001
Conductivity ($mmho \cdot cm^{-1}$)	37	12	456	0.0080	0.0015	39.129	7.7826	< 0.0001	< 0.0001
ORP (mV)	12	37	456	0.0990	0.0187	-9482.7	-1794.9	---	---
Secchi depth (m)	36		1332	0.3421		183.78		< 0.0001	
N^2 ($x\ 10^4 \cdot sec^{-2}$)	16		576	$2.1x10^6$		383.07		< 0.0001	
PAR ($\mu E \cdot m^{-2} \cdot sec^{-1}$)	14	30	434	3152.6	2739.9	1.1506	25.457	0.2700	< 0.0001
Dissolved organic carbon ($\mu g \cdot L^{-1}$)	25	13	338	$1.0x10^6$	$4.2x10^5$	15.739	6.1217	< 0.0001	< 0.0001
NH_3-N ($\mu g \cdot L^{-1}$)	38	13	507	4233.0	4977.3	8.9917	10.572	< 0.0001	< 0.0001
NO_3+NO_2-N ($\mu g \cdot L^{-1}$)	38	13	507	54413.	$1.4x10^5$	22.837	58.955	< 0.0001	< 0.0001
Soluble reactive phosphorus ($\mu g \cdot L^{-1}$)	38	13	507	34681.	22274.	2.3818	1.5297	< 0.0001	0.1024
SiO_2 ($\mu g \cdot L^{-1}$)	25	13	338	$2.9x10^6$	$2.6x10^6$	41.268	37.489	< 0.0001	< 0.0001
Total nitrogen ($\mu g \cdot L^{-1}$)	37	12	494	20402.	13504.	51.098	33.820	< 0.0001	< 0.0001
Total phosphorus ($\mu g \cdot L^{-1}$)	37	13	494	1285.3	423.22	10.270	3.38136	< 0.0001	< 0.0001

Table 2 (continued)

Variable[a]	d.f.[b] Date	d.f.[b] Depth	d.f.[b] Error	M.S.[c] Date	M.S.[c] Depth	F Date	F Depth	P > F Date	P > F Depth
DOC:DIN	25	13	338	4613.8	6458.7	26.013	36.415	< 0.0001	< 0.0001
DIN:SRP	24	12	300	4433.9	21466.	50.147	242.79	< 0.0001	< 0.0001
DOC:SRP	24	12	300	$1.8x10^6$	$1.2x10^6$	49.293	32.585	< 0.0001	< 0.0001
TN:TP	37	13	494	27064.	17812.	9.1414	6.0164	< 0.0001	< 0.0001
Chlorophyll ($\mu g \cdot L^{-1}$)	38	13	507	75.024	126.09	31.794	53.438	< 0.0001	< 0.0001
PPR (mg $C \cdot m^{-2} h^{-1}$)	10	6	66	1346.5	6775.8	7.9608	40.059	< 0.0001	< 0.0001
Phaeopigments ($\mu g \cdot L^{-1}$)	38	13	507	2.4484	0.0837	74.588	74.588	< 0.0001	< 0.0001
Particulate carbon ($\mu g \cdot L^{-1}$)	21	8	176	49962.	88954.	17.630	31.390	< 0.0001	< 0.0001
Particulate nitrogen ($\mu g \cdot L^{-1}$)	21	8	176	2221.3	3007.3	31.171	42.201	< 0.0001	< 0.0001
Particulate phosphorus ($\mu g \cdot L^{-1}$)	27	12	336	122.03	174.16	74.588	74.588	< 0.0001	< 0.0001

[a]Values for physical-chemical used were direct results of field measurements, dissolved and total nutrient values used were direct results from sample analysis, and particulate matter concentration values used were means of replicate samples. Dissolved Inorganic Nitrogen (DIN) equals NH_4-N + NO_3 + NO_2-N.

[b]Degrees of freedom.

[c]Mean Square.

Table 3. Product-moment correlations between pairings of time and depth with physical-chemical, nutrient and particulate matter concentration variables, not adjusted for sample size. These correlations quantify the degree, direction and significance of association between paired variables. Data were collected from Walker Branch embayment (main sampling site) on 39 dates between April 2 and October 30, 1986.

Variable[a]	Date r^b	Date $P > \lvert r \rvert$	Date n^c	Depth r	Depth $P > \lvert r \rvert$	Depth n
Temperature (°C)	0.0073	0.8877	376	-0.4623	0.0001	376
pH	0.0987	0.0893	297	-0.6018	0.0001	121
Dissolved oxygen ($mg \cdot L^{-1}$)	-0.2996	0.0001	363	-0.7691	0.0001	212
Conductivity ($mmho \cdot cm^{-1}$)	-0.3515	0.0001	376	0.1361	0.0082	376
ORP (mV)	0.3088	0.0001	376	0.1997	0.0001	376
Secchi depth (m)	-0.1142	0.0102	505			
N^2 ($x\ 10^4 \cdot sec^{-2}$)	-0.3626	0.0001	465			
PAR ($\mu E \cdot m^{-2} \cdot sec^{-1}$)	-0.0559	0.2483	427	-0.524	0.0001	427
Dissolved organic carbon ($\mu g \cdot L^{-1}$)	-0.4398	0.0001	123	-0.2202	-0.0144	123
NH_4-N ($\mu g \cdot L^{-1}$)	-0.3675	0.0001	179	0.2515	0.0007	179
NO_3-N ($\mu g \cdot L^{-1}$)	-0.0588	0.4337	179	0.5270	0.0001	179
Soluble reactive phosphorus ($\mu g \cdot L^{-1}$)	-0.0113	0.8805	179	-0.0074	0.9211	179
SiO_2 ($\mu g \cdot L^{-1}$)	-0.3214	0.0003	179	0.1491	0.0906	123

Table 3 (continued)

Variable[a]	r[b]	P > |r|	n[c]	r	P > |r|	n
Total nitrogen ($\mu g \cdot L^{-1}$)	-0.5937	0.0001	171	-0.0774	0.3140	171
Total phosphorus ($\mu g \cdot L^{-1}$)	0.3138	0.0001	171	-0.1553	0.0425	171
DOC:DIN	-0.3068	0.0006	123	-0.5179	0.0001	123
DIN:SRP	-0.2414	0.0135	104	0.3126	0.0012	104
DOC:SRP	-0.4656	0.0001	104	-0.1704	0.0836	104
TN:TP	-0.1037	0.1769	171	0.1027	0.1811	171
Chlorophyll ($\mu g \cdot L^{-1}$)	-0.3796	0.0001	178	-0.2827	0.0001	178
PPR (mg $C \cdot m^{-3} h^{-1}$)	0.2279	0.0524	73	-0.7651	0.0001	73
Phaeopigments ($\mu g \cdot L^{-1}$)	-0.1432	0.0565	178	0.4786	0.0001	178
Particulate carbon ($\mu g \cdot L^{-1}$)	-0.2650	0.1078	38	0.3640	0.0246	38
Particulate nitrogen ($\mu g \cdot L^{-1}$)	-0.4067	0.0113	38	0.2159	0.1928	38
Particulate phosphorus ($\mu g \cdot L^{-1}$)	-0.2577	0.0086	103	0.3428	0.0004	103

[a]Physical-chemical variables were from field sampling, dissolved and total nutrient values were from nonreplicate samples, particulate matter concentrations were means of replicate samples. Dissolved Inorganic Nitrogen (DIN) equals NH_4-N + NO_3 + NO_2-N.

[b]Correlation coefficient.

[c]Number of observations.

Table 4. One-way analyses of variance with time at the mixed layer biomass maximum, for physical-chemical, nutrient and particulate matter data. These test the significance of variance due to time at the chlorophyll biomass peak depth. Data were collected from Walker Branch embayment (main sampling site) on 39 dates between April 2 and October 30, 1986.

Variable[a]	d.f.[b] Date	Error	M.S.[c]	F	P > F
Temperature (°C)	35	6	19.022	652.75	< 0.0001
pH	26	4	0.2011	1.4×10^{13}	< 0.0001
Dissolved oxygen ($mg \cdot L^{-1}$)	34	5	2.4866	1.2124	0.4591
Conductivity ($mmho \cdot cm^{-1}$)	35	6	0.0013	5.3956	0.0209
ORP (mV)	35	6	0.0045	13.383	0.0018
PAR ($\mu E \cdot m^{-2} \cdot sec^{-1}$)	28	4	420.83	28.161	0.0025
Dissolved organic carbon ($\mu g \cdot L^{-1}$)	25	4	6.2×10^5	1.2371	0.4683
NH_4-N ($\mu g \cdot L^{-1}$)	38	4	1003.4	1.0641	0.5484
NO_3-N ($\mu g \cdot L^{-1}$)	38	4	17647.	1.1343	0.5158
Soluble reactive phosphorus ($\mu g \cdot L^{-1}$)	31	4	664.18	64.798	0.0004
SiO_2 ($\mu g \cdot L^{-1}$)	25	4	8.9×10^5	0.3333	0.9623
Total nitrogen ($\mu g \cdot L^{-1}$)	36	3	6280.2	3.5548	0.1614
Total phosphorus ($\mu g \cdot L^{-1}$)	36	3	613.55	7.0388	0.6592
DOC:DIN	25	4	1976.9	1.4155	0.4049

Table 4 (continued)

Variable[a]	d.f.[b] Date	Error	M.S.[c]	F	P > F
DIN:SRP	22	3	64.79	0.2639	0.9751
DOC:SRP	22	3	1.2×10^{6}	2.9170	0.2053
TN:TP	36	3	14133.	0.2603	0.9825
Chlorophyll ($\mu g \cdot L^{-1}$)	27	7	65.926	0.6442	0.8075
PPR (mg $C \cdot m^{-3} h^{-1}$)	10	62	1346.5	1.6111	0.1244
Phaeopigments ($\mu g \cdot L^{-1}$)	27	7	1.0796	1.3368	0.3657
Particulate carbon ($\mu g \cdot L^{-1}$)	21	6	63158.	1.1159	0.4542
Particulate nitrogen ($\mu g \cdot L^{-1}$)	21	6	2240.6	1.0433	0.5237
Particulate phosphorus ($\mu g \cdot L^{-1}$)	18	5	0	0	> 0.9999
Total biovolume	27	799	1.6×10^{17}	1.2118	0.2117
Mean cell size (μm^3)	27	0	5.9×10^{17}	---	---
H diversity	27	799	9.3705	1.7×10^{15}	< 0.0001
SD change	23	681	0.9763	7.1×10^{16}	< 0.0001
Chlorophyll sinking rate ($m \cdot d^{-1}$)	25	2	0.0424	135.11	0.0073
Phaeopigment sinking rate ($m \cdot d^{-1}$)	25	2	0.1295	1544.7	0.0006
Particulate carbon sinking rate ($m \cdot d^{-1}$)	16	1	0.0913	4.1×10^{14}	< 0.0001

Table 4 (continued)

Variable[a]	d.f.[b] Date	Error	M.S.[c]	F	P > F
Particulate nitrogen sinking rate ($m \cdot d^{-1}$)	16	1	0.0496	8.9×10^{14}	< 0.0001
Particulate phosphorus sinking rate ($m \cdot d^{-1}$)	16	2	0	0	> 0.9999
Chlorophyll ascent rate ($m \cdot d^{-1}$)	25	2	0.0370	259.50	0.0038
Net algal flux	19	552	17.497	7.1×10^{16}	< 0.0001
H descending assemblage	19	552	10.662	1.2×10^{16}	< 0.0001
SD descending assemblage	23	681	0.5180	3.0×10^{16}	< 0.0001

[a]Physical-chemical variables were from field sampling, dissolved and total nutrient values were from nonreplicate samples, particulate matter concentrations were means of replicate samples, and particulate matter flux values are either from mean (chlorophyll and phaeopigments), or from pooled (particulate nutrients) replicate settling columns. Dissolved Inorganic Nitrogen (DIN) equals NH_4-N + NO_3 + NO_2-N.

[b]Degrees of freedom.

[c]Mean square.

Table 5. Product-moment correlation coefficients for pairings of date with physical-chemical, nutrient or particulate matter variables at the mixed layer biomass maximum, not adjusted for sample size. These correlation coefficients establish the magnitude, direction and degree of association between the paired variables. Data were collected from Walker Branch embayment (main sampling site) on 39 dates between April 2 and October 30, 1986.

Variable[a]	r[b]	P > |r|	n[c]
Temperature (°C)	0.0733	0.6443	42
pH	0.1483	0.4258	31
Dissolved oxygen ($mg \cdot L^{-1}$)	-0.3324	0.0361	40
Conductivity ($mmho \mu cm^{-1}$)	-0.4980	0.0008	42
ORP (mV)	0.7983	0.0001	42
PAR ($\mu E \cdot m^{-2} \cdot sec^{-1}$)	-0.0667	0.7121	33
Dissolved organic carbon ($\mu g \cdot L^{-1}$)	-0.4048	0.0265	30
NH_4-N ($\mu g \cdot L^{-1}$)	-0.3876	0.0102	43
NO_3-N ($\mu g \cdot L^{-1}$)	-0.0210	0.8935	43
Soluble reactive phosphorus ($\mu g \cdot L^{-1}$)	0.1067	0.4956	43
SiO_2 ($\mu g \cdot L^{-1}$)	-0.3060	0.1000	30
Total nitrogen ($\mu g \cdot L^{-1}$)	-0.6122	0.0001	40
Total phosphorus ($\mu g \cdot L^{-1}$)	0.4611	0.0027	40

Table 5 (continued)

Variable[a]	r[b]	P > |r|	n[c]
DOC:DIN	-0.3665	0.0463	30
DIN:SRP	-0.4145	0.0352	26
DOC:SRP	-0.5392	0.0045	26
TN:TP	-0.0874	0.5915	40
Chlorophyll ($\mu g \cdot L^{-1}$)	-0.3279	0.0006	39
PPR ($mg \cdot C \cdot M^3 \cdot hr^{-1}$)	0.6541	0.0290	11
Phaeopigments ($\mu g \cdot L^{-1}$)	-0.2533	0.0290	11
Particulate carbon ($\mu g \cdot L^{-1}$)	-0.1420	0.5390	21
Particulate nitrogen ($\mu g \cdot L^{-1}$)	-0.3668	0.1019	21
Particulate phosphorus ($\mu g \cdot L^{-1}$)	-0.5438	0.0676	12
Total biovolume	-0.0895	0.6920	22
Mean cell size	0.0730	0.7466	22
H diversity	0.5045	0.0166	22
SD change	0.2586	0.2859	19
Chlorophyll sinking rate ($m \cdot d^{-1}$)	0.4605	0.0156	27
Phaeopigment sinking rate ($m \cdot d^{-1}$)	0.1060	0.5986	27
Particulate carbon sinking rate ($m \cdot d^{-1}$)	0.4601	0.0625	17

Table 5 (continued)

Variable[a]	r[b]	P > |r|	n[c]
Particulate nitrogen sinking rate ($m \cdot d^{-1}$)	0.5169	0.0336	17
Particulate phosphorus sinking rate ($m \cdot d^{-1}$)	0.4967	0.0360	18
Chlorophyll ascent rate ($m \cdot d^{-1}$)	0.3970	0.0405	37
Net algal flux	0.2860	0.2214	20
H descending assemblage	0.5951	0.0056	20
SD descending assemblage	0.3097	0.1408	24

[a]Values for physical-chemical used were direct results of field measurements, dissolved and total nutrient values used were direct results from sample analysis, particulate matter concentrations are the means of replicate samples, and particulate matter flux results, from settling column studies, either are mean values from replicate settling columns (chlorophyll and phaeopigments), or are from pooled replicate settling columns (particulate nutrients). Dissolved Inorganic Nitrogen (DIN) equals NH_4-N + NO_3 + NO_2-N.

[b]Correlation coefficient.

[c]Number of observations.

3.1.2 Dissolved, Particulate, and Total Nutrients

Dissolved, particulate and total nutrients varied significantly throughout the water column both with time and, except for SRP, depth (Table 2, Appendix A, p. 87, Appendix C, p.107). However, only SRP varied significantly due to time at the mixed layer biomass maximum (Table 4). Mixed layer dissolved inorganic nitrogen (DIN = NH_4N + NO_3 NO_2-N), DOC and total nitrogen concentrations declined while SRP and total phosphorus increased slightly over time, in a manner similar to that observed previously for freshwater ecosystems in the Southeastern U.S. (Table 5, Appendix A, p. 87; Elser, 1983). Since MHR has been characterized as phosphorus limited (Elser and Kimmel, 1985), the apparent increase in available phosphorus may have been strongly influenced by late season concentration increases (Appendix A, p. 87). Particulate nutrient concentrations increased with depth, though dissolved and total nutrient concentrations generally decreased throughout the water column (Table 3). Relative to the mixed-layer biomass maximum, means for particulate nutrient concentrations decreased during the growing season (Fig. 6, Table 3, Table 5, Appendix C, p. 107).

3.1.3 Phytoplankton Biomass and Growth

Chlorophyll concentrations (Fig. 7) declined significantly throughout the water column from April through October (Table 2, p. 22, Table 3, p. 24). Chlorophyll values from the mixed layer declined over time (Fig. 8, Table 4, Table 5, Appendix C, p. 107). Phaeopigment concentrations in the mixed layer (Fig. 8) changed significantly with both time and depth (Table 2, p. 22, Table 3, p. 24, Table 4, Table 5, Appendix C, p. 107). Phytoplankton photosynthesis rates changed with depth and time, though they did not increase significantly within the mixed layer from July through October (Fig. 9, Table 2, p. 22, Table 3, p. 24).

Algal biovolume decreased throughout the growing season (Fig. 10, Appendix D, p. 125) though there were no significant changes with time (Table 4, p. 26, Table 5, p. 29). Though both the mean size of

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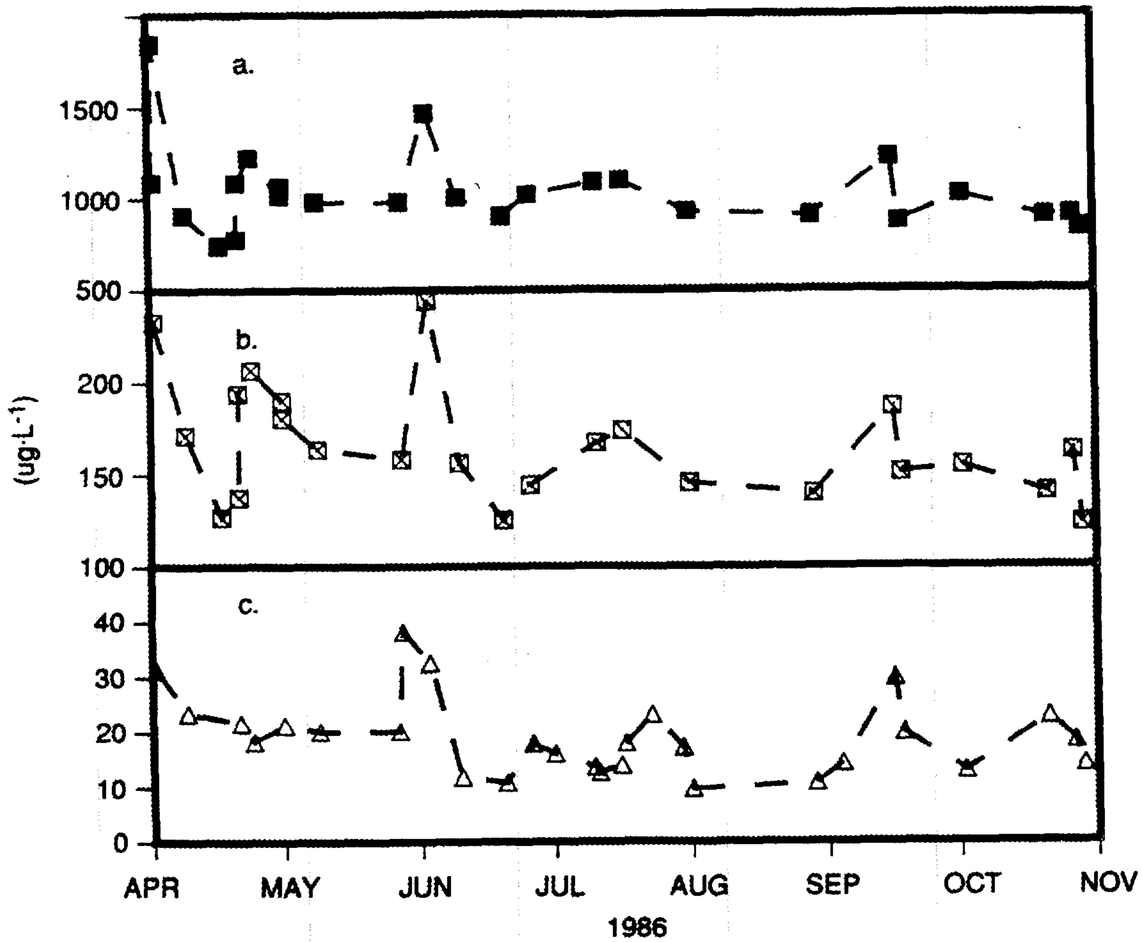

Fig. 6. Mixed layer particulate nutrient concentrations over time within the mixed layer of Walker Branch embayment, 1986.
(a) particulate carbon (range 740 to 1841 $\mu g \cdot L^{-1}$, filled boxes),
(b) particulate nitrogen range 123 to 300 $\mu g \cdot L^{-1}$, open boxes), and
(c) particulate phosphorus (range 9.5 to 43.6 $\mu g \cdot L^{-1}$, open triangles).

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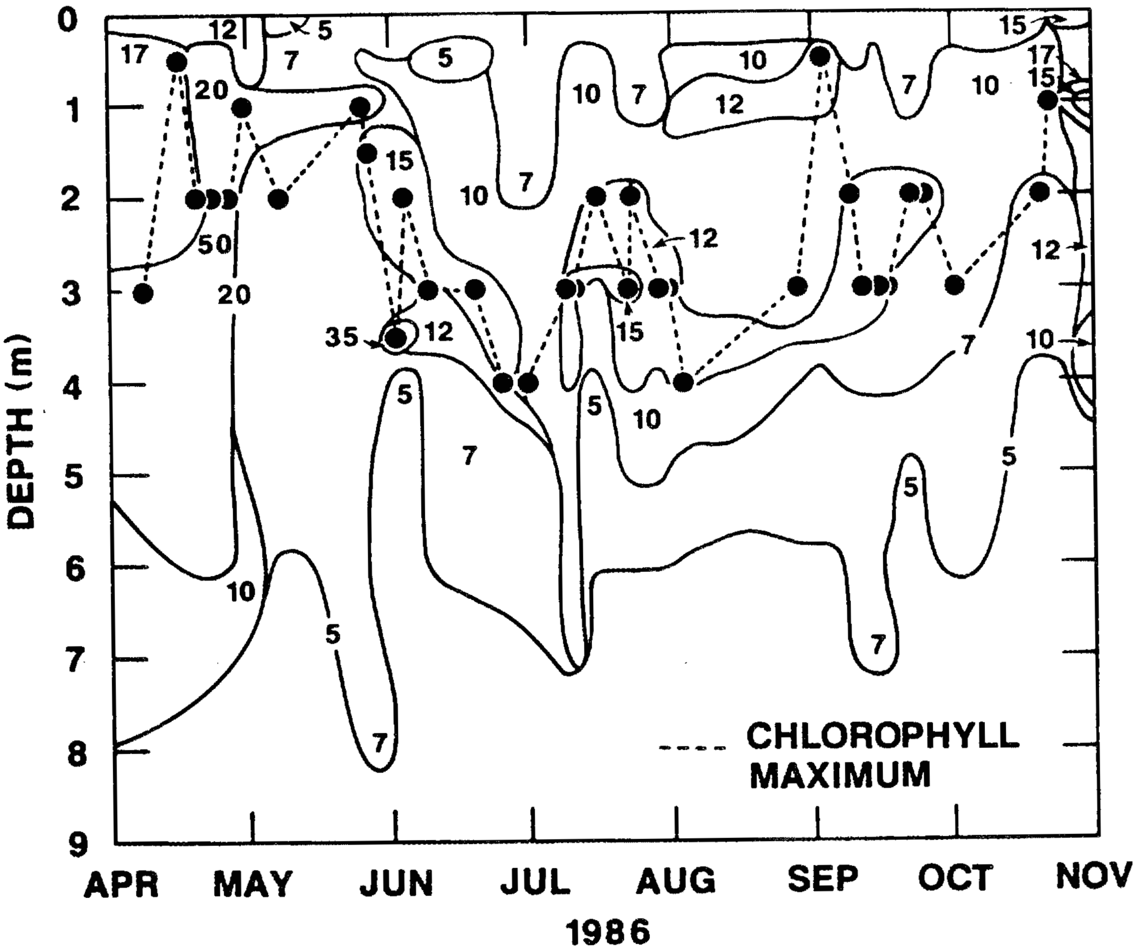

Fig. 7. Depth-Time plot of chlorophyll ($\mu g \cdot L^{-1}$) concentrations within Walker Branch embayment, 1986. Isopleths are in $\mu g \cdot L^{-1}$. Filled circles connected by the dashed line indicate the depth of the mixed layer chlorophyll concentration maximum.

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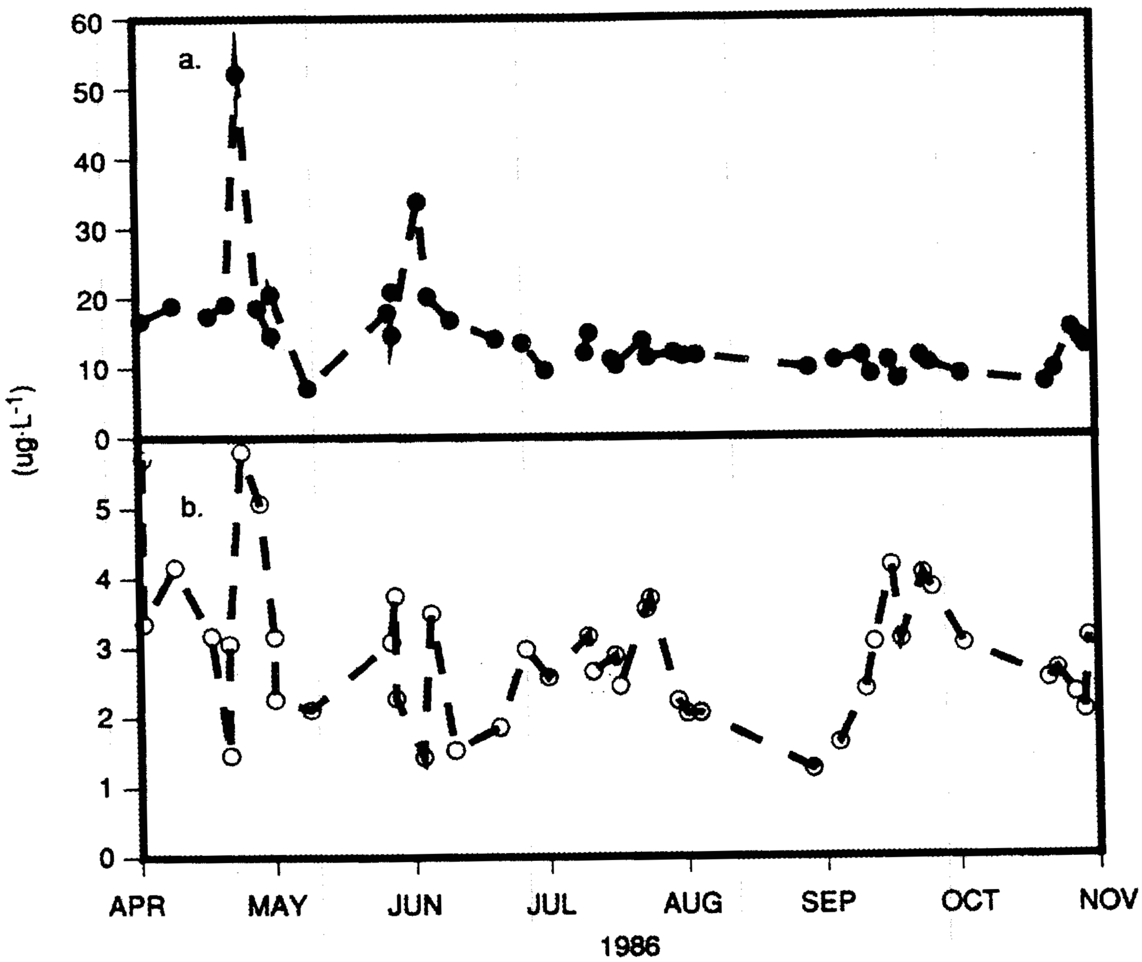

Fig. 8. Mixed layer chlorophyll and phaetophytin concentrations over time within Walker Branch embayment, 1986. (a) chlorophyll (range 7.0 to 52.1 $\mu g \cdot L^{-1}$, filled circles), (b) phaetophytin (range 1.2 to 5.8 $\mu g \cdot L^{-1}$, open circles).

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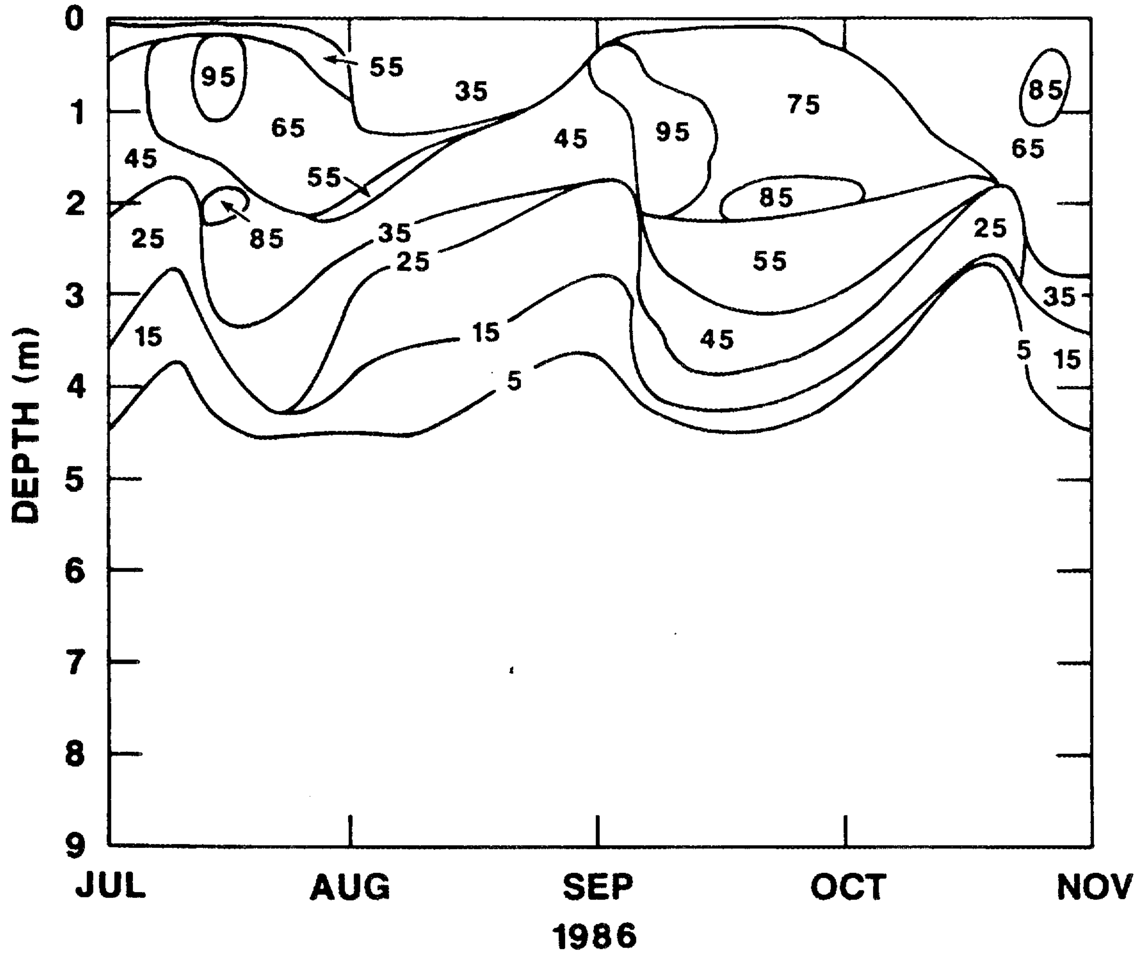

Fig. 9. Depth-Time plot of phytoplankton production ($mgC \cdot M^{-3} \cdot hr^{-1}$) within Walker Branch embayment, 1986. Isopleths are in $mgC \cdot M^{-3} \cdot hr^{-1}$.

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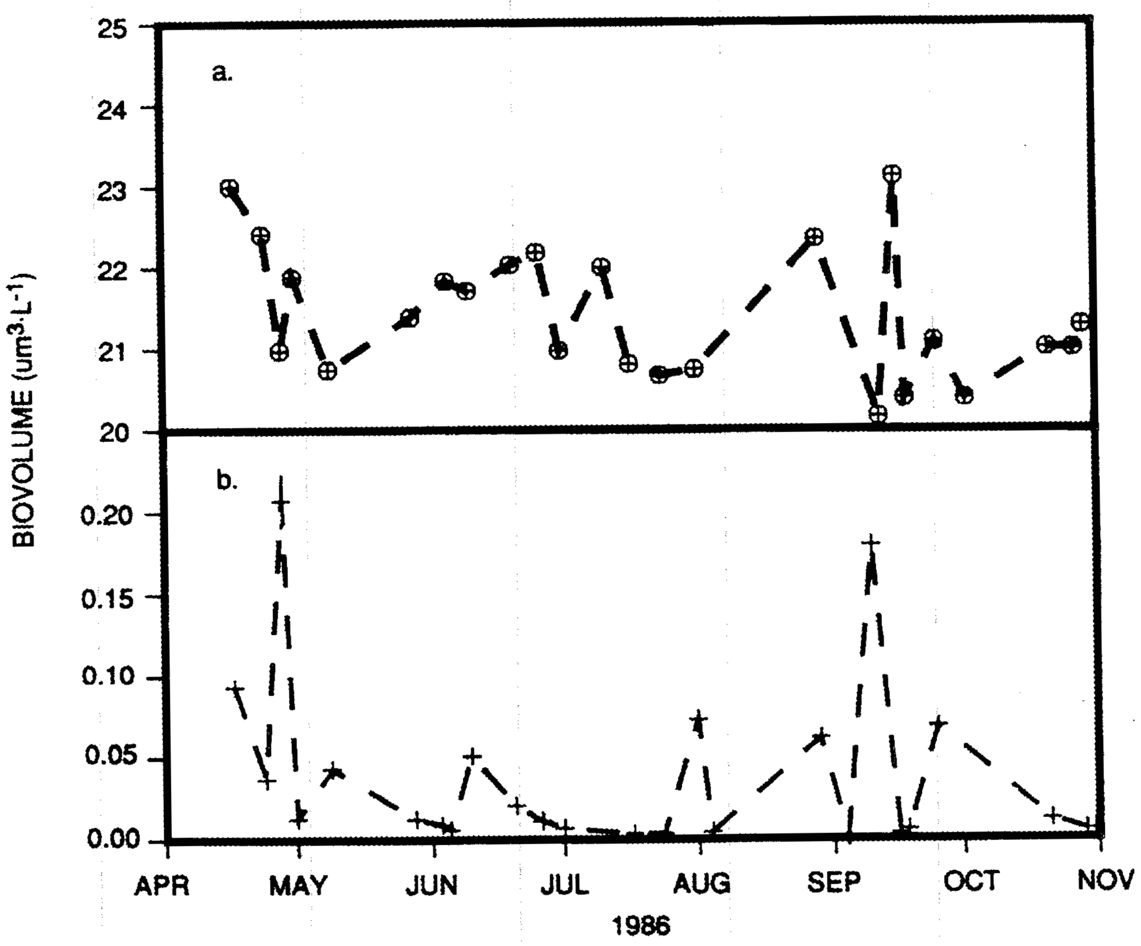

Fig. 10. Phytoplankton indices within the mixed layer of Walker Branch embayment, 1986. (a) phytoplankton total biovolume, (b) mean algal size (1 unit = 0.0037 μm^{-3}).

algal cells (Fig. 10) and the assemblage composition change index (SD_{ref}, Fig. 11) did not appear to change significantly with time, the diversity of the reference assemblage (H_{ref}, Fig. 11) both changed significantly due to and increased significantly with time (Table 4, p. 26, Table 5, p. 29).

Seasonal changes in the taxonomic composition of WBE phytoplankton assemblage (Appendix D, p. 125) followed a pattern similar to that of other freshwater systems (see Reynolds, 1984a). April populations of large, filamentous diatoms (Melosira) and cyanophyta (Anabaena and Oscillatoria) were replaced in May by large flagellates (dinoflagellate, cryptomonad and chlorophyta populations). The Melosira, Anabaena, and Oscillatoria populations were dominant again in June.

During summer stratification, colonial chlorophyta (Gloeocystis and Pandorina) populations were briefly abundant, and were replaced by smaller pennate diatoms and other chlorophyta groups from the Oocystaceae and Scenedesmaceae families. These latter groups persisted until late summer when assemblage composition alternated between (1) small unicellular greens and short cyanophyta filaments (Lyngbya), and (2) dinoflagellates, small greens and pennate diatoms. Cyanophyta filaments and pennate diatoms were dominant once again before fall destratification, although large green flagellates (Chlamydomonas), cryptomonads, euglenoids and dinoflagellates (Ceratium) dominated the autumn phytoplankton assemblage.

3.2 PARTICULATE MATTER DYNAMICS

3.2.1 Particulate Matter Sinking and Ascent Rates

The sinking rate of phytoplankton (as represented by chlorophyll sinking rates) generally decreased from mid spring until early fall, increasing greatly with fall mixing. Despite this decline over time,there was a significant increase in chlorophyll sinking rate for the whole study (Fig. 12, Table 4, p. 26, Table 5, p. 29, Table 6). The sinking rate of particulate algal detritus (as represented by phaeopigment sinking rates) (Fig. 12) changed significantly with time,

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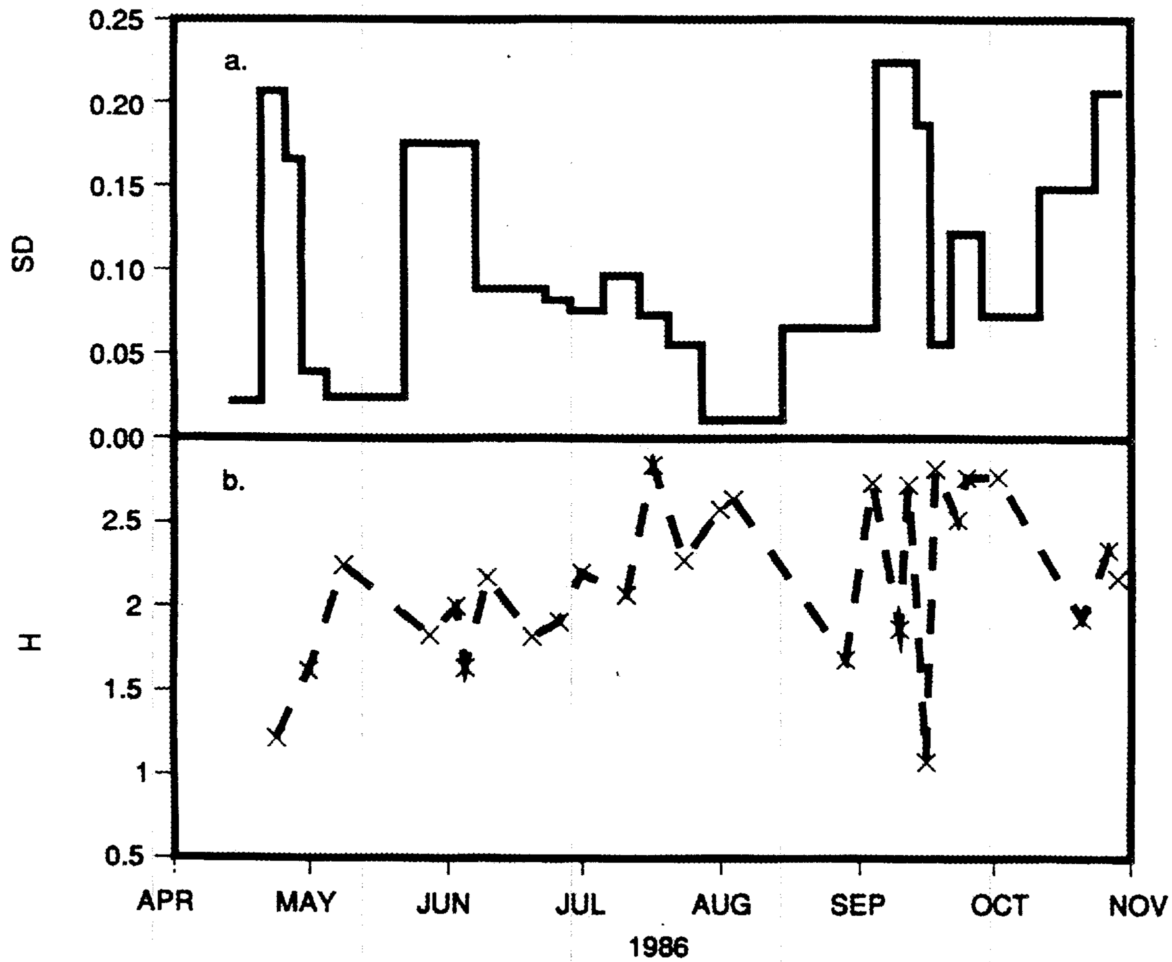

Fig. 11. Assemblage level composition change and diversity over time within the mixed layer of Walker Branch embayment, 1986. (a) rate of assemblage composition change (SD, solid line), (b) Shannon diversity (H, dashed line).

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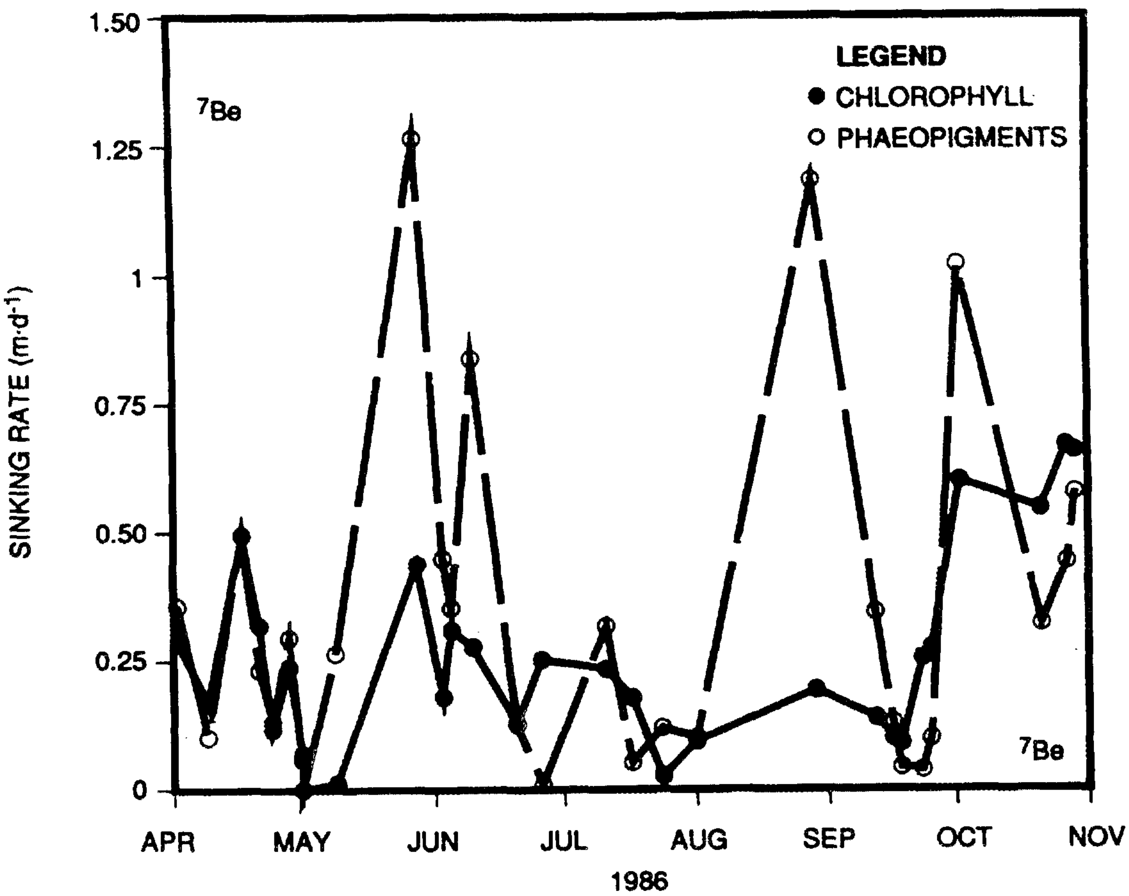

Fig. 12. Chlorophyll and phaeopigment sinking rates over time within the mixed layer of Walker Branch embayment, 1986. Chlorophyll sinking rates are plotted by filled circles, and phaeopigment sinking rates are plotted by open circles with dashed line. Sinking rates estimated using laboratory settling columns. Note: the ^{7}Be symbols refer to ^{7}Be sampling periods in both spring and fall.

Table 6. Chlorophyll flux rates and standard error (S.E.) measurements at the mixed layer biomass maximum. Sinking rates (S.R., in $m \bullet d^{-1}$), ascent rates (A.R., in $m \bullet d^{-1}$) and net particle flux (NPF) were measured using laboratory settling columns. Dates for which there was only one set of observations, and for which standard errors were not calculated, are indicated by ---.

Date	Depth (m)	S.R.	S.E.	A.R.	S.E.	NPF	S.E.
02Apr86	3.0	0.2883	---	0.1619	---	-0.6638	---
09Apr86	3.0	0.1700	---	0.0047	---	-1.4220	---
17Apr86	0.5	0.4936	---	0.4180	---	-0.8313	---
24Apr86	2.0	0.1172	---	<0.0001	---	-0.8637	---
28Apr86	2.0	0.2381	---	0.0893	---	-1.0840	---
01May86	1.0	<0.0001	---	0.1452	---	0.3817	---
09May86	2.0	0.0480	0.0389	0.0579	0.0364	-0.1176	0.1107
28May86	1.5	0.4373	0.0545	0.5503	0.0333	-0.5283	0.0797
03Jun86	3.5	0.1804	---	0.2077	---	-0.3713	---
05Jun86	2.0	0.3094	---	0.0747	---	-1.1180	---
10Jun86	3.0	0.2774	0.0566	0.2287	0.0787	-0.6453	0.1149
20Jun86	3.0	0.1277	0.0271	0.0392	0.0203	-0.3794	0.0553
26Jun86	4.0	0.2523	0.0171	0.2602	0.0392	-0.4510	0.0336
11Jul86	3.0	0.2344	0.0439	0.0388	0.0295	-0.8300	0.1421
17Jul86	2.0	0.1785	0.0258	0.2757	0.0844	-0.2911	0.0615
24Jul86	2.0	0.0264	0.0136	0.0116	0.0116	-0.1765	0.0514
01Aug86	3.0	0.0942	0.0299	0.1196	0.0266	-0.1982	0.0801

Table 6 (continued)

Date	Depth (m)	S.R.	S.E.	A.R.	S.E.	NPF	S.E.
29Aug86	3.0	0.1935	0.0408	0.1531	0.0450	-0.4166	0.0793
12Sep86	3.0	0.1392	---	0.1749	---	-0.2762	---
16Sep86	3.0	0.0999	0.0140	0.1007	0.0342	-0.2578	0.0664
18Sep86	3.0	0.0898	0.0205	0.3262	0.1508	0.0892	0.1352
23Sep86	2.0	0.2556	0.0357	0.0160	0.0098	-0.7103	0.0518
25Sep86	2.0	0.2745	---	0.3884	---	-0.3977	---
02Oct86	3.0	0.6008	0.2159	0.7268	0.3068	-0.7172	0.3239
21Oct86	2.0	0.6377	0.0603	0.5182	0.1266	-0.9286	0.0783
27Oct86	1.0	0.6697	0.0727	0.2592	0.0940	-0.9320	0.0633
29Oct86	1.0	0.6584	0.0531	0.3098	0.0800	-0.5817	0.0351

but was generally more variable than chlorophyll (Table 4, p. 26, Table 7). The sinking rates of both chlorophyll and phaeopigments had similar ranges during periods of mixing (Fig. 12, Table 6, Table 7). Sinking rates of both particulate carbon and particulate nitrogen increased significantly with time (Table 4, p. 26, Table 5, p. 29, Table 8, Fig. 13), although the sinking rate of particulate phosphorus did not change significantly during the study (Table 4, p. 26, Table 5, p. 29, Table 8, Fig. 13). The ascent rate of chlorophyll increased significantly with time (Table 5, p. 29).

Net particle flux indices for chlorophyll and phaeopigments (Fig. 14), as well as for particulate nutrients (Fig. 15) suggest that the bulk of particulate matter flux is negative (downward) throughout the growing season. However, there are seasonal shifts in the composition and concentration of the sinking particles; in spring, chlorophyll and phaeopigments have greater negative particle flux ratios than do particulate nutrients, a condition which reverses during summer stratification.

3.2.2 Phytoplankton Assemblage Dynamics

The mean of sample differences for ascending, descending, and reference algal assemblage indices, were compared using the paired-comparisons t-test (Table 9). None of the means of sample differences between ascending and descending samples was significantly different from zero; however, means of sample differences between H_{ref} and descending assemblage diversity (H_{desc}), as well as SD_{ref} and descending SD (SD_{desc}) indices were significantly different from zero (Table 9). Trends over time for both diversity and rate of change of the descending assemblage were similar to those from reference samples (Table 4, p. 26, Table 5, p. 29). The index of net algal flux (NAF), calculated to provide some index of assemblage flux, changed significantly over time, though there were no simple trends toward increasing or decreasing values during the growing season (Table 4, p. 26, Table 5, p. 29). Despite the significant differences between reference-descending algal assemblage indices, the composition of the

Table 7. Phaeopigment sinking rates and standard error (S.E.) measurements at the mixed layer biomass maximum. Sinking rates (S.R., in $m \cdot d^{-1}$) and net particle flux (NPF) were measured using laboratory settling columns. Dates for which there was only one set of observations, and for which standard errors were not calculated, are indicated by ---.

Date	Depth (m)	S.R.	S.E.	NPF	S.E.
02Apr86	3.0	0.3558	---	-0.6208	---
09Apr86	3.0	0.1022	---	-1.5330	---
17Apr86	0.5	0.4949	---	-1.7190	---
24Apr86	2.0	0.1315	---	-1.4884	---
28Apr86	2.0	0.2940	---	-1.1490	---
01May86	1.0	< 0.0001	---	0.2624	---
09May86	2.0	0.2453	0.1481	-0.5340	0.1330
28May86	1.5	1.2657	0.0799	-2.3680	0.0651
03Jun86	3.5	0.4486	---	-1.1990	---
05Jun86	2.0	0.3529	---	-0.9256	---
10Jun86	3.0	0.8377	0.1993	-0.9256	0.2377
20Jun86	3.0	0.1280	0.0090	-0.3710	0.1882
26Jun86	4.0	0.0091	0.0040	-0.7299	0.1100
11Jul86	3.0	0.3169	0.0750	-0.2580	0.1272
17Jul86	2.0	0.0521	0.0008	-0.3762	0.0787
24Jul86	2.0	0.1199	0.0065	-0.4295	0.0510
01Aug86	3.0	0.1017	0.0394	-0.5016	0.0643

Table 7 (continued)

Date	Depth (m)	S.R.	S.E.	NPF	S.E.
29Aug86	3.0	1.1827	0.2822	-0.9425	0.1587
12Sep86	3.0	0.3442	---	-0.8670	---
16Sep86	3.0	0.1290	0.0333	-0.4469	0.1092
18Sep86	3.0	0.0416	0.0211	0.0317	0.1406
23Sep86	2.0	0.0372	0.0169	-0.4355	0.1216
25Sep86	2.0	0.0991	---	-1.2660	---
02Oct86	3.0	1.0202	0.3682	-0.7103	0.3041
21Oct86	2.0	0.3751	0.1172	-0.6135	0.3407
27Oct86	1.0	0.4417	0.1205	-0.4666	0.1744
29Oct86	1.0	0.5761	0.3422	-0.2091	0.1707

Table 8. Sinking rates of particulate nutrients over time at the mixed layer biomass maximum. Sinking rates (S.R.) were measured using laboratory settling columns and are expressed in $m \cdot d^{-1}$.

Date	Depth (m)	Particulate carbon S.R.	Particulate nitrogen S.R.	Particulate phosphorus S.R.
01May86	3.0	0.1873	0.1785	0.1655
09May86	2.0	0.4656	0.3990	0.3660
28May86	1.5	0.5406	0.4246	0.4121
03Jun86	3.5	0.7178	0.2550	0.2920
10Jun86	3.0	0.5696	0.4097	0.3415
20Jun86	3.0	0.5233	0.4296	0.3712
26Jun86	4.0	0.4505	0.3495	0.4561
11Jul86	3.0	0.4638	0.4008	0.4455
17Jul86	2.0	0.4560	0.3904	0.4927
01Aug86	3.0	0.2964	0.3030	0.3733
29Aug86	3.0	0.9750	0.5358	0.5446
16Sep86	3.0	0.2494	0.1774	0.1091
18Sep86	3.0	0.4104	0.2939	0.3267
02Oct86	3.0	0.5665	0.5119	0.3319
21Oct86	2.0	0.5829	0.4962	0.4833
27Oct86	1.0	0.7924	0.5496	0.7055
29Oct86	1.0	1.4784	1.1749	0.8695

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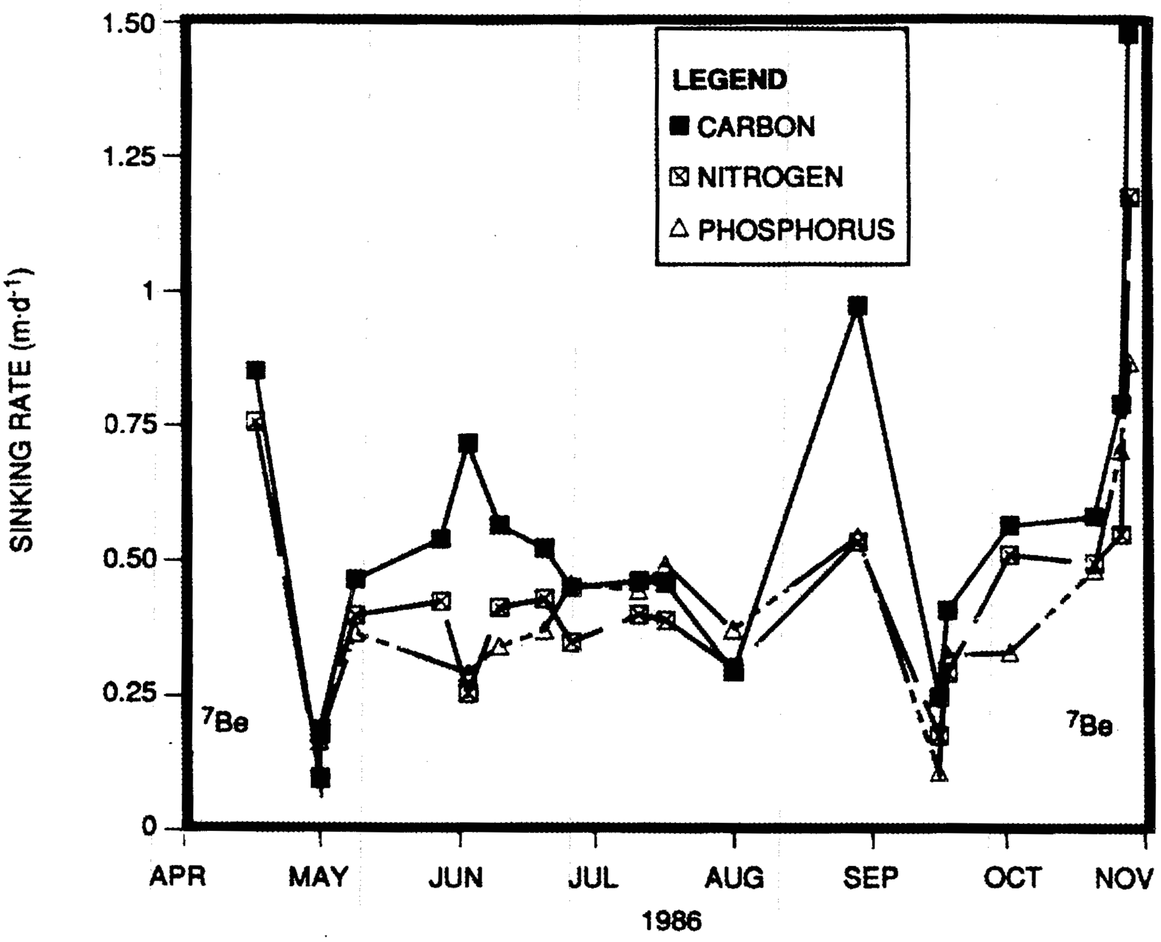

Fig. 13. Particulate nutrient sinking rates over time within the mixed layer of Walker Branch embayment, 1986. Sinking rates estimated using laboratory settling columns. Note: the ^{7}Be symbols refer to ^{7}Be sampling periods in both spring and fall.

ORNL-DWG 881/17265

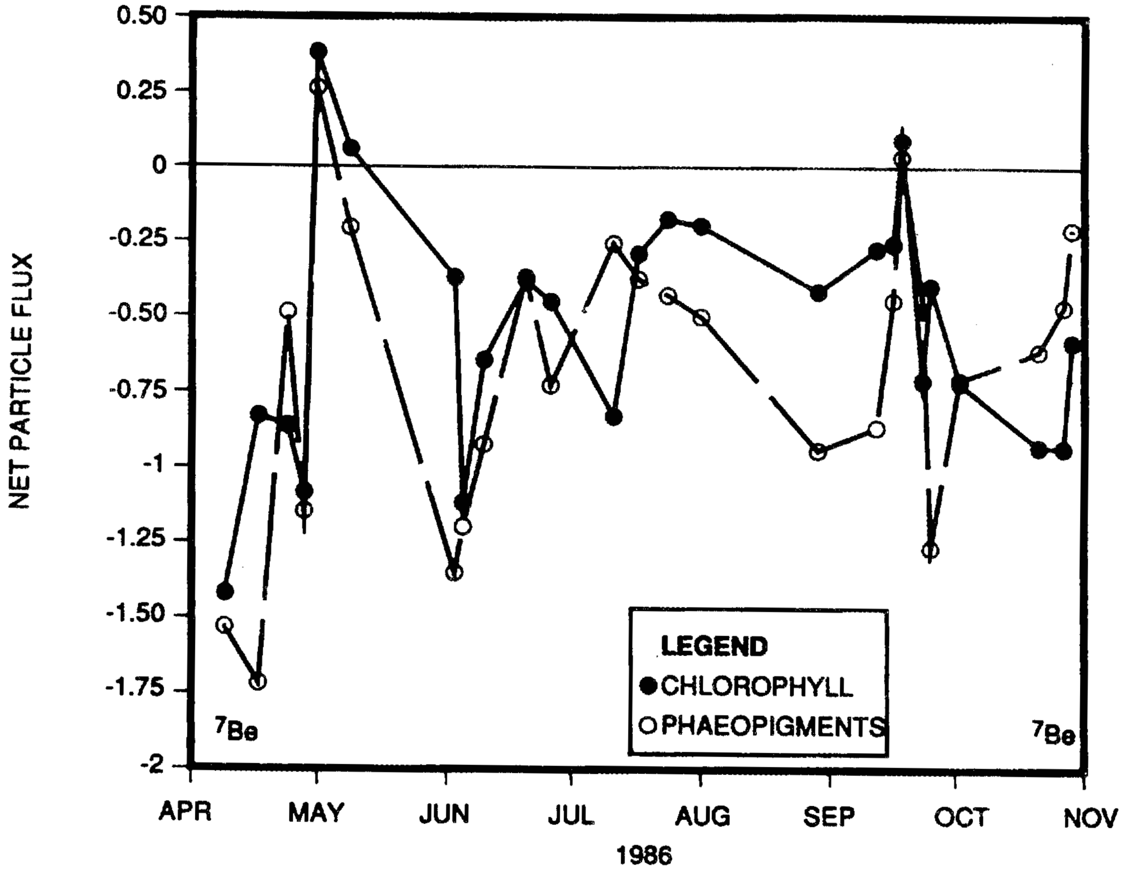

Fig. 14. Net particle flux for chlorophyll and phaeopigments over time within the mixed layer of Walker Branch embayment, 1986. These indices were derived from laboratory settling column measurements and are calculated using rearrangements of the sinking and ascent rate equations. Note: the ^{7}Be symbols refer to ^{7}Be sampling periods in both spring and fall.

ORNL-DWG 881/17266

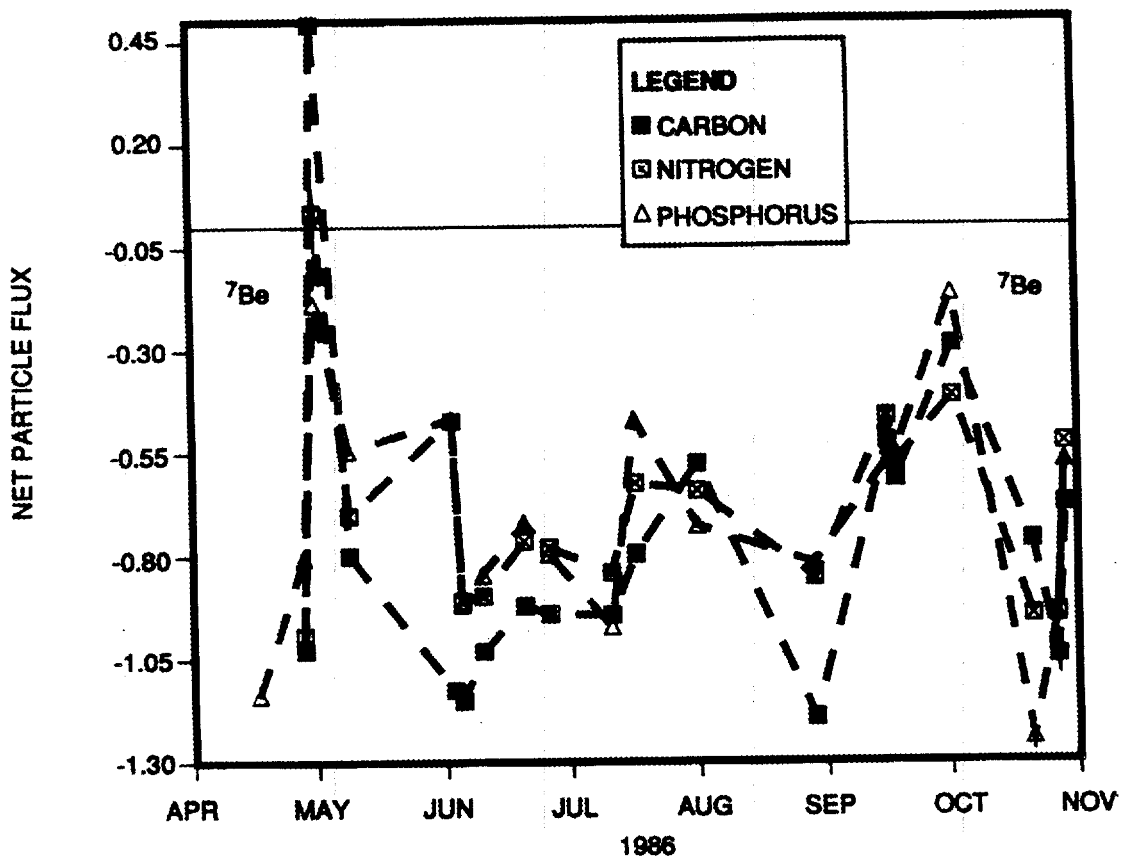

Fig. 15. Net particle flux for particulate nutrients over time within the mixed layer of Walker Branch embayment, 1986. These indices were derived from laboratory settling column measurements and are calculated using rearrangements of the sinking and ascent rate equations. Note: the ^{7}Be symbols refer to ^{7}Be sampling periods in both spring and fall.

Table 9. Paired comparisons tests of algal assemblage variables between ascending-reference, descending-reference and ascending-descending portions of settling columns. These are t-tests of whether the means of sample differences are significantly different from the null hypothesis of zero.

Variable[a]	df[b]	t_s	$P > \|t\|$
Algal biovolume:			
Reference-ascending	21	1.4879	0.1516
Reference-descending	19	0.0595	0.9531
Ascending-descending	19	-0.7089	0.4869
Mean cell size:			
Reference-ascending	19	0.4320	0.6706
Reference-descending	17	1.4074	0.1773
Ascending-descending	17	1.4125	0.1758
Diversity:			
Reference-ascending	21	1.4730	0.1555
Reference-descending	19	3.5037	0.0023
Ascending-descending	17	0.8890	0.3850
Assemblage change rate:			
Reference-ascending	23	1.4308	0.1659
Reference-descending	23	3.0984	0.0050
Ascending-descending	23	1.9552	0.0628

[a]All variables are total algal assemblage level indices, with the variable category listed first, followed by which segments of the assemblage are being paired for that particular variable.

[b]Degrees of freedom.

algal assemblage in settling column samples was similar to that from reference samples (Appendix D, p. 125).

3.2.3 Flux of Particle-Associated Radionuclides in the Mixed Layer

Two determinations of particle-associated radionuclide and suspended particle removal rates were made in the spring, and a third measurement was made in the fall. Particle-associated ^{7}Be removal rates (Table 10) were similar in the spring and fall sampling periods, while particle-associated ^{210}Pb removal rates (Table 10) were much lower than ^{7}Be removal, in both spring and fall. Removal rates of total suspended particulate matter (Table 10), estimated in conjunction with particle-associated radionuclide removal rates, shifted from positive to negative in the spring and were negligible in the fall.

3.3 INTERACTIONS WITHIN THE WBE ECOSYSTEM

Interactions within the WBE ecosystem were explored by the multivariate-stepwise regression combination of procedures outlined above. The best predictor variables for a given criterion variable were determined relative to the partial correlation coefficients, standardized partial regression coefficients, and overriding ecological relationships. Particulate nitrogen concentration and sinking rate variables represented all particulate nutrient flux indices; particulate nitrogen variables had the highest R^2 of all particulate nutrient variables in preliminary multiple regressions. Other predictor variables, including mean cell size and ratios of both dissolved and particulate nutrients, for which there were mathematical or ecological analogs have been omitted. Some confounding of relationships with time may be evident; however, predictor variables with similar ecological or statistical relationships have been either omitted or combined to simplify these procedures. A complete list of results of these regression procedures is found in Appendix F, page 151.

Table 10. Particle-associated radionuclide and suspended particle flux measurements. Removal rate (R.R., % lost•d^{-1}) and residence time (d) data were collected from in situ measurements.

Variable	Sampling period[a]	Concentration range[b]	R.R.	Residence time
^{7}Be	Early spring	320 to 60	11.1	9.0
	Mid spring	150 to 15	17.9	5.5
	Fall	92 to 29	17.1	5.8
^{210}Pb	Early spring	22 to 9	6.4	15.6
	Mid spring	13 to 3	13.3	7.5
	Fall	19 to 9	4.5	22.2
Total Suspended particles	Early spring	19.7 to 6.9	5.4	18.5
	Mid spring	7.3 to 12.3	-8.4	.
	Fall	3.4 to 6.8	-0.2	.

[a]The Early spring sampling extended from March 19 to April 4, Mid spring from April 9 through April 17 and Fall from October 25 through November 3, 1986. Fall data were not corrected for sample yield.

[b]The range of concentrations is from largest to smallest observed during a particular sampling period. Radionuclide concentrations are expressed as fCi•L^{-1}; total suspended particle concentrations expressed as mg•L^{-1}.

3.3.1 Particulate Matter Concentrations

Results of the multiple and stepwise regression procedures indicated that decreases in chlorophyll concentration were most influenced by both increases H_{ref} as well as decreases in net algal flux (negative NAF) and SD_{desc}. Decreases in phaeopigment concentration were most strongly associated with increases in both DOC and particulate nutrient concentrations over time. Any changes in the concentrations of particulate nutrients were most positively associated with changes in chlorophyll concentration, net algal flux and SD_{desc}.

3.3.2 Particulate Matter Flux

Flux rates of particulate matter were usually not significantly related to particle concentrations; however, increases in the ascent rate of chlorophyll were negatively associated with decreasing chlorophyll concentration over time. Increases in the sinking rate of chlorophyll were explained most by dissolved nutrient availability (an increase in NH_4-N concomitant with a decrease in SRP concentration) and with declines in conductivity and ORP over time. Phaeopigment sinking rate changes were positively associated with total phosphorus concentration, conductivity, and available light, though they were negatively associated with net algal flux, chlorophyll ascent and SD_{desc} rates over time. Trends in both particulate carbon and particulate nitrogen sinking were influenced to the same degree by chlorophyll flux (both sinking and ascent), H_{desc} and net algal flux. The sinking rate of particulate phosphorus was most associate with chlorophyll flux and increases in H_{desc}.

3.3.3 Algal Assemblage Indices

Increases in algal assemblage biovolume appeared to be most associated with increasing phaeopigment and particulate nutrient concentrations, along with decreasing chlorophyll ascent rates. Increases in the mean size of algal cells were best predicted by increasing water column stability, phaeopigment sinking, and conductivity, as well as with decreasing particulate nutrient sinking rates and SRP concentration over time. Changes in Href were similarly related to changes in chlorophyll ascent rates, total phosphorus concentrations and water column stability, though inverse trends in chlorophyll sinking rates, phaeopigment and NO_3+ NO_2-N concentrations also were relevant. In contrast, SD_{ref} seemed to be best related to similar trends in chlorophyll sinking rates, particulate nutrient concentration, and conductivity, though exhibiting opposite tendencies relative chlorophyll ascent rates, total phosphorus and DOC concentrations.

Assemblage level net algal flux increased with decreases in chlorophyll ascent rates, ammonia-nitrogen, dissolved oxygen and total phosphorus concentrations over time. Increases in H_{desc} were best described by increasing water column stability with decreasing NO_3 + NO_2-N and phaeopigment concentrations over time. SD_{desc} increased with increasing particulate nutrient concentration and chlorophyll sinking rates, though decreasing with increases in ammonia-nitrogen concentration, conductivity, chlorophyll ascent and particulate nutrient sinking rates.

IV. DISCUSSION

4.1 THE LENTIC NATURE OF WALKER BRANCH EMBAYMENT

Studies of particle flux within reservoir systems must address the horizontal rather than the vertical dynamics of particulate matter (Soballe and Bachmann, 1984; Soballe and Threlkeld, 1985; Trimbee and Harris, 1984; Elser and Kimmel, 1985). However, previous studies involving Melton Hill Reservoir (MHR) indicate that WBE is physically distinct from and may have a water residence time longer than that of the adjacent portion of MHR. Previous studies also indicate that suspended particles within the water column of WBE are primarily of autochthonous origin (Dahlman et al., 1977; Table 4 in Elser, 1983).

The results from this study (Table 1, p. 18) and factors such as minimal watershed inflow to WBE during the drought year of 1986, relatively constant water column stability, thermal and dissolved oxygen stratification, and a consistently high water transparency support the conclusion that WBE is physically distinct from MHR (Table 1, p. 18, Table 2, p. 22, Table 3, p. 24, Fig. 3, p. 19, Fig. 4, p. 20, Fig. 5, p. 21). The stratified condition of the water column and the similarity in trends for all seston concentration variables (Table 4, p. 26, Table 5, p. 29), indicate that autochthonous production is primarily responsible for the suspended particles and particle production in WBE, and that the WBE environment is more lentic than lotic in nature.

4.2 TEMPORAL TRENDS IN SUSPENDED PARTICULATE MATTER

Particulate matter concentrations in the mixed layer declined significantly from April through October (Table 4, p. 26, Table 5, p. 29, Fig. 6, p. 33, Fig. 8, p. 35) as is often observed in reservoirs (e.g., James et al., 1987; Kimmel et al. in press) as well as in natural lakes (e.g., Sommer, 1984; Verdouw et al., 1987). Concentrations of particulate carbon, nitrogen, and phosphorus, in the mixed layer of WBE, (Table 2, p. 22, Table 3, p. 24, Table 4, p. 26, Table 5, p. 29) exhibited almost identical patterns with time during

1986 (Fig. 6, p. 33). Though chlorophyll and algal biovolume concentrations also followed this pattern, phaeopigment concentrations were far more variable over time and exhibited a dissimilar temporal relationship.

The availability of nutrients depends upon factors including bacterioplankton and zooplankton cycling, as well as external loading; the importance of the latter may exhibit a distinct seasonality (Soballe and Bachmann, 1985; Sommer, 1985; Trimbee and Harris, 1986; Moloney et al., 1987). However, the dynamics of particulate nutrients, which exhibited a marked seasonality in WBE (Fig. 6, p. 33, Fig. 13, p. 47, Fig. 15, p. 49) do not necessarily reflect the dynamics of available nutrients (Uehlinger and Bloesch, 1987). Particulate nutrient dynamics may more directly reflect changes in autochthonous seston since nutrient availability is not strictly dependent on particle-associated processes (McCarthy and Goldman, 1979; Scavia, 1979; Bradford and Peters, 1987; Moloney et al., 1987). Initial multiple regression analysis, using particulate nutrient criterion variables, produced predictor variables of similar significances. For this analysis and discussion, trends in particulate nutrients are considered to represent trends in total biogenic seston.

Particulate nutrient concentrations in the mixed layer decreased throughout the study, with trends similar to those of other particulate matter concentration measures (Table 4, p. 26, Table 5, p. 29, Appendix F, p. 161). Trends in both particulate carbon and particulate nitrogen, predicted by chlorophyll concentration, descending assemblage change rate (SD_{desc}), net algal flux, and total algal biovolume, suggest that the concentration of particulate nutrients declines with declining influence of autogenic processes on algal assemblage indices within WBE. These relationships reflect changes in the general nutritional status of the algae, and may affect changes in cell nutrient adaptations either by individual cells, or through shifts in assemblage composition (Kalff and Knoechel, 1978; Crumpton and Wetzel, 1982; Lewis, 1986). Particulate phosphorus concentrations, which were related to changes in phaeopigment concentration, increased with decreasing water column stability and SRP concentrations. The strength of these relationships suggests the potential importance of both grazing and water column stability to particulate phosphorus dynamics as well as to phosphorus availability in WBE. These relationships offer a contrast to links between phosphorus concentration and algal biomass (e.g., Canfield and Bachmann, 1981; Premo et al., 1985). Relationships between particulate phosphorus and phaeopigment concentrations suggest that zooplankton grazing with subsequent nutrient regeneration becomes increasingly less important to particulate phosphorus availability as water column stability increases.

The concentration of phytoplankton in the mixed layer exhibited trends similar to those of other particulate matter variables, all of which decreased during this study (Table 4, p. 26, Table 5, p. 29, Fig. 6, p. 33, Fig. 7, p. 34, Fig. 8, p. 35, Fig. 10, p. 37). These chlorophyll concentrations were most influenced by indices of algal assemblage flux, though no chlorophyll flux variables were significant predictors of chlorophyll concentration (Appendix F, p. 151). Declining chlorophyll concentrations were related to lower SD_{desc}, as well as decreases in total algal flux with higher H_{desc}. The relationship between declining chlorophyll concentration and decreasing values of algal flux observed by other investigators, supports the link between decreasing concentrations of suspended particles, and declining particle flux (e.g., Goldman and Kimmel, 1978; Soballe and Bachmann, 1984; Stabel, 1986; James et al., 1987; Verdouw et al., 1987); in the present case, these relationships were determined by measuring different components of the plankton with very different techniques (Appendix C, p. 107, Appendix D, p. 125).

High chlorophyll concentrations, coincident with low diversity, were observed during periods dominated by a few populations of large filamentous diatoms (Appendix D, p. 125), while during periods of low chlorophyll concentrations, the algal assemblage was characterized by several, diverse groups. Such variations may also be related to declines in particle size (e.g., Smayda, 1970; Walsby and Reynolds, 1980; Malone, 1980), though cell sizes were not used to predict chlorophyll concentrations. The significantly positive relationships between chlorophyll and assemblage change may reflect shifts in algal assemblage composition, influenced by wholesale gain or loss of algal groups with similar morphological adaptations. Such a relationship is confounded by the importance of either autogenic or allogenic factors to water column physical-chemical conditions, making some adaptations to the environment favorable and others unfavorable.

The concentration of phaeopigments, often (though not exclusively) associated with zooplankton grazing, declined during this study, reflecting the general decline in the concentrations of all suspended particles. Declining phaeopigment concentrations over the growing season were most influenced by increasing DOC and particulate nutrient concentrations, though both DOC and particulate nutrients declined over time (Table 5, p. 29, Appendix F, p. 151). Inverse relationships indicate that trends in phaeopigment concentrations reflect trends in detrital algae, and suggest that grazing may affect rates of phytoplankton assemblage change, increase the quantity of autochthonous particles, and, by inference, affect the size of autochthonous particles and the transport of materials to other trophic levels (e.g., Bienfang, 1980; Malone, 1980; Reynolds, 1984a, 1984b; Hakanson, 1987). Although no quantitative zooplankton population data were collected from WBE, microscope examination of preserved algal samples yielded few large zooplankton (usually copepods); however, protozoan zoociliates were a frequent component of the pelagic community.

In order to derive the various indices of algal biovolume, population level data containing taxonomic groupings and algal cell counts were combined to obtain total algal biovolume. This summation effectively reduced several hundred observations of population level biovolume to a few observations of assemblage level biovolume. The loss in raw data was offset by the gain in useful information concerning diversity (H), rates of change (SD), mean cell size, and net algal flux, which were derived from the population-level data.

Seasonal declines in algal biovolume, as well as changes in both mean cell size and phytoplankton assemblage composition (Appendix D, p. 125) followed patterns similar to those observed by other investigators (e.g., Reynolds, 1976; Lewis, 1978a, 1986; Sommer, 1984).

Trends in these variables suggest that factors influencing algal assemblage dynamics work at the population, rather than individual cell level (Fig. 10, p. 37, Appendix D, p. 125). Studies indicate that significant increases in assemblage diversity over time, are influenced by increasing environmental heterogeniety, which includes water column stability, wind induced water movements, decreases in particle (i.e., cell) size and decreasing nutrient availability (George and Heaney, 1978; Crumpton and Wetzel, 1982; Tilman et al., 1982; Harris et al., 1983). Comparison of diversity, total algal biovolume and mean cell size (Fig. 10, p. 37, Fig. 11, p. 39) suggests inverse relationships between assemblage diversity and both total biovolume and mean cell size, associations which appear to be more complex than mathematical dependencies might indicate (Appendix B, p. 105). Trends in SD_{ref} which lacked obvious seasonality, corresponded with fluctuations in total biovolume, diversity and mean cell size during large changes in these indices (Fig. 10, p. 37, Fig. 11, p. 39). Due to the mathematical (see Appendix B, p. 105) and ecological interrelatedness of these indices, each was omitted from the list of predictor variable for the others.

Declining trends in biovolume, related to declining phaeopigment and particulate nutrient concentrations, suggest that total algal biovolume is related both to the grazed and total suspended particulate matter, reiterating that the bulk of total suspended particles is autochthonous (Appendix F, p. 151). The positive influence of algal flux rates (negative ascent) upon biovolume suggests that at low biovolume, motile cells dominate the assemblage, thus serving as energy and materials links to other trophic levels, while nonmotile cells may comprise a significant proportion of the algal assemblage at high biovolume (Appendix D, p. 125; Stewart and Wetzel, 1986). Both relationships at high and low biovolume appear to be influenced by trends in either zooplankton grazing, as suggested for oligotrophic lakes by McQueen et al. (1986), or through autogenic factors such as resource competition and cycling of nutrients by bacterioplankton (e.g., Reynolds, 1984b; Lewis, 1986).

Relationships between mean algal cell size and other variables contradict conventional ideas concerning the impact of grazing, nutrient availability, water column stability, and particle sinking on mean algal cell size (Smayda, 1970; Tilman et al., 1982; Reynolds, 1984b; Bailey-Watts, 1986; Johnson and Smith, 1986). Increases in mean cell size were influenced by increasing water column stability and phaeopigment sinking rates, with decreasing SRP concentration and particulate nutrient sinking rates (Appendix F, p. 151). An obvious implication of larger mean cell size with increasing phaeopigment flux rates may be that large senescent cells sink faster. This may also imply that zooplankton grazing is more intense on larger cells and results in larger fecal pellets, with high sinking rates relative to individual cells (Bienfang, 1980). However, there is little emperical evidence supporting this selective grazing hypothesis; further, such an outcome would contradict results of studies involving consumer-producer interactions at several trophic levels (e.g., Bartell and Kitchell, 1978; Lynch and Shapiro, 1981; DeMott, 1983).

The increase in mean cell size with decreasing particulate nutrient sinking rates may reflect the presence of cell aggregates or protuberances which should retard sinking, though none were quantified (see Malone, 1980; Walsby and Reynolds, 1980). Decreases in SRP concentration with increasing cell size may reflect the past history of these cells rather than violating ideas concerning nutrient uptake and transport at low concentrations (Pasicak and Gravis, 1974; Malone, 1980; Trimbee and Harris, 1983; Lewis, 1986). A final, complicating factor in these relationships may be the predominance of dinoflagellates at certain times of the year. These algae, capable of storing excess phosphorus, may be 1000 times larger than the bulk of phytoplankton and may cross the boundary between autotroph and heterotroph (Kalff and Knoechel, 1978; Elgavish et al., 1982; Bird and Kalff, 1986; Appendix D, p. 125).

Change in assemblage diversity (H_{ref}) corresponded with increasing water column stability, conditions which imply a broader range of environmental conditions (Tilman et al., 1982). However, Harris and Trimbee (1986) attributed high diversity in Hamilton Harbour, Ontario, over time to frequent, wind induced perturbations (low N^2), while the low diversity of a reservoir (Guelph lake) was attributed to infrequent perturbations and a high degree of water column stability. In the case of WBE, increased water column stability enhanced the advantages of motility (significant influence of chlorophyll flux), and nutrient limited growth adaptations (significant influence of total phosphorus and NO_3+ NO_2-N concentrations; e.g., Murphy et al, 1976; Premo et al., 1985), in a patchier environment (see Reynolds, 1984a). Yet, at high diversity, the assemblage was either less suitable for, or too sparse to support phaeopigment production by zooplankton grazing (negative association with phaeopigment concentrations; McQueen et al., 1986; Vanni, 1987).

The highly variable nature of SD_{ref} (Fig. 11, p. 39) reflected the episodic changes characteristic of the algal assemblage (Appendix D, p. 125) and suggested that assemblage composition change was influenced by both autogenic and allogenic factors (e.g., Crumpton and Wetzel, 1982; Lewis, 1986; Reynolds et al., 1984). Though water column stability was not a significant predictor of SD_{ref}, results suggest that the association between SD_{ref} and N^2, which were high during periods of low water column stability, but disassociated with N^2 during periods of high water column stability, was similar to that observed by Reynolds, (1980) and Trimbee and Harris (1986; Fig. 5, p. 21, Fig. 11, p. 39). The positive influence of chlorophyll sinking and particulate nutrient concentrations with negative values of total phosphorus suggest that rates of assemblage change are affected by water column stability, though there may be a skewed effect of high autumn values. Several different algal populations have been observed to exhibit similar morphological adaptations to environmental change (Appendix D, p. 125; Reynolds, 1984a). These results suggest that allogenic environmental change may affect rapid changes at the morphological level of organization; however, in a more autogenically driven environment, assemblage composition changes occur at the population level.

These results illustrate that the processes affecting rates of assemblage change are poorly understood. This condition may be improved by: (1) investigating the impact of allogenic and autogenic factors; (2) understanding the scales experienced by phytoplankton assemblages (Reynolds, 1976; George and Heaney, 1978; Harris and Trimbee, 1986); and (3) making use of more advanced statistical techniques (such as state-space, principal components and factor analysis; Allen et al., 1977; Paloheimo and Fulthorpe, 1987; Sigg et al., 1987). These may further understanding of the fundamental problem underlying Hutchinson's (1961) 'paradox of the plankton', that environmental changes occur at a higher rate than do the adaptations of individual phytoplankton.

4.3 SESTON FLUX WITHIN WALKER BRANCH EMBAYMENT

Changes in suspended particle concentrations were not significantly explained by particle flux, though both particle concentration and flux exhibited similar trends from April through mid September (Fig. 6, p. 33, Fig. 8, p. 35, Fig. 12, p. 40, Fig. 13, p. 47, Appendix F, p. 151). Such a lack of relationship especially when considering the significant decline in particulate matter concentration within the mixed layer of WBE over time (Table 4, p. 26, Table 5, p. 29) indicates either that sinking is not the process responsible for particulate matter loss, or that sinking rate estimates from settling columns do not reflect <u>in situ</u> particle loss. Though horizontal advection out of WBE and into MHR is a plausible mechanism for particle movement, the significant difference in water column structure between WBE and adjacent portions of MHR indicates, as discussed above, that there was little exchange of water between WBE and the body of MHR (Table 1, p. 18, Fig. 1, p. 6). This is plausible since (1) WBE is relatively isolated from MHR, and (2) similar discontinuities between adjacent bodies of water have been observed at this scale (Harris and Smith 1977; Dahlman et al., 1977).

Concerning the relevance of particle flux measured in the lab to total suspended particle concentration, settling column flux measurements are biomass neutral (see Fig. 2, p. 11, Appendix B, p. 105). This is in contrast to sedimentation rates measured with sediment traps, where particle flux is expressed in terms of grams deposited per square meter per year ($g \cdot m^{-2} yr^{-1}$, Bloesch and Evans, 1982), cells deposited per cubic meter per day ($cells \cdot m^{-3} d^{-1}$, Sommer, 1985; Carpenter et al., 1986), or kilograms deposited per day ($kg \cdot d^{-1}$, Soballe and Bachmann, 1984). Finally, trends in flux rates measured in the laboratory are in a range comparable to in situ loss rates derived from field measurements (Table 10, p. 52, Appendix E, p. 149).

Though both sinking and ascent rates were often comparable (see Table 6, p. 41), and despite the fact that phytoplankton ascent rates increased significantly over time, (Table 4, p. 26, Table 5, p. 29, Appendix F, p. 151), negative particle flux occurred much more frequently than did positive particle flux (Fig. 14, p. 48, Fig. 15, p. 49). The negative relationships between phytoplankton ascent with both chlorophyll concentration and ORP suggest that bouyancy became increasingly advantageous as nutrient and physical-chemical conditions imposed limitations on algal persistence and growth; similar associations between assemblage diversity and phytoplankton ascent are likely due to the occurrence of motility in several taxonomic groups (Appendix D, p. 125; Reynolds, 1976; Walsby and Reynolds, 1980; Trimbee and Harris, 1984). Periods of positive flux coincided with and possibly were affected by relatively large flagellate populations in the algal assemblage (Appendix D, p. 125; Elgavish et al., 1982; Frempong, 1984).

The ultimate significance of ascending particulate matter in terms of net particle flux may be limited to delaying sedimentation; however, some mechanism for maintaining or regulating suspension is important both to seasonal periodicity of algal assemblages and the existence of particular populations (e.g., Sverdrup, 1953; Walsby and Reynolds, 1950; Reynolds, 1984a). Whatever the mechanism, exposure of particle-reactive materials and material transfer between trophic levels is increased, which in turn enhances the mobility of particle-reactive substances within aquatic ecosystems (Smith, 1982; Pedros-Alio and Brock, 1983; Güde, 1986; Moloney et al., 1986; Simon, 1987; Verdouw et al., 1987). Based upon negative flux, the potentially negative affect of wind mixing on ascending biomass and the inability of chlorophyll ascent (in the absence of sinking) to predict change in other particle variables (Appendix F, p. 151), the net flux of particles is considered to be downward in WBE.

Phytoplankton sinking rates, mimicked by net chlorophyll flux, were highly variable during the spring, declined from late spring throughout the summer, and increased greatly in the fall (Table 6, p. 41, Fig. 12, p. 40, Fig. 14, p. 48); there was a significant increase in phytoplankton sinking with time, perhaps due to consistently high fall values (Table 4, p. 26, Table 5, p. 29, Table 6, p. 41, Fig. 12, p. 40). Increases in phytoplankton sinking rates were influenced most by physical-chemical factors such as NH_4-N concentration and declining available phosphorus and ORP values. These relationships indicate an increase in phytoplankton sinking, with increasing NH_4-N:SRP, and ORP, which suggest declining nutrient availability. Though increases in NH_4-N accompany zooplankton grazing, and though recent studies have found viable algal cells in fecal pellets (Adrian, 1987), there were no concomitant relationships between phytoplankton sinking and phaeopigment variables. Therefore there is no evidence of a significant association between zooplankton and rates of phytoplankton sinking. The influence of mixed layer nutrient status upon phytoplankton flux has been observed in several studies (Eppley et al., 1967; Smayda, 1970; Sommer, 1985), though increased sinking rates with nutrient limitations have been viewed as indicators of senescent cells, rather than advantageous adaptations (Titman and Kilham, 1976). The association between particle flux and an enhanced nutrient microenvironment supports the hypothesis that increased flux is advantageous to cells in deep mixing environments, or capable of large diel migrations (Pascaick and Gravis, 1974; Titman and Kilham, 1976; McCarthy and Goldman, 1979; Johnson and Smith, 1986; Verdouw et al., 1987).

The multivariate-stepwise regression sequence for both sinking and ascent rates of phytoplankton explained only a small (34%) amount of the variance in either phytoplankton flux variable (Appendix F, p. 151). This low R^2 may be the result of lumping different taxonomic and morphological algal cell counts into a single variable of total algal biovolume, which eliminate specific data for each population and probably suppress specific relationships between population and trends in chlorophyll flux. However, as indicated above, summed data yield more practical information about whole assemblage level processes, than do cell counts involving individual populations.

Sinking rates of detrital phytoplankton varied over a much larger range and lacked the seasonal aspects of viable phytoplankton. This does not preclude relationships with factors influenced by seasonal changes (Table 4, p. 26, Table 5, p. 29, Table 7, p. 44, Fig. 12, p. 40). Peaks in phaeopigment sinking rates, which do not necessarily correspond with peaks in either chlorophyll, or particulate nutrient flux (Fig. 12, p. 40, Fig. 13, p. 47), may represent physiological decline in particular populations, increased grazing pressure, or a change in the quality of zooplankton fecal materials. As noted previously, there is not necessarily a direct relationship between increased grazing rates and increases in either phaeopigment sinking rates, or phaeopigment concentrations (Fig. 8, p. 35, Fig. 12, p. 40, Table 7, p. 44, Appendix C, p. 107; Gliwicz, 1975; Porter, 1976; Lynch and Shapiro, 1981; Lehman and Scavia, 1982; Adrian, 1987); however, phaeopigment sinking rates are affected by different types of fecal pellets which result from differences in either algal or zooplankton (or both) populations (e.g., Bienfang, 1980; DeMott, 1982; Sommer, 1984; Adrian, 1987).

Zooplankton fecal pellets sink at rates higher than either viable or senescent algae, and much higher than the maximum rates from this study (Table 6, p. 41, Table 7, p. 44, Table 8, p. 46; Smayda, 1970; Bienfang, 1980; Wiseman et al., 1983; Johnson and Smith, 1986). Fecal pellets have, as noted above, been observed to contain large concentrations of viable algal cells, implying that (1) not all rapidly sinking particles are strictly detrital, and (2) that the actual production of phaeopigments may result as much from the limitations of being bound in a pellet as from passing the gut of zooplankton (Porter, 1976; Lynch and Shapiro, 1981; Adrian, 1987). Though phaeopigment concentrations did not change significantly over time (Table 4, p. 26), there were periods of high flux which were affected by either senescence of particular algal groups, or changes in the zooplankton assemblage, both of which tend to be episodic. Sinking of detrital algae, may represent a significant loss of particulate matter from the mixed layer.

The association of SD_{ref} with phaeopigment sinking (Appendix F, p. 151) suggests that decline in or removal of algal populations increases phaeopigment sinking. It may also reflect the time lag in the response of the grazer assemblage to change in the algal assemblage, especially if, as observed by Harris and Trimbee (1986), change in algal assemblage composition previews changes in water column physical conditions.

Net flux estimates for particulate nutrients were very similar throughout the growing season (Fig. 13, p. 47, Fig. 15, p. 49), reaffirming the observation made earlier that all particulate nutrients represent the same suspended particle component. Sinking rates and net flux exhibited trends similar to but generally higher than those of phytoplankton, excluding phaeopigments (see above, Fig. 12, p. 40, Fig. 13, p. 47, Fig. 15, p. 49). The similarity between flux of various forms of particulate matter was much more pronounced during the spring and fall periods of low water column stability. Also, there are apparently strong associations between total autochthonous particles and particulate nutrients in terms of concentration and dynamics (Fig. 6, p. 33, Fig. 8, p. 35, Fig. 11, p. 39, Fig. 14, p. 48, Fig. 15, p. 49). Multivariate-stepwise regression results suggest that particulate carbon, nitrogen and phosphorus are similarly influenced by chlorophyll flux (Appendix F, p. 151) which reinforce the association between particulate nutrient sinking rates and flux of total autochthonous seston.

Though the dynamics of particulate phosphorus are related to those of autochthonous particulate matter, and though trends in particulate phosphorus flux are similar to those of other particulate nutrients, the dynamics of particulate phosphorus can not simply be equated with those of other particulate nutrients. The combination of phosphorus limitations and the importance of particulate matter as a limiting resource (Hargrave, 1977; Paerl, 1980; Kjelleberg, 1984; Paerl et al., 1987) emphasizes the ecological relationships between particulate phosphorus flux and resource availability. However, except for chlorophyll flux, only increasing H_{desc} significantly predicted the increases in particulate phosphorus sinking rates.

Values for the index of net algal flux, analogous to the other net particle flux indices, is presumed to be a function of algal groups present as well as cell nutrient status (e.g., Sommer, 1985; Titman and Kilham, 1976). Declining values of net algal loss were significantly predicted by decreasing chlorophyll ascent rates, lower concentrations of total phosphorus, and dissolved oxygen over time (Appendix F, p. 151). Decreases in net loss with declining environmental conditions imply that nutritionally stressed cells exhibit less net flux than do healthy cells, a conclusion which contradicts studies where cell loss rates accelerate with declining nutrient availability (Smayda, 1970; Sommer, 1984); however, a plausible alternative explanation is that senescent cells have undergone physiological changes which effectively make them unrecognizable as formerly viable cells. The positive influence of phytoplankton ascent upon net algal loss is confusing, and though this cannot be dismissed simply as a spurious relationship, ecological rationale for these relationships may be difficult to find.

Diversity of the descending assemblage (H_{desc}), which increased during the study, was significantly predicted by NO_3+NO_2-N and N^2, as was H_{ref}. However, the inverse relationships with phaeopigment concentration and ORP were unique to H_{desc} (Appendix F, p. 151). The association between declining phaeopigment concentration and increasing H_{desc} may be confounded with time. The negative association with ORP reinforces the contention that diversity increases with a broader range of environmental conditions (see above). The rate of composition change for the descending assemblage was not influenced to an ecologically significant extent by factors other than those discussed above for the reference assemblage.

4.4 DYNAMICS OF PARTICLE-ASSOCIATED MATERIALS

Removal rates and residence times for particle-associated ^{7}Be, particle-associated ^{210}Pb, and total suspended particles were similar in range, both to each other and to published values

(Hawley et al., 1986; Sigg et al., 1987); however, each of these showed very different seasonal trends in the mixed layer of WBE (Table 10, p. 52). The mixed layer dynamics of ^{7}Be were similar in both spring and fall, though residence within the mixed layer was highest for the high ^{7}Be concentrations observed in early spring. ^{210}Pb removal rates were similar in early spring and fall, though they doubled from the first to the second spring sampling periods. This may have been influenced by factors including differences in water column stability, differences in initial ^{210}Pb concentrations, and differences in ^{210}Pb source between the two spring sampling periods. The low removal rates in the fall, relative to those of spring may indicate some degree of particle resuspension. Removal rates of total suspended particles were very different from those of particle-associated radionuclides, with the exception of ^{210}Pb in early spring (Table 10, p. 52). The negative removal rate in mid spring apparently was related to an increase in particle concentration, perhaps influenced by growth of biogenic particles. There were no coincident increases in either viable or detrital algal biomass; no particulate nutrient data are available for the end of this sampling period (Appendix C, p. 107). The negative removal rate for fall may be related to periodic wind mixing of the water column and particle resuspension. Water column stability was low (Fig. 5, p. 21), phaeopigment and total nutrient concentrations increased as did particle flux; however concentrations of both chlorophyll and particulate nutrients decreased slightly during the fall sampling period.

Particle resuspension may be quantified by using the difference in the half-lives of ^{7}Be and ^{210}Pb the ratio of ^{7}Be to excess ^{210}Pb on suspended particles. Though excess ^{210}Pb accumulates to relatively high concentrations in the sediments, providing both an atmospheric and a sediment source for excess ^{210}Pb in the aquatic environment, the rapid ^{7}Be decay prevents the buildup of such a sediment inventory (Hakanson, 1980; Olsen et al., 1985; Hawley et al., 1986). Additionally, the atmospheric input of excess ^{210}Pb is approximately 10 times less than that of ^{7}Be (Appendix E, p. 149; Olsen et al., 1985). Thus the ^{7}Be:^{210}Pb ratio on sediment derived particles should be lower than found on suspended particles residing in the mixed layer during and after a precipitation event.

The volume ratios of ^{7}Be to ^{210}Pb (Appendix E, p. 149) indicate a net loss of ^{7}Be relative to ^{210}Pb during both the first and last sampling periods, suggesting resuspension following each of these precipitation events. There was a relatively large flux of allochthonous material into WBE from the Walker Branch watershed during the first sampling period (Olsen, unpublished data). The ^{7}Be content of this input was initially similar to that of WBE, but over time came to be dominated by erosion products, relatively enriched in ^{210}Pb. The removal rates of both ^{7}Be and ^{210}Pb include this allochthonous input which should not change the interpretation of the ^{7}Be results, but which suggest that some portion of the ^{210}Pb in this first experiment was actually supported, rather than excess, and thus may not reflect the actual particle-associated flux of interest. The fall sampling period was likely dominated by particle resuspension. Despite dilution, growth and resuspension events (for the first, second and third sampling periods respectively), ^{7}Be removal seemed fairly consistent in both spring and fall, while ^{210}Pb removal seemed to reflect bulk particle flux, though not the flux of total suspended particles (Table 10, p. 52).

Particle-associated radionuclide and total suspended particle removal rates were compared to both the concentration and net particle flux indices of chlorophyll, phaeopigments and particulate nutrients. Concentrations of chlorophyll, phaeopigments, and particulate nutrients changed little relative to other <u>in situ</u> measurements during the radionuclide sampling periods (Appendix C, p. 107); however, there were relatively large changes in the ratio of total nitrogen to total phosphorus (TN:TP) during the fall sample period which may affect the sorption characteristics of particulate matter (Appendix A, p. 87; Sigg et al., 1987; Uehlinger and Bloesch, 1987). Similar relationships were observed for particulate nutrients, though concentrations of dissolved nutrients varied greatly between sample dates (Fig. 6, p. 33, Appendix A, p. 87, Appendix C, p. 107). Trends in chlorophyll net particle flux more closely resembled those of ^{7}Be removal than they did the other removal rates. During the spring, the concentration and net flux of phaeopigments were similar to those of total suspended particles as were fall trends in phaeopigment concentrations; however, phaeopigment net particle flux was more similar to that of chlorophyll and ^{7}Be, than total suspended particles.

Shifts in either cell size or assemblage composition concomitant with these trends in particle-associated radionuclides were inconclusive. Other investigators have stressed the importance of particle composition, surface area to volume ratios (SA:V), and trophic-level interactions to the net flux of particle-reactive radionuclides (Muller et al., 1978; Olsen et al., 1982; Olsen et al., 1985; Hawley et al., 1986; Fisher et al., 1987; Sigg et al., 1987). No evidence was found to associate mean size of phytoplankton cells, total assemblage biovolume, or grazing with particle-associated radionuclide removal (Table 7, p. 44, Fig. 8, p. 35, Fig. 10, p. 37, Fig. 11, p. 39, Appendix D, p. 125). The dynamics of planktonic bacteria, which were not quantified, may dominate nutrient cycles, even to the extent of changes in the chemical composition of the particulate matter (Paerl, 1980; Scavia and Laird, 1987; Simon, 1987). Bacterioplankton maximize cell SA:V, sink very slowly, and may be grazed at high rates (Walsby and Reynolds, 1980; Borsheim and Andersen, 1987).

The similarities in ^{7}Be removal rates measured under physically different environmental conditions suggest that particulate matter present initially may be the most important factor in determining the ultimate fate of ^{7}Be. These rapid, strong and unique associations may involve a highly metabolizing component of suspended particulate matter, which must also exhibit seasonal trends in removal. Based upon the similarities in removal rates and seasonal trends between phytoplankton and ^{7}Be, associations with phytoplankton are considered to be the principal mechanism for ^{7}Be removal from the mixed layer of WBE. Though bacterioplankton may present a greater portion of SA:V, they may not be present in large enough concentrations when ^{7}Be is initially introduced into WBE to "compete" with other suspended particulate matter for dissolved ^{7}Be. Bacterioplankton sedimentation rates might be increased by zooplankton grazing and fecal pellet production, or by association with suspended particles. However, due to the fact that neither a dramatic change in phaeopigment loss, nor a large increase in particle sinking was observed, both grazing of and total suspended particle association with bacterioplankton are discounted as specific reoutes for ^{7}Be removal (Table 6, p. 41, Table 7, p. 44, Table 8, p. 46, Table 10, p. 52; Hargrave and Phillips, 1977; Kjelleberg, 1984).

^{210}Pb may be associated primarily with another portion of autochthonous particluate matter, which exhibited a great deal of seasonality. A third, unquantified compartment of biogenic particulate matter may explain the relation of phaeopigment dynamics with total particles in the spring, and with ^{7}Be in the fall.

This study affirms the assertion by Hawley et al. (1986) that in order to understand the dynamics of particle-associated materials (e.g., nutrients, toxicants, radionuclides), it is necessary to understand the dynamics of particulate matter. There are changes, not only in particle concentration, but also in particle composition, as well as in other aspects of the biota, which have often been identified as important to radionuclide dynamics (Olsen et al., 1985; Olsen et al., 1985; Talbot and Andren, 1984; Fisher et al., 1987; Sigg et al., 1987). Seasonal aspects of suspended particles have a large and important influence on the largest influence upon the dynamics of particle-associated materials in aquatic ecosystems.

V. CONCLUSIONS

(1) During this study (April through October, 1986) the primary source for particulate matter within WBE was autochthonous algal production.

(2) The magnitudes of assemblage composition change indicate that adaptations to changing environmental conditions, both autogenic and allogenic, occur above the level of the individual cell.

(3) Seasonal fluctuations in concentration, diversity and rate of change of the algal assemblage were reflected by the seasonal aspects of suspended particle dynamics.

(4) Factors which influenced changes in suspended particle dynamics were related to environmental heterogeniety.

(5) Though changes in algal assemblage composition were not specifically associated with either allogenic or autogenic change in environmental conditions, particulate matter sinking rates appear to be related to the prevalent mechanisms of environmental change.

(6) Sinking of particulate matter is a far more continuous and more important relative to both phytoplankton compositional change and vertical flux than is the more intermittent process of rising in the water column.

(7) Beryllium-7 removal rates correspond to those of the predominant, and potentially the most metabolically active, form of particulate matter in the mixed layer.

(8) The rapid association of particle-reactive materials with the predominant form of particulate matter following input events suggests that the seasonality of particulate matter is a central factor in the sorption, residence time and ultimate fate of particle-associated materials within aquatic ecosystems.

VI. SUMMARY

(1) Particle flux within the mixed layer of WBE was measured using both laboratory settling columns and *in situ* particle-associated radionuclide removal determinations.

(2) During 1986, the physical, chemical and biological conditions within the mixed layer of Walker Branch embayment resembled those of a natural lake, more than did adjacent portions of Melton Hill Reservoir.

(3) Phytoplankton production was the primary source of suspended particles within the mixed layer of Walker Branch embayment.

(4) Though ascending biomass was intermittently important to particle movement, sinking was consistently a more prevalent form of particle flux.

(5) Phytoplankton assemblage composition, diversity and change indices reflected contemporary environmental conditions.

(6) Particulate matter dynamics and phytoplankton seasonality were highly interrelated.

(7) Removal rates of ^{7}Be were related to loss of a prevalent, and metabolically active form of suspended particulate matter within WBE, while removal rates of ^{210}Pb and total suspended particles were more dependent upon physical processes such as mixing.

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Appendix A. List of water column physical-chemical conditions.

------------- Date=02APR86 N^2=2744.87 Secchi Depth (m)=1.15 -------------

Depth (m)	Temp (C)	pH	D.O. (mg/L)	Cond (mmhos)	ORP (mV)	PAR	Total N (μg/L)	TN:TP	Total P (μg/L)
0.00	18.36	.	11.6700	0.3180	0.0960	128.9	.	.	.
0.50	18.23	.	11.7600	0.3200	0.0960	93.8	260	26	10
1.00	17.96	.	11.9400	0.3200	0.0970	48.3	.	.	.
2.00	16.80	.	13.8800	0.3160	0.0960	15.2	.	.	.
3.00	15.64	.	13.7600	0.3150	0.1010	4.8	.	.	.
4.00	15.03	.	11.4400	0.3230	0.1120	1.1	.	.	.

------------- Date=09APR86 N^2=2416.65 Secchi Depth (m)=1.1 -------------

Depth (m)	Temp (C)	pH	D.O. (mg/L)	Cond (mmhos)	ORP (mV)	PAR	DOC (μg/L)	DOC:DIN (μg/L)	NH_3N
0.00	17.72	.	9.9700	0.3280	0.1230	.	.	.	.
0.50	17.80	.	10.0700	0.3280	0.1220	.	2900	24.1667	52.0000
1.00	17.88	.	10.1500	0.3290	0.1210	.	.	.	.
2.00	17.89	.	10.1900	0.3240	0.1200	.	.	.	.
3.00	15.55	.	8.1800	0.3260	0.1340	.	2700	54.7667	23.0000
4.00	14.42	.	7.9400	0.3440	0.1460	.	.	.	.

Depth (m)	NO_3-N (μg/L)	DOC:SRP	DIN:SRP	SRP (μg/L)	SiO_2 (μg/L)	Total N (μg/L)	TKN:TP	Total P (μg/L)
0.50	68	181.25	7.5	16	40	270	27	10
3.00	26.3	1350	24.65	2	340	.	.	.

------------- Date=17APR86 N^2=68.2902 Secchi Depth (m)=1.0 -------------

Depth (m)	Temp (C)	pH	D.O. (mg/L)	Cond (mmhos)	ORP	PAR	DOC (μg/L)	DOC:DIN	NH^3-N (μg/L)
0.00	15.4200	.	9.8900	0.3100	0.0810	.	.	.	.
0.50	15.5300	.	9.8500	0.3440	0.0830	.	2800	17.3913	22.0000
1.00	15.5200	.	9.8600	0.3430	0.0840	.	.	.	.
2.00	15.5300	.	9.9400	0.3410	0.0840	.	3000	19.3548	48.0000
3.00	15.5200	.	9.8500	0.3410	0.0860	.	.	.	.
4.00	15.4100	.	9.6600	0.3390	0.0870	.	.	.	.
5.00	15.3100	.	9.4800	0.3380	0.0900	.	.	.	.
6.00	15.2000	.	9.6700	0.3380	0.0910	.	.	.	.

Depth (m)	NO_3-N (μg/L)	DOC:SRP	DIN:SRP	SRP (μg/L)	SiO_2	Total N (μg/L)	TKN:TP	Total P (μg/L)
0.50	139	1400	80.5000	2.0000	1130	220	22.0000	10.0000
2.00	107	250	12.9167	12.0000	40.0000	250	250	1.0000

Appendix A. Continued.

------------------------ Date=21APR86 N^2=. Secchi Depth (m)=. ----------------------

Depth (m)	Temp (C)	pH	D.O. (mg/L)	Cond (mmhos)	ORP	PAR	DOC (μg/L)	DOC:DIN	NH_3-N (μg/L)
0.00	16.9400	.	10.2900	0.3390	0.0870	.	.	.	.
0.50	16.9000	.	10.3100	0.3380	0.0860	.	3100	27.4336	38.0000
1.00	16.9000	.	10.4100	0.3380	0.0850	.	.	.	.
2.00	16.7300	.	10.1000	0.3360	0.0850	.	3000	32.2581	43.0000
3.00	16.6500	.	10.1400	0.3370	0.0850	.	.	.	.
4.00	16.4400	.	9.4000	0.3370	0.0890	.	.	.	.

Depth (m)	NO_3-N (μg/L)	DOC:SRP	DIN:SRP	SRP (μg/L)	SiO_2 (μg/L)	Total N (μg/L)	TKN:TP	Total P(μg/L)
0.50	75.0000	163.158	5.9474	19.0000	60.0000	340	17.0000	20.0000
2.00	50.0000	166.667	5.1667	18.0000	130	250	250	1.0000

----------------- Date=24APR86 N^2=661.617 Secchi Depth (m)=0.80 -------------------

Depth (m)	Temp (C)	pH	D.O. (mg/L)	Cond (mmhos)	ORP	PAR	DOC (μg/L)	DOC:DIN	NH^3-N (μg/L)
0.00	16.3200	.	10.8350	0.2860	0.0900	138.6	3200	23.3577	45.0000
0.50	16.2300	.	10.8700	0.3505	0.0875	95.5500	3600	35.2941	13.0000
1.00	16.1700	.	10.8850	0.3495	0.0865	47.1000	3000	13.2159	128
2.00	15.9200	.	10.8050	0.3485	0.0860	11.9000	3100	30.0971	15.0000
3.00	15.7900	.	10.6200	0.3480	0.0860	4.3000	.	.	.
4.00	15.5650	.	10.1600	0.3470	0.0880	1.0500	3400	37.7778	18.0000
5.00	15.4300	.	10.0100	0.3530	0.0900	0.3000	.	.	.
6.00	15.3100	.	9.7000	0.3530	0.0920	.	3200	5.2033	520

Depth (m)	NO_3-N (μg/L)	DOC:SRP	DIN:SRP	SRP (μg/L)	SiO_2 (μg/L)	Total N (μg/L)	TKN:TP	Total P(μg/L)
0.00	92.0000	290.909	12.4545	11.0000	40.0000	230	230	1.0000
0.50	89.0000	900	25.5000	4.0000	810	290	29.0000	10.0000
1.00	99.0000	1000	75.6667	3.0000	560	330	330	1.0000
2.00	88.0000	1550	51.5000	2.0000	1240	300	30.0000	10.0000
4.00	72.0000	850	22.5000	4.0000	640	250	250	1.0000
6.00	95.0000	1600	307.5	2.0000	90.0000	270	27.0000	10.0000

Appendix A. Continued.

------------------ Date=28APR86 N^2=2520.23 Secchi Depth (m)=1.3 ---------------------

Depth (m)	Temp (C)	pH	D.O. (mg/L)	Cond (mmhos)	ORP	PAR	DOC (μg/L)	DOC:DIN	NH_3-N (μg/L)
0.00	20.7100	.	11.5900	0.3240	0.1140	100.7	.	.	.
0.50	20.7500	.	11.6400	0.3240	0.1150	91.7000	.	.	.
1.00	20.6800	.	11.8700	0.3230	0.1160	55.4000	.	.	.
2.00	19.4500	.	13.3600	0.3170	0.1150	26.1000	.	.	0.0000
3.00	18.4300	.	13.0600	0.3180	0.1190	9.3000	.	.	.
4.00	17.2200	.	10.8000	0.3280	0.1240	4.4000	.	.	.
5.00	.	.	.	.	.	1.3000	.	.	.

------------------- Date=01MAY86 N^2=2448.7 Secchi Depth (m)=1.2 ---------------------

Depth (m)	Temp (C)	pH	D.O. (mg/L)	Cond (mmhos)	ORP	PAR	DOC (μg/L)	DOC:DIN	NH_3-N (μg/L)
0.00	21.1250	.	10.5300	0.3270	0.1165	120.05	.	.	0.0000
0.50	21.1200	.	10.7000	0.3270	0.1135	86.9500	.	.	0.0000
1.00	21.1200	.	10.8250	0.3270	0.1125	44.1500	5400	83.0769	50.0000
2.00	20.7000	.	11.2400	0.3260	0.1125	14.4000	3600	65.4545	35.0000
3.00	19.9900	.	11.3700	0.3260	0.1130	7.0500	.	.	.
4.00	18.6550	.	9.7250	0.3305	0.1235	2.0500	.	.	.
5.00	17.4200	.	8.4300	0.3330	0.1250	0.7000	.	.	.
6.00	16.6900	.	6.3100	0.3360	0.1330	.	.	.	0.0000

Depth (m)	NO_3-N (μg/L)	DOC:SRP	DIN:SRP	SRP (μg/L)	SiO_2 (μg/L)	Total N (μg/L)	TKN:TP	Total P(μg/L)
1.00	15.0000	174.194	2.0968	31.0000	90.0000	320	32.0000	10.0000
2.00	20.0000	450	6.8750	8.0000	40.0000	290	290	1.0000

--------------------- Date=09MAY86 N^2=. Secchi Depth (m)=1.1 -----------------------

Depth (m)	Temp (C)	pH	D.O. (mg/L)	Cond (mmhos)	ORP	PAR	DOC (μg/L)	DOC:DIN	NH^3-N (μg/L)
0.00	23.3300	8.1000	.	0.3300	0.0540	175.775	3000	93.7500	22.0000
0.50	23.4650	8.2000	.	0.3055	0.0270	99.1500	.	.	.
1.00	23.3000	8.1500	.	0.3050	0.0275	62.9000	.	.	.
2.00	22.8500	8.2000	.	0.3015	0.0280	28.9500	3100	163.158	19.0000
3.00	22.0150	8.3000	.	0.3000	0.0285	13.7500	.	.	.
4.00	21.3150	8.1000	.	0.3060	0.0305	6.9000	.	.	.
5.00	20.6000	7.5000	.	0.2850	0.0000	1.9000	.	.	.
6.00	19.2000	7.6000	.	0.2960	0.0000	0.2000	5800	53.7037	105

Appendix A. Continued.

--------------------- Date=09MAY86 N^2=. Secchi Depth (m)=1.1 -------------------------

Depth (m)	NO_3-N (µg/L)	DOC:SRP	DIN:SRP	SRP (µg/L)	SiO_2 (µg/L)	Total N (µg/L)	TKN:TP	Total P(µg/L)
0.00	10.0000	1500	16.0000	2.0000	470	250	25.0000	10.0000
2.00	0.0000	3100	19.0000	1.0000	510	370	370	1.0000
6.00	3.0000	414.286	7.7143	14.0000	90.0000	420	14.0000	30.0000

--------------------- Date=27MAY86 N^2=1715.47 Secchi Depth (m)=. --------------------

Depth (m)	Temp (C)	pH	D.O. (mg/L)	Cond (mmhos)	ORP	PAR	DOC (µg/L)	DOC:DIN	NH_3-N (µg/L)
0.00	22.7500	7.6000	10.2400	0.1440	0.1870	133.9	3500	50.7246	49.0000
0.50	22.8200	8.0000	10.4800	0.2620	0.1420	73.6000	.	.	.
1.00	22.4600	7.5000	9.7700	0.2670	0.1810	32.1000	3300	53.2258	49.0000
2.00	22.2500	7.5000	9.3500	0.2670	0.1790	17.1000	.	.	.
3.00	22.0700	7.6000	8.7000	0.2690	0.1810	6.4000	.	.	.
4.00	21.5600	7.4000	6.7500	0.2730	0.1900	2.2000	.	.	.
5.00	20.7700	7.3000	6.3500	0.2750	0.1950	0.1000	.	.	.
6.00	19.7600	7.0000	3.9000	0.2760	0.2070	.	2800	7.7348	179

Depth (m)	NO_3-N (µg/L)	DOC:SRP	DIN:SRP	SRP (µg/L)	SiO_2 (µg/L)	Total N (µg/L)	TKN:TP	Total P(µg/L)
0.00	20.0000	388.889	7.6667	9.0000	170	380	38.0000	10.0000
1.00	13.0000	330	6.2000	10.0000	1040	440	44.0000	10.0000
6.00	183	933.333	120.667	3.0000	2950	440	44.0000	10.0000

------------------ Date=28MAY86 N^2=2125.04 Secchi Depth (m)=1.4 --------------------

Depth (m)	Temp (C)	pH	D.O. (mg/L)	Cond (mmhos)	ORP	PAR	DOC (µg/L)	DOC:DIN	NH^3-N (µg/L)
0.00	23.3200	7.6500	11.0150	0.2450	0.5770	114.85	.	.	.
0.50	23.2350	7.6500	10.8400	0.2455	0.5750	88.8500	3400	48.5714	40.0000
1.00	23.1350	7.6000	10.7300	0.2455	0.5785	59.5000	.	.	.
1.50	.	.	.	.	.	33.8500	4000	54.0541	59.0000
2.00	22.6900	7.6000	10.3600	0.2475	0.5690	20.8000	.	.	.
3.00	22.1400	7.6000	8.1500	0.2525	0.5830	10.1000	.	.	.
4.00	21.7450	7.3500	6.3200	0.2540	0.5980	3.7000	.	.	.
5.00	20.9100	7.1000	5.5250	0.2555	0.6035	0.6000	.	.	.
6.00	18.9500	7.1000	4.8050	0.2580	0.5000	0.2000	3500	10.5105	183
7.00	16.4000	7.0000	5.3500	0.2650	0.4370	.	.	.	.
8.00	15.2100	7.1000	6.3000	0.2610	0.4030	.	.	.	0.0000
9.00	15.0400	7.2000	6.0400	0.2600	0.3880	.	.	.	.

Appendix A. Continued.

------------------ Date=28MAY86 N^2=2125.04 Secchi Depth (m)=1.4 --------------------

Depth (m)	NO_3-N (μg/L)	DOC:SRP	DIN:SRP	SRP (μg/L)	SiO_2 (μg/L)	Total N (μg/L)	TKN:TP	Total P(μg/L)
0.50	30.0000	566.667	11.6667	6.0000	90.0000	370	370	1.0000
1.50	15.0000	307.692	5.6923	13.0000	130	370	18.5000	20.0000
6.00	150	500	47.5714	7.0000	260	390	39.0000	10.0000
8.00	0.0000	.	.	0.0000	.	290	290	1.0000

------------------- Date=03JUN86 N^2=3735.4 Secchi Depth (m)=1.4 --------------------

Depth (m)	Temp (C)	pH	D.O. (mg/L)	Cond (mmhos)	ORP	PAR	DOC (μg/L)	DOC:DIN	NH_3-N (μg/L)
0.00	25.1750	7.5500	10.7850	0.2565	0.1310	112.75	.	.	.
0.50	25.0150	7.7500	10.8950	0.2605	0.1380	78.3000	3800	126.667	22.0000
1.00	24.9150	8.0500	10.8650	0.2615	0.1410	45.0500	.	.	.
2.00	24.5050	8.0500	11.0150	0.2615	0.1450	30.1500	.	.	.
3.00	22.7150	7.8000	8.7600	0.2735	0.1610	10.7500	.	.	.
3.50	.	.	.	.	.	.	4000	23.2558	82.0000
4.00	20.7250	7.4500	4.0250	0.2785	0.1920	7.3000	.	.	.
5.00	17.9900	7.7000	7.8400	0.2790	0.1890	1.5000	.	.	.
6.00	15.5200	7.6000	6.9300	0.2780	0.1960	0.5000	.	.	.
7.00	15.0600	8.0000	6.3700	0.2770	0.2000	0.2000	.	.	.
8.00	14.4200	8.0000	6.5400	0.2760	0.2020	.	2900	5.6974	90.0000

Depth (m)	NO_3-N (μg/L)	DOC:SRP	DIN:SRP	SRP (μg/L)	SiO_2 (μg/L)	Total N (μg/L)	TKN:TP	Total P(μg/L)
0.50	8.0000	.	.	0.0000	1280	330	33.0000	10.0000
2.50	70.0000	1066.67	31.3333	3.0000	1710	450	45.0000	10.0000
3.50	90.0000	1333.33	57.3333	3.0000	3020	440	44.0000	10.0000
8.00	419	2900	509	1.0000	3600	330	33.0000	10.0000

------------------ Date=05JUN86 N^2=3099.59 Secchi Depth (m)=1.5 --------------------

Depth (m)	Temp (C)	pH	D.O. (mg/L)	Cond (mmhos)	ORP	PAR	DOC (μg/L)	DOC:DIN	NH^3-N (μg/L)
0.00	24.0900	7.8500	10.3350	0.2660	0.1815	134.3	.	.	.
0.50	24.0700	7.8000	10.3450	0.2645	0.1815	60.4000	3600	38.7097	43.0000
1.00	24.0050	7.7500	10.3300	0.2645	0.1825	35.1000	.	.	.
2.00	23.8100	7.5000	9.4100	0.2675	0.1880	24.1000	4900	42.2414	57.0000
3.00	22.7400	7.4000	7.4050	0.2750	0.2065	8.9000	4100	23.4286	88.0000
4.00	20.4900	7.2000	5.5900	0.2790	0.2225	1.8000	4000	13.2013	103
4.50	.	.	.	.	.	.	3100	9.9359	123
5.00	17.4850	7.1500	5.7550	0.2765	0.2355	.	.	.	.
6.00	15.2100	7.5000	7.7100	0.2740	0.2370	.	.	.	.
7.00	14.4200	7.5000	6.6400	0.2770	0.2420	.	.	.	.
8.00	13.4100	7.5000	7.5100	0.2730	0.2430	.	.	.	.

Appendix A. Continued.

------------------ Date=05JUN86 N^2=3099.59 Secchi Depth (m)=1.5 ----------------------

Depth (m)	NO_3-N (μg/L)	DOC:SRP	DIN:SRP	SRP (μg/L)	SiO_2 (μg/L)	Total N (μg/L)	TKN:TP	Total P(μg/L)
0.50	50.0000	.	.	0.0000	1540	310	15.5000	20.0000
2.00	59.0000	490	11.6000	10.0000	210	380	380	1.0000
3.00	87.0000	585.714	25.0000	7.0000	170	330	330	1.0000
4.00	200	.	.	0.0000	2820	370	370	1.0000
4.50	189	.	.	0.0000	3380	400	40.0000	10.0000

------------------ Date=10JUN86 N^2=4114.2 Secchi Depth (m)=1.5042 ------------------

Depth (m)	Temp (C)	pH	D.O. (mg/L)	Cond (mmhos)	ORP	PAR	DOC (μg/L)	DOC:DIN	NH_3-N ($\mu\gamma/\Lambda$)
0.00	26.8250	7.6500	9.9850	0.2585	0.1270	62.1000	.	.	.
0.50	26.8450	7.6000	9.9550	0.2570	0.1235	31.6000	2600	152.941	10.0000
1.00	26.7950	7.5500	9.7500	0.2570	0.1375	22.5000	.	.	.
2.00	25.9700	7.5500	10.5800	0.2590	0.1405	22.1000	.	.	.
3.00	24.1100	7.5000	9.0100	0.2705	0.1645	13.9000	3600	21.0526	52.0000
4.00	21.6550	7.4000	7.1600	0.2775	0.1770	6.4000	.	.	.
5.00	19.7850	7.2000	3.8150	0.2795	0.1970	1.6000	.	.	.
6.00	17.1700	7.4000	5.4300	0.2800	0.2010	1.7000	2400	4.8682	70.0000

------------------ Date=10JUN86 N^2=4114.2 Secchi Depth (m)=1.5 ---------------------

Depth (m)	NO_3-N (μg/L)	DOC:SRP	DIN:SRP	SRP (μg/L)	SiO_2 (μg/L)	Total N (μg/L)	TKN:TP	Total P(μg/L)
0.50	7.0000	.	.	0.0000	1370	190	190	1.0000
3.00	119	.	.	0.0000	560	260	260	1.0000
6.00	423	.	.	0.0000	3400	230	230	1.0000

----------------- Date=20JUN86 N^2=3654.45 Secchi Depth (m)=1.5 ---------------------

Depth (m)	Temp (C)	pH	D.O. (mg/L)	Cond (mmhos)	ORP	PAR	DOC (μg/L)	DOC:DIN	NH^3-N (μg/L)
0.00	26.5350	7.5500	10.2650	0.2595	0.1460	143.4	3300	97.0588	15.0000
0.50	26.5200	7.7500	10.2700	0.2600	0.1470	111.8	3400	113.333	15.0000
0.50	26.5200	7.7500	10.2700	0.2600	0.1470	111.8	2800	147.368	10.0000
1.00	26.4300	8.0000	10.2500	0.2590	0.1480	65.4000	.	.	.
2.00	26.1650	8.0500	10.8950	0.2570	0.1485	27.2000	.	.	.
3.00	25.6650	8.0000	10.6200	0.2560	0.1525	15.2000	3400	35.7895	17.0000
4.00	25.1550	7.6000	6.7800	0.2660	0.1745	7.1000	.	.	.
5.00	22.9700	7.5000	4.4000	0.2770	0.1970	2.5000	.	.	.
6.00	19.8500	7.4000	3.1700	0.2830	0.2120	1.0000	2800	6.1135	88.0000
7.00	18.3000	7.6000	3.4800	0.2810	0.2170	0.9000	.	.	.

Appendix A. Continued.

------------------ Date=20JUN86 N^2=3654.45 Secchi Depth (m)=1.5 --------------------

Depth (m)	NO_3-N (μg/L)	DOC:SRP	DIN:SRP	SRP (μg/L)	SiO_2 (μg/L)	Total N (μg/L)	TKN:TP	Total P(μg/L)
0.00	19.0000	.	.	0.0000	1480	320	16.0000	20.0000
0.50	15.0000	3400	30.0000	1.0000	1970	200	20.0000	10.0000
3.00	78.0000	.	.	0.0000	1580	270	27.0000	10.0000
6.00	370	.	.	0.0000	3550	350	35.0000	10.0000

------------------ Date=26JUN86 N^2=3957.26 Secchi Depth (m)=1.75 -------------------

Depth (m)	Temp (C)	pH	D.O. (mg/L)	Cond (mmhos)	ORP	PAR	DOC (μg/L)	DOC:DIN	NH_3-N (μg/L)
0.00	27.6000	7.8500	10.5000	0.2505	0.1330	.	.	.	.
0.50	27.5800	7.8000	10.6050	0.2505	0.1380	.	2700	41.5385	10.0000
1.00	27.3900	8.1000	10.6900	0.2485	0.1405	.	.	.	.
2.00	27.1900	8.1000	10.5350	0.2490	0.1440	.	.	.	0.0000
3.00	26.6550	8.0000	9.8700	0.2525	0.1520	.	.	.	.
4.00	24.4700	7.7500	8.8550	0.2655	0.1685	.	2500	12.1951	75.0000
5.00	21.3700	7.6000	6.0250	0.2770	0.1865	.	.	.	.
6.00	18.7650	7.5500	5.1850	0.2800	0.2040	.	2600	5.0290	72.0000
7.00	17.7900	7.9500	3.2400	0.2815	0.2110	.	.	.	.

Depth (m)	NO_3-N (μg/L)	DOC:SRP	DIN:SRP	SRP (μg/L)	SiO_2 (μg/L)	Total N (μg/L)	TKN:TP	Total P(μg/L)
0.50	55.0000	.	.	0.0000	1110	330	8.2500	40.0000
2.00	0.0000	.	.	0.0000	.	310	15.5000	20.0000
4.00	130	357.143	29.2857	7.0000	170	330	33.0000	10.0000
6.00	445	.	.	0.0000	3470	340	34.0000	10.0000

------------------ Date=01JUL86 N^2=4799.76 Secchi Depth (m)=1.3 --------------------

Depth (m)	Temp (C)	pH	D.O. (mg/L)	Cond (mmhos)	ORP	PAR	DOC (μg/L)	DOC:DIN	NH^3-N (μg/L)
0.00	29.2100	7.5000	9.6200	0.2460	0.1730	139.9	.	.	.
0.50	29.2100	7.5000	9.6000	0.2460	0.1720	92.6000	3400	59.6491	44.0000
1.00	29.1100	7.6000	9.7000	0.2450	0.1730	52.6000	3400	136	17.0000
2.00	28.8100	8.0000	9.6300	0.2430	0.1750	26.3000	3200	72.7273	32.0000
3.00	26.6400	8.0000	9.9700	0.2440	0.1810	12.9000	4100	24.8485	33.0000
4.00	23.0200	7.6000	7.9500	0.2720	0.2090	5.5000	3300	8.2090	60.0000
5.00	20.6700	7.7000	3.1800	0.2820	0.2290	0.8000	3100	6.1265	62.0000
6.00	18.5600	8.0000	6.8200	0.2770	0.2320	0.2000	3300	5.7391	20.0000
7.00	17.5600	8.1000	4.9500	0.2790	0.2360	.	.	.	.

Appendix A. Continued.

------------------ Date=01JUL86 N^2=4799.76 Secchi Depth (m)=1.3 --------------------

Depth (m)	NO_3-N (µg/L)	DOC:SRP	DIN:SRP	SRP (µg/L)	SiO_2 (µg/L)	Total N (µg/L)	TKN:TP	Total P(µg/L)
0.50	13.0000	1133.33	19.0000	3.0000	1070	280	280	1.0000
1.00	8.0000	1700	12.5000	2.0000	900	320	320	1.0000
2.00	12.0000	457.143	6.2857	7.0000	980	310	310	1.0000
3.00	132	.	.	0.0000	1800	310	310	1.0000
4.00	342	.	.	0.0000	2400	290	290	1.0000
5.00	444	.	.	0.0000	3250	280	280	1.0000
6.00	555	.	.	0.0000	3470	220	220	1.0000

----------------- Date=10JUL86 N^2=1866.06 Secchi Depth (m)=1.2 ----------------------

Depth (m)	Temp (C)	pH	D.O. (mg/L)	Cond (mmhos)	ORP	PAR	DOC (µg/L)	DOC:DIN	NH_3-N (µg/L)
0.00	28.1500	.	9.8350	0.1655	0.1790	137.6	.	.	.
0.50	28.9700	.	9.9150	0.2440	0.1785	98.9000	3400	154.545	20.0000
1.00	28.9600	.	9.8150	0.2425	0.1800	62.4000	3100	134.783	20.0000
2.00	28.5300	.	9.8650	0.2450	0.1845	20.9000	2.0000	0.080	20.0000
3.00	27.1400	.	8.9650	0.2525	0.1935	8.4000	3500	53.8462	10.0000
4.00	24.5250	.	5.5700	0.2680	0.2195	1.7000	3500	14.7059	50.0000
5.00	21.8200	.	4.7250	0.2770	0.2335	0.6000	2300	5.1685	90.0000
6.00	20.2300	.	4.2450	0.2795	0.2415	0.0000	2300	4.5908	60.0000
7.00	19.1050	.	2.9450	0.2810	0.2465	.	.	.	.

Depth (m)	NO_3-N (µg/L)	DOC:SRP	DIN:SRP	SRP (µg/L)	SiO_2 (µg/L)	Total N (µg/L)	TKN:TP	Total P(µg/L)
0.50	2.0000	680	4.4000	5.0000	1580	250	250	1.0000
1.00	3.0000	3100	23.0000	1.0000	1330	330	330	1.0000
2.00	5.0000	0.0007	0.0083	3000	860	310	310	1.0000
3.00	55.0000	205.882	3.8235	17.0000	0.0000	230	230	1.0000
4.00	188	70.0000	4.7600	50.0000	0.0000	270	270	1.0000
5.00	355	766.667	148.333	3.0000	0.0000	340	17.0000	20.0000
6.00	441	60.5263	13.1842	38.0000	0.0000	220	220	1.0000

Appendix A. Continued.

------------------ Date=11JUL86 N^2=2640.11 Secchi Depth (m)=1.3 ----------------------

Depth (m)	Temp (C)	pH	D.O. (mg/L)	Cond (mmhos)	ORP	PAR	DOC (µg/L)	DOC:DIN	NH^3-N (µg/L)
0.00	27.9900	.	9.2700	0.2440	0.1790	180.7	.	.	.
0.50	28.0300	.	9.2700	0.2400	0.1800	114.8	2900	72.5000	30.0000
1.00	28.0000	.	9.2300	0.2390	0.1820	72.6000	.	.	.
2.00	27.9300	.	9.1700	0.2390	0.1840	35.6000	.	.	.
3.00	26.5400	.	8.2700	0.2520	0.1960	15.9000	1400	9.1503	110
4.00	23.3300	.	4.4800	0.2700	0.2250	5.0000	.	.	.
5.00	20.5300	.	5.9200	0.2760	0.2380	3.4000	.	.	.
6.00	18.8000	.	4.8000	0.2750	0.2430	2.9000	.	.	.
7.00	18.0200	.	3.8900	0.2780	0.2460	2.8000	2900	4.8253	80.0000

Depth (m)	NO_3-N (µg/L)	DOC:SRP	DIN:SRP	SRP (µg/L)	SiO_2 (µg/L)	Total N (µg/L)	TKN:TP	Total P(µg/L)
0.50	10.0000	152.632	2.1053	19.0000	0.0000	260	13.0000	20.0000
3.00	43.0000	280	30.6000	5.0000	0.0000	270	13.5000	20.0000
7.00	521	70.7317	14.6585	41.0000	0.0000	230	7.6667	30.0000

------------------ Date=16JUL86 N^2=2586.07 Secchi Depth (m)=1.2 ----------------------

Depth (m)	Temp (C)	pH	D.O. (mg/L)	Cond (mmhos)	ORP	PAR	DOC (µg/L)	DOC:DIN	NH_3-N (µg/L)
0.00	27.4600	8.7500	8.9900	0.2480	0.2220	127.9	.	.	.
0.50	27.5100	8.7800	8.9000	0.2480	0.2220	94.7500	2500	25.0000	90.0000
1.00	27.5100	8.7800	9.8000	0.2440	0.2220	59.8500	3100	18.4524	40.0000
2.00	27.0900	8.7200	8.9400	0.2400	0.2230	24.4500	2800	24.1379	70.0000
3.00	26.0100	8.4400	7.9000	0.2490	0.2360	13.6000	2600	15.4762	40.0000
4.00	24.2300	7.7000	4.0900	0.2660	0.2550	7.1500	2600	6.7532	110
5.00	21.1200	7.6900	6.2100	0.2690	0.2620	4.0500	2500	5.3879	10.0000
6.00	18.1300	7.4000	3.7000	0.2750	0.2720	3.3500	2400	3.9474	70.0000

Depth (m)	NO_3-N (µg/L)	DOC:SRP	DIN:SRP	SRP (µg/L)	SiO_2 (µg/L)	Total N (µg/L)	TKN:TP	Total P(µg/L)
0.50	10.0000	250	10.0000	10.0000	0.0000	250	6.2500	40.0000
1.00	128	172.222	9.3333	18.0000	0.0000	280	14.0000	20.0000
2.00	46.0000	400	16.5714	7.0000	0.0000	250	12.5000	20.0000
3.00	128	20.3125	1.3125	128	0.0000	260	13.0000	20.0000
4.00	275	52.0000	7.7000	50.0000	0.0000	280	14.0000	20.0000
5.00	454	44.6429	8.2857	56.0000	0.0000	260	260	1.0000
6.00	538	38.7097	9.8065	62.0000	0.0000	240	240	1.0000

Appendix A. Continued.

------------------ Date=17JUL86 N^2=4286.89 Secchi Depth (m)=1.3 ----------------------

Depth (m)	Temp (C)	pH	D.O. (mg/L)	Cond (mmhos)	ORP	PAR	DOC (μg/L)	DOC:DIN	NH^3-N (μg/L)
0.00	27.9300	8.5100	9.3600	0.2350	0.1720	145.3	.	.	.
0.50	27.9100	8.5400	9.3800	0.2330	0.1730	102.6	2700	58.6957	40.0000
1.00	27.8100	8.5600	9.5300	0.2330	0.1760	67.5000	.	.	.
2.00	27.4500	8.4300	9.5700	0.2340	0.1790	29.9000	2700	26.4706	40.0000
3.00	26.5600	8.0100	7.2000	0.2420	0.1920	11.9000	.	.	.
4.00	24.6700	7.3400	4.3200	0.2590	0.2110	2.5000	2500	9.3284	100
5.00	22.1400	7.4800	6.3000	0.2610	0.2150	1.1000	.	.	.
6.00	20.1800	7.2600	5.5200	0.2660	0.2200	0.6000	2600	4.9524	50.0000
7.00	19.1200	7.1700	4.1900	0.2670	0.2250	0.5000	.	.	.

Depth (m)	NO_3-N (μg/L)	DOC:SRP	DIN:SRP	SRP (μg/L)	SiO_2 (μg/L)	Total N (μg/L)	TKN:TP	Total P(μg/L)
0.50	6.0000	385.714	6.5714	7.0000	0.0000	240	240	1.0000
2.00	62.0000	158.824	6.0000	17.0000	0.0000	230	230	1.0000
4.00	168	62.5000	6.7000	40.0000	0.0000	260	260	1.0000
6.00	475	34.2105	6.9079	76.0000	0.0000	200	200	1.0000

------------------ Date=23JUL86 N^2=3461.63 Secchi Depth (m)=1.3 ----------------------

Depth (m)	Temp (C)	pH	D.O. (mg/L)	Cond (mmhos)	ORP	PAR	DOC (μg/L)	DOC:DIN	NH_3-N (μg/L)
0.00	29.7500	8.5200	9.7200	0.2350	0.2830	130.8	.	.	.
0.50	29.7500	8.5500	9.7600	0.2350	0.2830	88.5000	3500	31.5315	80.0000
1.00	29.7700	8.5600	9.8200	0.2340	0.2770	47.7000	3200	71.1111	40.0000
1.50	.	.	.	.	.	37.7000	.	.	.
2.00	28.5700	8.5700	12.6700	0.2300	0.2770	24.6000	3500	57.3770	20.0000
3.00	26.4500	8.3300	11.1600	0.2430	0.2880	12.9000	3200	23.1884	30.0000
4.00	23.5000	7.8300	7.3500	0.2560	0.3010	6.5000	2700	8.6538	30.0000
5.00	20.6800	7.4400	5.6000	0.2670	0.3130	3.3000	3200	7.0953	30.0000
6.00	19.3400	7.2800	4.3300	0.2700	0.3190	0.9000	2800	5.5556	40.0000
7.00	17.8400	7.1500	2.9200	0.2700	0.3230	.	.	.	.

Depth (m)	NO_3-N (μg/L)	DOC:SRP	DIN:SRP	SRP (μg/L)	SiO_2 (μg/L)	Total N (μg/L)	TKN:TP	Total P(μg/L)
0.50	31.0000	26.1194	0.8284	134	0.0000	310	310	1.0000
1.00	5.0000	188.235	2.6471	17.0000	0.0000	280	280	1.0000
2.00	41.0000	152.174	2.6522	23.0000	0.0000	290	290	1.0000
3.00	108	94.1176	4.0588	34.0000	0.0000	380	380	1.0000
4.00	282	71.0526	8.2105	38.0000	0.0000	290	14.5000	20.0000
5.00	421	49.2308	6.9385	65.0000	0.0000	210	10.5000	20.0000
6.00	464	40.5797	7.3043	69.0000	0.0000	240	12.0000	20.0000

Appendix A. Continued.

------------------ Date=24JUL86 N^2=3829.11 Secchi Depth (m)=1.5 ----------------------

Depth (m)	Temp (C)	pH	D.O. (mg/L)	Cond (mmhos)	ORP	PAR	DOC (µg/L)	DOC:DIN	NH^3-N (µg/L)
0.00	29.9200	8.5100	9.8800	0.2300	0.1960	127.9	.	.	.
0.50	29.9700	8.5300	9.8800	0.2270	0.1950	96.7000	2800	164.706	10.0000
1.00	29.9400	8.5300	10.0200	0.2270	0.1960	60.4000	.	.	.
2.00	28.6200	8.5000	12.3100	0.2260	0.2000	33.6000	2700	117.391	0.0000
3.00	27.2000	8.1200	9.6800	0.2400	0.2130	14.0000	.	.	.
4.00	24.4400	7.7200	7.2000	0.2530	0.2270	5.1000	.	.	.
5.00	21.9200	7.4500	6.2700	0.2600	0.2380	1.5000	.	.	.
6.00	19.7100	7.0800	2.0900	0.2710	0.2470	0.5000	2900	6.3877	10.0000
7.00	18.1300	7.1600	3.6000	0.2330	0.2490	.	.	.	.

Depth (m)	NO_3-N (µg/L)	DOC:SRP	DIN:SRP	SRP (µg/L)	SiO_2 (µg/L)	Total N (µg/L)	TKN:TP	Total P(µg/L)
0.50	7.0000	121.739	0.7391	23.0000	0.0000	300	15.0000	20.0000
2.00	23.0000	117.391	1.0000	23.0000	0.0000	340	34.0000	10.0000
6.00	444	40.8451	6.3944	71.0000	0.0000	310	310	1.0000

------------------ Date=30JUL86 N^2=3257.42 Secchi Depth (m)=1.25 ----------------------

Depth (m)	Temp (C)	pH	D.O. (mg/L)	Cond (mmhos)	ORP	PAR	DOC (µg/L)	DOC:DIN	NH_3-N (µg/L)
0.00	28.8200	8.5300	9.9800	0.2373	0.1663	126.333	.	.	.
0.50	28.7933	8.5300	10.0133	0.2353	0.1640	99.9333	2500	23.8095	30.0000
1.00	28.5733	8.5333	10.1200	0.2350	0.1640	70.6333	3100	35.6322	30.0000
2.00	28.1800	8.5267	10.2800	0.2340	0.1657	34.6667	3100	26.2712	40.0000
3.00	26.9500	8.3367	10.8600	0.2450	0.1723	14.3000	2500	9.6154	40.0000
4.00	24.1567	7.7033	6.9467	0.2593	0.1843	5.8667	2300	5.7789	40.0000
5.00	22.0067	7.2800	4.4167	0.2687	0.1993	2.2333	2400	5.6604	50.0000
6.00	19.8533	7.1600	3.6200	0.2720	0.2070	0.4333	2300	4.8936	10.0000
7.00	18.3667	7.1400	3.5533	0.2680	0.2093	.	.	.	.

Depth (m)	NO_3-N (µg/L)	DOC:SRP	DIN:SRP	SRP (µg/L)	SiO_2 (µg/L)	Total N (µg/L)	TKN:TP	Total P(µg/L)
0.50	75.0000	125	5.2500	20.0000	0.0000	230	230	1.0000
1.00	57.0000	100	2.8065	31.0000	0.0000	270	270	1.0000
2.00	78.0000	73.8095	2.8095	42.0000	0.0000	220	22.0000	10.0000
3.00	220	69.4444	7.2222	36.0000	0.0000	260	260	1.0000
4.00	358	27.3810	4.7381	84.0000	0.0000	200	20.0000	10.0000
5.00	374	47.0588	8.3137	51.0000	0.0000	210	21.0000	10.0000
6.00	460	37.7049	7.7049	61.0000	0.0000	210	210	1.0000

Appendix A. Continued.

------------------ Date=01AUG86 N^2=3244.69 Secchi Depth (m)=1.4 ----------------------

Depth (m)	Temp (C)	pH	D.O. (mg/L)	Cond (mmhos)	ORP	PAR	DOC (µg/L)	DOC:DIN	NH^3-N (µg/L)
0.00	26.7600	8.3800	9.1300	0.2470	0.1750	100	.	.	.
0.50	26.7700	8.3800	9.1100	0.2460	0.1740	64.7000	3100	35.6322	20.0000
1.00	26.7900	8.3800	9.1000	0.2450	0.1740	36.1000	.	.	.
2.00	26.8000	8.3800	9.1000	0.2450	0.1750	22.1000	.	.	.
3.00	26.8100	8.3500	8.9500	0.2430	0.1740	13.3000	2800	19.0476	30.0000
4.00	24.2100	7.3700	6.3100	0.2660	0.1900	6.1000	.	.	.
5.00	21.3000	7.2700	4.2500	0.2760	0.2010	2.1000	.	.	.
6.00	19.4300	7.1700	4.2900	0.2740	0.2050	0.9000	2400	4.0678	80.0000
7.00	18.1000	7.1300	3.8500	0.2740	0.2070	.	.	.	.

Depth (m)	NO_3-N (µg/L)	DOC:SRP	DIN:SRP	SRP (µg/L)	SiO_2 (µg/L)	Total N (µg/L)	TKN:TP	Total P(µg/L)
0.50	67.0000	119.231	3.3462	26.0000	0.0000	200	200	1.0000
3.00	117	96.5517	5.0690	29.0000	0.0000	170	17.0000	10.0000
6.00	510	480	118	5.0000	0.0000	130	130	1.0000

------------------ Date=04AUG86 N^2=1773.57 Secchi Depth (m)=1.3 ----------------------

Depth (m)	Temp (C)	pH	D.O. (mg/L)	Cond (mmhos)	ORP	PAR	DOC (µg/L)	DOC:DIN	NH_3-N (µg/L)
0.00	27.3233	8.5600	10.0400	0.2440	0.1773	124.633	.	.	.
0.50	27.3200	8.5600	10.0267	0.2427	0.1753	92.9333	3100	34.4444	0.0000
1.00	27.2267	8.5633	10.0900	0.2420	0.1747	58.1000	3000	27.2727	20.0000
2.00	26.6333	8.6000	10.5233	0.2387	0.1747	29.1000	2900	23.0159	20.0000
3.00	26.1833	8.4967	10.4833	0.2413	0.1767	15.1333	3400	10.4615	10.0000
4.00	24.4867	7.4567	4.8867	0.2603	0.1967	8.5667	3000	5.4250	60.0000
5.00	21.7333	7.2067	3.5433	0.2710	0.2053	2.8000	2300	3.5714	100
6.00	19.6867	7.1733	3.4900	0.2713	0.2097	0.7000	1900	3.2423	50.0000
7.00	18.5067	7.1167	2.4900	0.2710	0.2117	0.2000	.	.	.

Depth (m)	NO_3-N (µg/L)	DOC:SRP	DIN:SRP	SRP (µg/L)	SiO_2 (µg/L)	Total N (µg/L)	TKN:TP	Total P(µg/L)
0.50	90.0000	110.714	3.2143	28.0000	0.0000	160	16.0000	10.0000
1.00	90.0000	750	27.5000	4.0000	0.0000	150	15.0000	10.0000
2.00	106	87.8788	3.8182	33.0000	0.0000	160	16.0000	10.0000
3.00	315	109.677	10.4839	31.0000	0.0000	150	7.5000	20.0000
4.00	493	66.6667	12.2889	45.0000	0.0000	180	180	1.0000
5.00	544	33.3333	9.3333	69.0000	0.0000	180	180	1.0000
6.00	536	28.3582	8.7463	67.0000	0.0000	110	110	1.0000

Appendix A. Continued.

------------------ Date=29AUG86 N^2=730.523 Secchi Depth (m)=1 -------------------------

Depth (m)	Temp (C)	pH	D.O. (mg/L)	Cond (mmhos)	ORP	PAR	DOC (μg/L)	DOC:DIN	NH^3-N (μg/L)
0.00	24.1900	8.1500	8.2700	0.2540	0.1970	.	.	.	.
0.50	24.2800	8.2000	8.2000	0.2540	0.1910	.	2600	14.0541	40.0000
1.00	24.3400	8.2000	8.1600	0.2510	0.1900	.	.	.	.
2.00	24.3800	8.2100	8.1500	0.2500	0.1900	.	.	.	.
3.00	24.4100	8.2100	8.1000	0.2470	0.1900	.	2800	14.0000	50.0000
4.00	24.4900	8.2100	8.0600	0.2470	0.1900	.	.	.	.
5.00	23.4200	7.3600	4.3000	0.2750	0.1970	.	2400	5.6338	70.0000
6.00	22.0100	7.1700	2.3400	0.2800	0.2080	.	.	.	.
7.00	20.2100	7.1700	2.3400	0.2800	0.2090	.	2100	3.5058	50.0000
8.00	19.3300	7.1600	2.5700	0.2830	0.2110	.	.	.	.

Depth (m)	NO_3-N (μg/L)	DOC:SRP	DIN:SRP	SRP (μg/L)	SiO_2 (μg/L)	Total N (μg/L)	TKN:TP	Total P(μg/L)
0.50	145	650	46.2500	4.0000	0.0000	280	280	1.0000
3.00	150	93.3333	6.6667	30.0000	0.0000	220	220	1.0000
5.00	356	42.1053	7.4737	57.0000	0.0000	230	230	1.0000
7.00	549	28.0000	7.9867	75.0000	0.0000	190	190	1.0000

------------------ Date=04SEP86 N^2=1099.92 Secchi Depth (m)=1.3 ----------------------

Depth (m)	Temp (C)	pH	D.O. (mg/L)	Cond (mmhos)	ORP	PAR	DOC (μg/L)	DOC:DIN	NH_3-N (μg/L)
0.00	23.4300	7.9500	8.1000	0.2530	0.2470	103.3	.	.	.
0.50	23.4600	8.0400	7.9800	0.2530	0.2470	78.5000	2900	15.8470	40.0000
1.00	23.4600	8.0400	7.8600	0.2500	0.2290	41.4000	2400	16.1074	20.0000
2.00	23.0400	7.7700	7.8700	0.2580	0.2270	21.8000	3200	12.2137	30.0000
3.00	22.9200	8.1100	8.6000	0.2630	0.2260	12.7000	2800	7.9772	30.0000
4.00	22.5700	7.8200	6.3200	0.2650	0.2220	8.0000	2700	7.2581	40.0000
5.00	22.2200	7.6300	6.6700	0.2660	0.2240	6.3000	2700	6.2937	50.0000
6.00	21.6000	7.3500	3.3500	0.2690	0.2270	5.7000	2500	4.7710	110
7.00	20.3400	7.2000	2.8600	0.2730	0.2320	5.4000	.	.	.

Depth (m)	NO_3-N (μg/L)	DOC:SRP	DIN:SRP	SRP (μg/L)	SiO_2 (μg/L)	Total N (μg/L)	TKN:TP	Total P(μg/L)
0.50	143	20.2797	1.2797	143	0.0000	190	190	1.0000
1.00	129	18.6047	1.1550	129	0.0000	190	190	1.0000
2.00	232	64.0000	5.2400	50.0000	0.0000	230	230	1.0000
3.00	321	44.4444	5.5714	63.0000	0.0000	200	200	1.0000
4.00	332	54.0000	7.4400	50.0000	0.0000	240	240	1.0000
5.00	379	47.3684	7.5263	57.0000	0.0000	660	660	1.0000
6.00	414	43.1034	9.0345	58.0000	0.0000	210	210	1.0000

Appendix A. Continued.

------------------ Date=10SEP86 N^2=2285.39 Secchi Depth (m)=1.3 ----------------------

Depth (m)	Temp (C)	pH	D.O. (mg/L)	Cond (mmhos)	ORP	PAR	DOC (μg/L)	DOC:DIN	NH^3-N (μg/L)
0.00	24.0300	8.4900	9.7500	0.2590	0.2220	129.4	.	.	.
0.50	23.9700	8.4900	9.7200	0.2590	0.2180	96.4000	2500	13.8889	30.0000
1.00	23.7800	8.5000	9.8400	0.2580	0.2170	69.6000	.	.	0.0000
2.00	23.4000	8.5300	10.6000	0.2570	0.2160	35.6500	2500	4.0717	20.0000
3.00	23.0200	8.4700	10.4000	0.2580	0.2160	10.7500	2500	8.5616	60.0000
4.00	22.6700	8.0000	7.6000	0.2650	0.2200	4.2500	2800	8.6687	40.0000
5.00	21.5100	7.3300	3.1000	0.2780	0.2310	1.4500	2600	5.4622	80.0000
6.00	19.5800	7.2300	3.1000	0.2790	0.2400	0.3500	2600	4.1534	60.0000
7.00	18.2500	7.1900	3.1600	0.2780	0.2440	.	.	.	.

Depth (m)	NO_3-N (μg/L)	DOC:SRP	DIN:SRP	SRP (μg/L)	SiO_2 (μg/L)	Total N (μg/L)	TKN:TP	Total P(μg/L)
0.50	150	277.778	20.0000	9.0000	0.0000	200	200	1.0000
1.00	0	.	.	0	.	210	210	1.0000
2.00	594	49.0196	12.0392	51.0000	0.0000	280	28.0000	10.0000
3.00	232	48.0769	5.6154	52.0000	0.0000	230	23.0000	10.0000
4.00	283	45.9016	5.2951	61.0000	0.0000	210	210	1.0000
5.00	396	33.7662	6.1818	77.0000	0.0000	190	19.0000	10.0000
6.00	566	26.2626	6.3232	99.0000	0.0000	210	7.0000	30.0000

------------------ Date=12SEP86 N^2=2117.4 Secchi Depth (m)=1.3 -----------------------

Depth (m)	Temp (C)	pH	D.O. (mg/L)	Cond (mmhos)	ORP	PAR	Total N (μg/L)	TN:TP	Total P (μg/L)
0.00	23.8900	8.6300	9.9600	0.2520	0.2220	141.7	.	.	.
0.50	23.9100	8.6200	9.8100	0.2550	0.2220	63.5000	240	8	30
1.00	23.9100	8.6300	9.8400	0.2560	0.2230	26.9000	.	.	.
2.00	23.9100	8.6300	9.8400	0.2560	0.2230	15.1000	.	.	.
3.00	23.5700	8.6100	10.0400	0.2520	0.2240	12.1000	240	24	10
4.00	23.3300	8.3100	8.6700	0.2570	0.2290	8.4000	.	.	.
5.00	21.5500	7.6200	5.8200	0.2720	0.2430	5.2000	.	.	.
6.00	19.9900	7.4000	4.0900	0.2770	0.2540	4.9000	.	.	.
7.00	18.6700	7.4000	4.5400	0.2760	0.2620	5.1000	240	24	10

Appendix A. Continued.

------------------ Date=16SEP86 N^2=2130.73 Secchi Depth (m)=1.4 ----------------------

Depth (m)	Temp (C)	pH	D.O. (mg/L)	Cond (mmhos)	ORP	PAR	Total N (µg/L)	TN:TP	Total P (µg/L)
0.00	23.7600	8.5400	10.0900	0.2560	0.2600	113.8	.	.	.
0.50	23.8300	8.5100	10.1100	0.2550	0.2580	94.3000	220	22	10
1.00	23.8300	8.5100	10.1400	0.2540	0.2570	59.1000	.	.	.
2.00	23.7600	8.5600	10.3900	0.2520	0.2560	34.4000	.	.	.
3.00	23.0700	8.4600	10.5700	0.2540	0.2510	22.3000	190	190	1
4.00	22.4400	8.2700	9.2900	0.2620	0.2550	15.7000	.	.	.
5.00	21.3900	7.7000	6.5800	0.2720	0.2670	13.5000	.	.	.
6.00	19.4000	7.3300	4.4700	0.2790	0.2770	10.9000	180	9	20
7.00	18.0600	7.2300	3.3800	0.2810	0.2790	9.7000	180	180	1

------------------ Date=18SEP86 N^2=2155.08 Secchi Depth (m)=1.5 ----------------------

Depth (m)	Temp (C)	pH	D.O. (mg/L)	Cond (mmhos)	ORP	PAR	Total N (µg/L)	TN:TP	Total P (µg/L)
0.00	23.6600	8.6100	10.3500	0.2580	0.2620	.	.	.	.
0.50	23.6900	8.6000	10.2300	0.2570	0.2600	.	200	6.6	30
1.00	23.7300	8.5900	10.2200	0.2570	0.2570	.	.	.	.
2.00	23.7100	8.5900	10.2200	0.2550	0.2560	.	.	.	.
3.00	23.2500	8.3500	9.0700	0.2650	0.2610	.	230	230	1
4.00	22.4700	7.8500	6.9500	0.2710	0.2650	.	.	.	.
5.00	21.2500	7.5900	5.5400	0.2760	0.2730	.	.	.	.
6.00	20.1200	7.3400	3.5400	0.2810	0.2800	.	170	170	1
7.00	18.0000	7.2900	3.6200	0.2840	0.2860	.	200	200	1

------------------- Date=23SEP86 N^2=3000.7 Secchi Depth (m)=1.3 ----------------------

Depth (m)	Temp (C)	pH	D.O. (mg/L)	Cond (mmhos)	ORP	PAR	Total N (µg/L)	TN:TP	Total P (µg/L)
0.00	24.2300	8.4800	9.9600	0.2650	0.2500	138.2	.	.	.
0.50	24.2300	8.4600	9.8800	0.2630	0.2450	89.9000	200	200	1
1.00	24.2700	8.4600	9.8900	0.2630	0.2430	64.0000	250	250	1
2.00	23.8900	8.5100	10.5700	0.2630	0.2410	24.7000	220	22	10
3.00	23.0800	8.1000	8.3300	0.2680	0.2460	13.7000	220	220	1
4.00	21.6000	7.6100	6.1300	0.2780	0.2530	7.4000	200	200	1
5.00	19.6300	7.4300	5.0400	0.2860	0.2600	4.9000	180	180	1
6.00	17.7700	7.3200	5.1600	0.2900	0.2670	2.7000	120	1.7	70
7.00	16.8500	7.2700	4.7200	0.2850	0.2700	.	.	.	.
7.50	16.8400	7.2300	3.7200	0.2840	0.2730	.	.	.	.

Appendix A. Continued.

Date=25SEP86 N^2=2949.99 Secchi Depth (m)=1.3

Depth (m)	Temp (C)	pH	D.O. (mg/L)	Cond (mmhos)	ORP	PAR	Total N (µg/L)	TN:TP	Total P (µg/L)
0.00	24.5900	8.5200	10.0900	0.2640	0.1880	160.6	.	.	.
0.50	24.6100	8.5400	10.0900	0.2630	0.1870	112.1	160	8	20
1.00	24.5700	8.5500	10.1400	0.2620	0.1850	68.7000	.	.	.
2.00	23.9600	8.4800	10.4500	0.2660	0.1870	33.3000	220	220	1
3.00	23.2600	8.2400	9.0800	0.2710	0.1890	14.2000	.	.	.
4.00	22.0500	7.7200	6.3400	0.2810	0.1960	5.1000	.	.	.
5.00	20.4100	7.4700	5.1000	0.2840	0.2060	2.4000	150	150	1
6.00	18.7100	7.3600	4.5500	0.2870	0.2110	1.6000	.	.	.
7.00	17.5500	7.2700	3.7100	0.2860	0.2150	1.2000	130	130	1

Date=02OCT86 N^2=. Secchi Depth (m)=.

Depth (m)	Total N (µg/L)	TKN:TP	Total P(µg/L)
0.50	200	4.0000	50.0000
3.00	170	4.2500	40.0000
4.00	130	130	1.0000
6.00	130	13.0000	10.0000

Date=21OCT86 N^2=172.588 Secchi Depth (m)=1.3

Depth (m)	Temp (C)	pH	D.O. (mg/L)	Cond (mmhos)	ORP	PAR	Total N (µg/L)	TKN:TP	Total P(µg/L)
0.00	16.3900	7.7700	8.6000	0.1100	0.3100	178.1	150	15	10
0.50	16.6500	7.7900	8.4900	0.2930	0.2320	76.0000	.	.	
1.00	16.7100	7.8000	8.4200	0.2940	0.2320	41.1000	.	.	
2.00	16.7300	7.8100	8.3900	0.2920	0.2310	14.4000	180	2.25	80
3.00	16.7500	7.8000	8.2300	0.2900	0.2330	7.4000	.	.	
4.00	16.6600	7.6200	7.2200	0.2920	0.2350	2.5000	.	.	
5.00	16.6500	7.5700	6.7600	0.2920	0.2410	0.6000	.	.	
6.00	16.5600	7.6000	7.2800	0.2900	0.2410	0.2000	150	1.67	90
7.00	16.5200	7.5500	6.6600	0.2890	0.2430	0.1000	.	.	

Appendix A. Continued.

------------------ Date=23OCT86 N^2=251.956 Secchi Depth (m)=1.3 ----------------------

Depth (m)	Temp (C)	pH	D.O. (mg/L)	Cond (mmhos)	ORP	PAR	Total N (μg/L)	TKN:TP	Total P(μg/L)
0.00	15.8100	7.5500	8.3600	0.2970	0.2480	112.05	.	.	
0.50	15.8200	7.6400	8.2900	0.2970	0.2460	81.1500	130	2.167	60
1.00	15.8200	7.6600	8.2900	0.2960	0.2430	41.1000	220	22	10
2.00	15.7700	7.6700	8.2400	0.2960	0.2430	10.9000	220	220	1
3.00	15.5400	7.5900	8.1700	0.2960	0.2460	3.5000	140	140	1
4.00	15.4300	7.5700	8.1400	0.2940	0.2460	1.2000	140.	140	1
5.00	15.4100	7.5600	8.0000	0.2960	0.2480	0.5000	.	.	

------------------ Date=27OCT86 N^2=210.373 Secchi Depth (m)=1.1 ----------------------

Depth (m)	Temp (C)	pH	D.O. (mg/L)	Cond (mmhos)	ORP	PAR	Total N (μg/L)	TKN:TP	Total P(μg/L)
0.00	15.9800	7.4700	8.8600	0.2960	0.2610	160	2.28	7	
1.00	15.9500	7.5400	8.7800	0.2940	0.2430	200	2.2	9	
2.00	15.9100	7.5000	8.3500	0.2930	0.2430	.	.	.	
3.00	15.7900	7.4300	7.9300	0.2920	0.2450	150	150	1	
4.00	15.7400	7.3800	7.4400	0.2920	0.2450	.	.	.	
5.00	15.6500	7.3600	7.1200	0.2900	0.2460	.	.	.	
6.00	15.6700	7.2900	6.3800	0.2930	0.2480	160	160	1	

------------------ Date=29OCT86 N^2=169.957 Secchi Depth (m)=1.4 ----------------------

Depth (m)	Temp (C)	pH	D.O. (mg/L)	Cond (mmhos)	ORP	PAR	Total N (μg/L)	TKN:TP	Total P(μg/L)
0.00	15.8500	7.7000	9.0000	0.2950	0.1920	.	.	.	
0.50	15.8700	7.7100	8.9500	0.2950	0.1920	160	0.667	240	
1.00	15.7600	7.7000	8.8300	0.2940	0.1930	270	2.7	100	
2.00	15.6700	7.6900	8.7200	0.2940	0.1920	.	.	.	
3.00	15.6200	7.6600	8.4500	0.2920	0.1940	150	2.7	100	
4.00	15.6000	7.6200	8.2400	0.2910	0.1950	.	.	.	
5.00	15.5500	7.5900	7.9000	0.2900	0.1980	.	.	.	
6.00	15.5400	7.5400	7.6000	0.2900	0.1990	150	150	1	

Appendix A. Continued.

Date=30OCT86 N^2=198.66 Secchi Depth (m)=1.3

Depth (m)	Temp (C)	pH	D.O. (mg/L)	Cond (mmhos)	ORP	PAR	Total N (μg/L)	TKN:TP	Total P(μg/L)
0.00	17.2200	7.5750	8.9250	0.2940	0.2530	138.533	.	.	.
0.50	17.0050	7.6450	8.8100	0.2945	0.2415	91.8000	210	5.25	40
1.00	16.7700	7.6350	8.5300	0.2940	0.2385	51.7000	190	3.8	50
2.00	16.2650	7.6750	8.7000	0.2920	0.2365	24.8000	220	5.5	40
3.00	16.2000	7.6500	8.5300	0.2915	0.2355	11.1333	220	2.0	110
4.00	16.1000	7.5900	8.0100	0.2900	0.2355	4.5333	210	210	1
5.00	16.0100	7.5100	7.4500	0.2910	0.2375	1.9000	.	.	.
6.00	15.9800	7.4750	7.1450	0.2900	0.2390	0.7333	.	.	.

Appendix B. A list of equations, F and t statistics.

(1) Chlorophyll and phaeopigment concentrations:

$$\text{Chlorophyll } (\text{ug}\cdot\text{L}^{-1}) = \frac{0.0044 \times CF \times Vext \times (Fic - Fac)}{Vfil}$$

$$\text{Phaeopigments } (\text{ug}\cdot\text{L}^{-1}) = \frac{0.0037 \times CF \times Vext \times (2 \times Fac - Fic)}{Vfil}$$

where CF is a fluorometer correction factor (MULT x dilution factor), Vext is the volume of the extraction fluid (L), Fic is blank corrected initial fluoresence, Fac is blank corrected acidified fluoresence, and Vfil is the filtered volume of the initial sample (L).

(2) The square of the Brunt-Väisälä frequency (N^2):

$$N^2\ (\times 10^{-4}\cdot \text{sec}^{-2}) = \frac{9.8\times 10^{6} \times (rho_o - rho_f)}{z_f - z_o}$$

where rho_o (initial water density) and rho_f (final water density) are

$$rho_o = 1 - (9.02\times 10^{-5} - 5.422\times 10^{-5} \times temp_o - 7.66\times 10^{-6} \times temp_o^{2} - 3.83\times 10^{-8} \times temp_o^{3}),$$

$$rho_f = 1 - (9.02\times 10^{-5} - 5.422\times 10^{-5} \times temp_f - 7.66\times 10^{-6} \times temp_f^{2} - 3.83\times 10^{-8} \times temp_f^{3}),$$

z_o and z_f are initial and final depth (their difference being the depth of the mixed layer), and $temp_o$ and $temp_f$ are initial and final water temperature in ^oC.

(3) Shannon diversity index (H) of phytoplankton assemblage diversity:

$$H = \text{Sum } (n_i/N \times \log(n_i/N))$$

where n_i is the biovolume of a particular algal group (i), and N is the total biovolume of the assemblage.

Appendix B. Continued.

(4) Summed Difference (SD) rate of change index:

$$SD = \frac{\text{Sum} \left| \frac{n_{itf}}{N_{tf}} - \frac{n_{ito}}{N_{to}} \right|}{t_f - t_o}$$

where n_i is the biovolume of a particular algal group (i), N is the total biovolume of the assemblage, t_o is initial time, and t_f is final time.

(5) Particulate matter removal rates:

$$RR* \ (\text{change} \cdot d^{-1}) = \frac{([\text{Desc. } *] - [\text{Ref. } *])}{([\text{Ref. } *] \times \text{Tinc})}$$

where RR* is the removal rate ('*'= chlorophyll, phaeopigments, particulate carbon, particulate nitrogen, or particulate phosphorus), [Desc. *] is the concentration in the lower portion of the settling column, [Ref. *] is the concentration of particulate matter in the reference incubation, and Tinc is the incubation time (in days).

(6) Particulate matter net particle flux:

NPF* = Log([Asc. *]/[Desc. *])

where NPF* is the net particle flux ('*'= chlorophyll, phaeopigments, particulate carbon, particulate nitrogen, or particulate phosphorus), [Asc. *] is the concentration in the upper portion of the settling column, [Desc. *] is the concentration in the lower portion of the settling column, and Log is the log of base e.

(7) Phytoplankton net algal flux:

NAF* = Log(Asc. Biovolume*/Desc. Biovolume*)

where NAF* is the net algal flux of a particular taxonomic grouping ('*'= population, division or total assemblage classification), Asc. Biovolume* is the biovolume in the upper portion of the settling column, Desc. Biovolume* is the biovolume in the lower portion of the settling column, and Log is the log of base e.

Appendix C. Values for mixed layer phytoplankton variables. List of particulate matter concentration (in µg/L) and standard error (S.E.) values from the water column of Walker Branch embayment, 1986. Missing values are denoted by ".". Flag codes refer to settling column data from ascending (Asc) descending (Desc), initial reference (Refo) and find reference (Reff) samples.

Date	Depth	Flag	Chlorophyll (µg/L)	S.E.	Phaeopigments (µg/L)	S.E.	Part. carbon (µg/L)	S.E.
02Apr86	0.5		16.656	4.966	5.698	2.561	1087.008	.
	3.0		3.944	0.095	1.588	0.110	1841.654	.
		Asc	21.402	3.931	5.964	0.800	.	.
		Desc	41.566	2.826	11.096	1.245	.	.
		Refo	22.306	1.709	5.113	0.347	.	.
		Reff	24.971	2.411	6.351	0.658	.	.
09Apr86	0.5		19.879	1.822	4.396	0.333	1401.080	.
		Asc	16.196	1.228	3.630	0.500	.	.
		Desc	40.194	8.811	12.154	4.912	.	.
		Refo	14.441	3.050	3.175	0.773	.	.
		Reff	17.701	0.911	4.329	0.067	.	.
	3.0		17.424	0.871	3.830	0.167	906.229	.
		Asc	10.534	0.396	1.465	0.200	.	.
		Desc	43.659	2.772	6.785	0.458	.	.
		Refo	20.381	1.695	4.484	0.393	.	.
		Reff	19.285	0.356	3.397	0.466	.	.
17Apr86	0.5	Asc	15.840	0.079	1.099	0.300	.	.
		Desc	36.374	1.199	6.133	0.694	.	.
		Refo	17.398	0.026	3.175	0.044	.	.
		Reff	15.618	2.175	2.384	0.324	.	.
	2.0	Refo	12.791	0.832	3.097	0.433	.	.
		Desc	42.570	5.478	0	.	.	.
		Refo	17.384	0.515	2.797	0.200	.	.
		Reff	22.414	0.792	0	.	.	.

Date	Depth	Flag	Part. Nitr (µg/L)	S.E.	Part. Phos (µg/L)	S.E.
02Apr86	0.5		232.648	.	31.220	.
	3.0		300.331	.	43.620	.
09Apr86	0.5	Asc	270.044	.	14.820	.
	3.0	Refo	171.036	.	23.420	.

Appendix C. Continue

Date	Depth	Flag	Chlorophyll (µg/L)	S.E.	Phaeopigments (µg/L)	S.E.	Part. carbon (µg/L)	S.E.
21Apr86	0.5		19.103	.	1.459	.	774.73	.
	2.0		14.921	.	3.956	.	1085.057	.
		Asc1	7.801	0.198	6.227	0.033	.	.
		Desc1	37.290	4.026	10.989	0.777	.	.
		Asc2	6.692	0.832	6.260	0.266	.	.
		Desc2	37.670	1.336	16.692	0.791	.	.
		Asc2	6.811	0.238	6.926	0.266	.	.
		Desc2	31.284	1.188	14.485	0.611	.	.
		Asc3	10.732	5.029	8.392	1.399	.	.
		Desc3	38.610	1.094	16.212	0.876	.	.
		Refo	17.226	2.812	2.764	1.299	.	.
		Reff	12.514	4.039	11.089	2.364	.	.
24Apr86	0.0		20.473	0.277	2.964	0.033	1083.679	.
	0.5		18.929	0.475	3.696	0.233	973.545	.
	1.0		24.710	0.396	3.730	0.266	1372.635	.
		Asc	15.906	0.462	3.108	0.444	.	.
		Desc	46.035	7.883	5.239	1.182	.	.
		Refo	24.790	3.169	1.558	0.183	.	.
		Reff	20.110	2.052	2.570	0.463	.	.
	2.0		24.116	0.040	3.929	0.400	1220.933	.
		Asc	52.074	0.990	8.991	0.666	.	.
		Desc	123.51	24.841	14.652	4.798	.	.
		Refo	80.119	9.959	7.672	1.436	.	.
		Reff	65.340	10.386	8.758	1.525	.	.
	4.0		20.038	0.079	3.330	0.200	865.815	.
	6.0		18.850	0.792	4.129	0.932	1553.761	.
28Apr86	2.0		17.288	1.264	5.578	0.121	2037.328	219.827
		Asc	16.139	0.862	3.019	0.266	.	.
		Desc	47.735	5.365	9.522	2.485	.	.
		Refo	19.787	1.632	4.564	0.594	.	.
		Reff	23.777	1.597	3.143	0.438	.	.

Date	Depth	Flag	Part. Nitr (µg/L)	S.E.	Part. Phos (µg/L)	S.E.
21Apr86	0.5		137.13	.	21.620	.
	2.0		193.67	.	24.220	.
24Apr86	0.0		177.745	.	20.620	.
	0.5		162.452	.	20.220	.
	1.0		270.137	.	23.820	.
	2.0		206.337	.	18.220	.
	4.0		143.901	.	19.620	.
28Apr86	2.0		331.844	36.581	27.828	2.905

Appendix C. Continued.

Date	Depth	Flag	Chlorophyll (μg/L)	S.E.	Phaeopigments (μg/L)	S.E.	Part. carbon (μg/L)	S.E.
01MAY86	0.0		11.947	0.536	2.576	0.322	944.786	.
	1.0		23.510	6.050	1.642	1.642	1897.529	326.976
		Asc	20.275	0.172	3.453	0.169	.	.
		Desc	13.842	3.044	2.656	0.097	.	.
		Refo	17.518	0.402	2.874	0.217	.	.
		Reff	15.680	3.216	2.608	0.821	.	.
	0.5		10.836	0.574	2.383	0.064	885.604	.
	2.0		14.665	0.268	3.477	0.064	1204.029	114.549
		Asc	14.043	1.235	2.149	0.314	.	.
		Desc	20.734	3.561	4.250	1.256	.	.
		Refo	14.416	0.459	2.850	0.097	.	.
		Reff	13.354	1.063	3.164	0.894	.	.
	6.0		8.347	0.230	3.059	0.290	1468.609	.
09MAY86	0.0		5.086	0.215	1.908	0.112	.	.
	2.0		2.895	0.207	3.787	0.464	1052.600	53.184
		Asc1	5.342	0.909	2.636	0.390	.	.
		Desc1	7.965	0.275	3.735	0.390	.	.
		Asc2	5.702	0.322	2.206	0.422	.	.
		Desc2	5.114	2.784	5.519	2.031	.	.
		Asc3	4.726	0.635	1.537	0.215	.	.
		Desc3	5.635	0.047	2.564	0.016	.	.
		Asc4	5.095	0.095	1.864	0.127	.	.
		Desc4	5.114	0.170	2.668	0.231	.	.
		Refo	5.626	0.492	2.254	0.040	.	.
		Reff	4.792	0.265	2.246	0.255	.	.
		Asc5	6.876	0.815	4.149	0.550	.	.
		Desc5	5.910	0.114	3.584	0.255	.	.
		Asc6	6.990	0.758	3.775	0.510	.	.
		Desc6	7.795	0.161	4.516	0.390	.	.
		Asc7	6.791	0.065	3.082	0.358	.	.
		Desc7	5.427	0.142	3.010	0.669	.	.
		Asc8	5.578	0.256	1.617	0.438	.	.
		Desc8	5.758	0.019	3.664	0.478	.	.
		Refo	7.179	0.379	2.158	0.008	.	.
		Reff	6.080	0.436	1.943	0.207	.	.
	6.0		2.745	0.080	1.140	0.097	.	.

Date	Depth	Flag	Part. Nitr (μg/L)	S.E.	Part. Phos (μg/L)	S.E.
01MAY86	0.0		155.934	.	15.020	.
	0.5		153.929	.	15.420	.
	1.0		264.850	26.717	26.114	2.112
	2.0		244.672	21.570	15.877	1.112
	6.0		246.520	.	39.367	.
09MAY86	2.0		171.482	4.225	23.466	6.407

Appendix C. Continued.

Date	Depth	Flag	Chlorophyll (µg/L)	S.E.	Phaeopigments (µg/L)	S.E.	Part. carbon (µg/L)	S.E.
27MAY86	0.0		70.993	3.030	24.049	1.542	.	.
	1.0		69.556	3.449	12.004	1.208	.	.
	6.0		118.85	53.198	44.149	4.733	.	.
28MAY86	0.5		89.387	0.287	25.378	0.725	.	.
	1.5	Ascl	17.199	0.358	1.080	0.176	1367.260	
		Descl	24.603	0.239	8.838	1.004	.	.
		Asc2	14.362	0.030	0.879	0.025	.	.
		Desc2	33.979	2.807	10.746	1.306	.	.
		Asc3	17.510	0.060	1.027	0.175	.	.
		Desc3	33.919	3.941	11.751	2.511	.	.
		Asc4	20.131	1.668	1.102	0.150	.	.
		Desc4	31.889	1.433	13.257	0.100	.	.
		Asc5	20.012	0.893	1.052	0.100	.	.
		Desc5	25.559	.	10.847	.	.	.
		Desc6	36.129	6.390	12.052	0.000	.	.
		Asc7	16.706	0.963	1.102	0.150	.	.
		Desc7	32.426	1.732	13.960	0.904	.	.
		Desc	33.143	1.971	14.462	0.100	.	.
		Refo	14.592	0.060	2.304	0.050	1367.260	243.565
		Reff	13.108	0.926	2.687	0.176	.	.
	6.0		34.395	0.479	37.140	1.692	.	.

Date	Depth	Flag	Part. Nitr (µg/L)	S.E.	Part. Phos (µg/L)	S.E.
09MAY86	2.0		199.501	28.442	25.108	3.168
27MAY86	0.0		.	.	13.320	.
	1.0		.	.	20.020	.
	6.0		.	.	28.050	.
28MAY86	0.5		.	.	19.020	.
	1.5		211.462	29.176	30.912	4.669
	6.0		.	.	30.367	.

Appendix C. Continued.

Date	Depth	Flag	Chlorophyll (μg/L)	S.E.	Phaeopigments (μg/L)	S.E.	Part. carbon (μg/L)	S.E.
03JUN86	0.5		8.521	0.458	1.567	0.026	1319.595	245.337
		Asc	5.834	0.580	0.899	0.128	.	.
		Desc	18.692	0.244	4.572	0.051	.	.
		Refo	8.521	0.458	1.567	0.026	.	.
		Reff	7.351	1.629	2.046	1.327	.	.
	3.5		36.957	0.102	1.969	0.257	2515.489	633.992
		Desc	53.572	1.161	7.602	0.616	.	.
		Refo	30.481	1.771	0.899	0.899	.	.
		Reff	32.986	3.461	4.709	1.798	.	.
05JUN86	0.5		8.825	0.024	3.160	0.080	.	.
	2.0		20.158	1.833	3.493	0.616	1618.191	395.690
		Asc	15.516	0.550	2.106	0.771	.	.
		Desc	47.463	0.916	6.986	0.308	.	.
		Refo	20.158	1.833	3.493	0.616	.	.
		Reff	24.465	0.275	2.620	0.257	.	.
	3.0		6.090	0.048	4.741	0.060	.	.
	4.0		4.781	0.103	5.021	0.367	.	.
	4.5		4.734	0.071	7.361	0.040	.	.
10JUN86	0.5		3.971	0.305	0.832	0.113	.	.
	3.0	Asc1	14.796	0.058	1.976	0.415	1283.613	225.185
	3.0	Desc1	38.789	4.704	0.000	0.000	.	.
		Asc2	14.071	0.029	1.708	0.049	.	.
		Desc2	26.389	0.977	2.825	0.051	.	.
		Asc3	13.084	0.667	2.098	0.098	.	.
		Desc3	28.771	1.405	6.421	2.003	.	.
		Asc4	9.370	0.172	2.344	0.024	.	.
		Desc4	27.000	3.787	4.212	0.719	.	.
		Asc5	17.619	1.466	5.124	0.677	.	.
		Desc5	27.610	3.787	6.267	1.644	.	.
		Desc6	25.900	0.855	4.520	1.233	.	.
		Asc7	16.247	0.986	1.415	0.342	.	.
		Desc7	21.197	0.672	7.089	0.103	.	.
		Asc8	15.928	0.551	1.220	0.293	.	.
		Desc8	22.907	0.794	5.650	0.411	.	.
		Refo	16.711	0.298	1.529	0.165	.	.
		Reff	14.767	0.493	1.561	0.390	.	.
	6.0		3.030	0.000	1.911	0.123	.	.

Date	Depth	Flag	Part. Nitr (μg/L)	S.E.	Part. Phos (μg/L)	S.E.
03JUN86	0.5		189.828	30.161	42.304	8.651
	3.5		305.263	35.526	36.054	4.826
05JUN86	0.5		.	.	12.620	.
	2.0		224.521	43.570	27.252	5.421
	3.0		.	.	14.220	.
	4.0		.	.	20.550	.
	4.5		.	.	39.550	.

Appendix C. Continued.

Date	Depth	Flag	Chlorophyll (µg/L)	S.E.	Phaeopigments (µg/L)	S.E.	Part. carbon (µg/L)	S.E.
20JUN86	0.0		5.008	0.033	1.133	0.042	.	.
	0.5		4.924	0.017	1.042	0.007	.	.
	3.0		13.026	0.145	1.488	0.073	1182.400	199.578
		Desc1	19.148	0.696	2.928	0.098	.	.
		Asc2	10.938	0.203	1.195	0.024	.	.
		Desc2	17.929	1.335	2.928	0.000	.	.
		Asc3	11.460	0.435	1.220	0.146	.	.
		Desc3	16.885	0.870	2.928	0.293	.	.
		Asc4	12.417	0.348	1.708	0.195	.	.
		Desc4	18.162	1.102	2.488	0.049	.	.
		Asc5	13.113	0.290	1.854	0.146	.	.
		Desc5	14.738	1.277	2.098	0.146	.	.
		Asc6	12.852	0.609	2.244	0.195	.	.
		Desc6	17.871	.	1.366	.	.	.
		Asc7	11.750	0.667	2.025	0.561	.	.
		Desc7	15.608	1.335	2.342	0.195	.	.
		Asc8	12.504	0.725	2.049	0.195	.	.
		Desc8	24.138	0.348	0.000	0.000	.	.
		Refo	14.013	0.609	1.854	0.146	.	.
		Reff	13.404	0.232	1.879	0.024	.	.
	6.0		5.914	0.025	3.504	0.105	.	.

Date	Depth	Flag	Part. Nitr (µg/L)	S.E.	Part. Phos (µg/L)	S.E
10JUN86	0.5		.	.	8.620	.
	3.0		185.985	26.113	14.782	1.902
	6.0		.	.	19.200	.
20JUN86	0.0		.	.	8.820	.
	0.5		.	.	8.740	.
	3.0		163.142	23.240	13.162	1.697
	6.0		.	.	23.750	.
26JUN86	0.5		.	.	10.060	.
	2.0		.	.	13.820	.
	4.0		175.395	23.529	23.628	3.650
	6.0		.	.	10.940	.

Appendix C. Continued.

Date	Depth	Flag	Chlorophyll (μg/L)	S.E.	Phaeopigments (μg/L)	S.E.	Part. carbon (μg/L)	S.E.
26JUN86	0.5		6.559	0.224	1.195	0.524	.	.
	2.0		8.379	.	0.881	.	.	.
	4.0		11.671	0.000	2.852	0.084	1336.174	219.343
		Asc1	12.040	0.029	2.049	0.000	.	.
		Desc1	19.786	0.522	4.099	0.293	.	.
		Asc2	12.127	0.986	2.196	0.049	.	.
		Desc2	19.206	1.451	3.952	146	.	.
		Asc3	12.185	0.580	2.122	0.171	.	.
		Desc3	20.715	1.915	4.196	0.878	.	.
		Asc4	13.433	0.203	1.439	0.024	.	.
		Desc4	21.759	1.915	3.416	0.293	.	.
		Asc5	14.738	.	1.757	.	.	.
		Desc5	19.148	1.509	3.367	0.537	.	.
		Asc6	13.433	0.203	1.586	0.073	.	.
		Desc6	20.250	3.191	2.928	0.293	.	.
		Asc7	14.999	0.783	1.000	0.073	.	.
		Desc7	22.339	0.290	4.099	0.098	.	.
		Asc8	13.317	1.422	1.635	0.561	.	.
		Desc8	23.500	0.174	2.293	0.829	.	.
		Refo	13.404	0.116	2.976	0.146	.	.
		Reff	12.156	2.640	4.831	2.147	.	.
	6.0		5.811	0.274	2.999	0.231	.	.
01JUL86	0.5		5.244	0.065	1.381	0.129	.	.
	1.0		5.325	0.129	1.300	0.048	.	.
	2.0		6.968	0.316	1.490	0.020	.	.
	3.0		9.225	0.146	2.858	0.041	.	.
	4.0		9.468	0.049	2.572	0.082	.	.
	5.0		5.487	0.032	2.947	0.088	.	.
	6.0		5.470	0.065	2.518	0.041	.	.
10JUL86	0.5		7.138	0.275	1.926	0.088	.	.
	1.0		0	7.769	0.146	1.429	0.082	.
	2.0		7.720	0.243	1.266	0.000	.	.
	3.0		12.042	0.146	3.164	0.020	.	.

Date	Depth	Flag	Part. Nitr (μg/L)	S.E.	Part. Phos (μg/L)	S.E.
01JUL86	0.5		.	.	13.160	.
	1.0		.	.	11.040	.
	2.0		.	.	11.700	.
	3.0		.	.	15.740	.
	4.0		.	.	15.900	.
	5.0		.	.	20.780	.
	6.0		.	.	7.100	.
10JUL86	1.0		.	.	10.700	.
	2.0		.	.	10.260	.
	3.0		.	.	13.500	.

Appendix C. Continued.

Date	Depth	Flag	Chlorophyll (μg/L)	S.E.	Phaeopigments (μg/L)	S.E.	Part. carbon (μg/L)	S.E.
10JUL86	4.0		11.362	0.000	4.369	0.041	.	.
	5.0		9.905	0.000	3.164	0.061	.	.
	6.0		7.947	0.016	4.243	0.078	.	.
11JUL86	0.5		7.963	0.194	1.552	0.122	.	.
	3.0	Asc1	8.439	0.000	4.569	0.486	.	.
		Desc1	8.959	1.214	8.555	1.944	.	.
		Asc2	5.722	1.503	5.881	1.021	.	.
		Desc2	19.711	0.867	4.472	0.778	.	.
		Asc3	8.208	2.832	3.062	1.701	.	.
		Desc3	18.902	0.405	5.395	0.729	.	.
		Asc4	6.850	1.127	5.395	0.389	.	.
		Desc4	16.011	0.867	6.076	0.340	.	.
		Asc5	7.370	0.491	5.055	0.875	.	.
		Desc5	14.740	2.370	6.659	1.896	.	.
		Asc6	10.722	0.260	3.475	0.510	.	.
		Desc6	20.115	2.197	6.076	1.021	.	.
		Asc7	4.827	2.399	6.270	1.458	.	.
		Desc7	19.037	3.067	9.683	1.800	.	.
		Asc8	8.216	0.694	6.885	0.024	.	.
		Desc8	21.583	2.372	5.401	0.730	.	.
		Refo	14.826	0.318	2.649	0.316	1346.953	219.719
		Reff	7.341	1.676	4.642	0.170	.	.
	7.0		8.910	0.413	4.961	0.061	.	.

Date	Depth	Flag	Part. Nitr (μg/L)	S.E.	Part. Phos (μg/L)	S.E.
10JUL86	4.0		.	.	22.620	.
	5.0		.	.	9.820	.
	6.0		.	.	31.050	.
11JUL86	0.5		.	.	9.220	.
	3.0		206.889	29.966	16.441	2.678
	7.0		.	.	17.420	.
16JUL86	0.5		.	.	11.275	.
	1.0		.	.	14.220	.
	2.0		.	.	13.820	.
	3.0		.	.	11.420	.
	4.0		.	.	15.620	.
	5.0		.	.	17.050	.
	6.0		.	.	17.550	.

Appendix C. Continued.

Date	Depth	Flag	Chlorophyll (μg/L)	S.E.	Phaeopigments (μg/L)	S.E.	Part. carbon (μg/L)	S.E.
16JUL86	0.5		9.250	0.024	2.062	0.143	.	.
	1.0		9.420	0.243	2.838	0.225	.	.
	2.0		11.022	0.194	2.879	0.061	.	.
	3.0		8.983	0.146	3.226	0.000	.	.
	4.0		5.924	0.000	3.368	0.020	.	.
	5.0		4.418	0.065	3.382	0.157	.	.
	6.0		5.082	0.097	3.321	0.082	.	.
17JUL86	0.5		8.327	0.024	2.348	0.020	.	.
	2.0	Asc1	10.577	1.495	4.036	1.136	.	.
		Desc1	14.256	1.360	4.592	0.242	.	.
		Asc2	8.450	0.115	3.166	0.604	.	.
		Desc2	10.979	1.207	3.577	0.387	.	.
		Asc3	8.134	1.063	2.876	0.169	.	.
		Desc3	10.979	1.437	4.447	0.677	.	.
		Asc4	7.099	1.293	2.610	0.725	.	.
		Desc4	9.753	1.629	3.899	0.516	.	.
		Asc5	6.994	0.172	2.538	0.749	.	.
		Desc5	13.528	0.613	5.253	0.419	.	.
		Asc6	10.951	1.351	3.746	0.749	.	.
		Desc6	11.593	0.594	4.479	0.322	.	.
		Asc7	10.606	0.201	3.408	0.024	.	.
		Desc7	12.340	0.651	5.124	0.419	.	.
		Asc8	9.676	2.108	3.045	0.628	.	.
		Desc8	12.838	1.380	5.591	0.467	.	.
		Refo	10.232	0.690	2.441	0.701	1465.490	210.306
		Reff	6.237	0.891	5.849	1.692	.	.
	4.0		9.007	0.461	4.083	0.082	958.750	.
	6.0		5.454	0.097	3.314	0.034	.	.

Date	Depth	Flag	Part. Nitr (μg/L)	S.E.	Part. Phos (μg/L)	S.E.
17JUL86	0.5		.	.	9.420	.
	2.0		220.975	26.508	23.355	3.019
	4.0		145.906	.	25.220	.
17JUL86	6.0		.	.	35.550	.

Appendix C. Continued.

Date	Depth	Flag	Chlorophyll (μg/L)	S.E.	Phaeopigments (μg/L)	S.E.	Part. carbon (μg/L)	S.E.
23JUL86	0.5		5.962	0.302	0.769	0.033	.	.
	1.0		5.946	0.111	0.461	0.100	.	.
	2.0		12.019	0.095	2.988	0.020	.	.
	3.0		13.736	0.286	3.549	0.221	.	.
	4.0		12.210	0.238	3.670	0.100	.	.
	5.0		8.776	0.238	3.128	0.080	.	.
	6.0		7.083	0.072	2.888	0.080	.	.
24JUL86	0.5	Asc1	4.425	0.406	1.090	0.075	.	.
		Desc1	5.761	0.356	2.156	0.125	.	.
		Asc2	3.871	0.267	1.374	0.108	.	.
		Desc2	4.692	0.218	1.906	0.008	.	.
		Asc3	3.118	0.129	1.057	0.142	.	.
		Desc3	5.761	1.307	2.148	0.300	.	.
		Asc4	4.969	0.238	1.415	0.033	.	.
		Desc4	7.187	0.119	2.589	0.075	.	.
		Refo	8.774	0.653	3.592	0.330	.	.
		Reff	6.484	0.525	1.590	0.025	.	.
	2.0	Asc1	10.483	1.930	3.271	0.425	.	.
		Desc1	12.859	0.445	5.094	0.100	.	.
		Asc2	10.483	1.930	3.271	0.425	.	.
		Desc2	11.077	2.109	4.345	0.899	.	.
		Asc3	9.414	1.812	3.097	0.549	.	.
		Desc3	12.711	0.772	4.970	0.325	.	.
		Asc4	11.879	1.010	3.346	0.200	.	.
		Desc4	13.750	0.802	5.619	0.375	.	.
		Refo	11.315	0.742	3.696	0.549	.	.
		Reff	12.770	0.594	3.896	0.250	.	.
	6.0		6.367	0.167	3.610	0.120	.	.

Date	Depth	Flag	Part. Nitro (μg/L)	S.E.	Part. Phos (μg/L)	S.E.
23JUL86	0.5		.	.	17.775	.
	1.0		.	.	15.275	.
	2.0		.	.	17.775	.
	3.0		.	.	23.025	.
	4.0		.	.	21.775	.
	5.0		.	.	19.275	.
	6.0		.	.	19.275	.

Appendix C. Continued.

Date	Depth	Flag	Chlorophyll (µg/L)	S.E.	Phaeopigments (µg/L)	S.E.	Part. carbon (µg/L)	S.E.
30JUL86	0.5		7.703	0.167	0.622	0.140	.	.
	1.0		7.440	0.095	1.123	0.160	.	.
	2.0		8.299	0.572	1.404	0.000	.	.
	3.0		12.424	0.262	2.306	0.140	.	.
	4.0		10.016	0.429	2.286	0.000	.	.
	5.0		9.634	0.238	1.945	0.100	.	.
	6.0		10.763	3.184	4.047	1.178	.	.
01AUG86	0.5		9.466	0.622	1.530	0.368	.	.
	3.0	Asc1	13.395	0.145	1.800	0.049	.	.
		Desc1	15.102	1.215	2.919	0.097	.	.
		Asc2	11.833	0.897	2.238	0.243	.	.
		Desc2	14.813	0.810	4.525	0.827	.	.
		Asc3	11.891	0.897	2.506	0.268	.	.
		Desc3	21.120	6.191	3.941	0.924	.	.
		Asc4	12.412	0.145	1.460	0.146	.	.
		Desc4	13.771	1.157	2.822	0.097	.	.
		Asc5	14.061	0.694	1.995	0.146	.	.
		Desc5	14.292	0.752	2.270	0.292	.	.
		Asc6	11.804	1.562	1.922	0.122	.	.
		Desc6	13.713	0.984	2.968	0.341	.	.
		Refo	11.515	0.231	2.044	0.049	1208.503	153.438
		Reff	12.093	0.058	2.919	0.049	.	.
	6.0		5.297	0.184	2.615	0.097	.	.

Date	Depth	Flag	Part. Nitr (µg/L)	S.E.	Part. Phos (µg/L)	S.E.
30JUL86	0.5		.	.	16.420	.
	1.0		.	.	19.220	.
	2.0		.	.	18.620	.
	3.0		.	.	17.020	.
	4.0		.	.	11.820	.
	5.0		.	.	10.820	.
	6.0		.	.	12.120	.
01AUG86	0.5		.	.	7.420	.
	3.0		183.991	24.407	12.604	1.950

Appendix C. Continued.

Date	Depth	Flag	Chlorophyll (μg/L)	S.E.	Phaeopigments (μg/L)	S.E.	Part. carbon (μg/L)	S.E.
04AUG86	0.5		10.087	0.418	0.469	0.078	.	.
	1.0		10.365	0.604	0.958	0.059	.	.
	2.0		8.994	0.582	1.153	0.082	.	.
	3.0		9.715	0.186	1.544	0.137	.	.
	4.0		11.597	0.349	2.052	0.098	.	.
	5.0		5.880	0.070	2.599	0.059	.	.
	6.0		4.648	0.186	2.397	0.000	.	.
29AUG86	0.5		8.392	0.207	2.475	0.039	.	.
	3.0	Asc1	10.734	0.348	0.756	0.317	.	.
		Desc1	15.047	0.503	2.830	1.008	.	.
		Asc2	9.167	0.232	1.830	0.122	.	.
		Desc2	11.411	2.824	2.244	0.748	.	.
		Asc3	10.763	0.029	1.049	0.415	.	.
		Desc3	14.815	0.348	2.927	0.065	.	.
		Asc4	9.719	0.087	1.927	0.561	.	.
		Desc4	16.478	1.006	4.651	0.553	.	.
		Asc5	9.399	0.116	1.391	0.268	.	.
		Desc5	13.190	2.050	4.261	0.033	.	.
		Asc6	9.051	0.454	2.074	0.291	.	.
		Desc6	19.285	2.835	6.252	0.934	.	.
		Refo	9.603	0.899	1.293	0.512	1448.190	352.722
		Reff	10.560	0.580	0.732	0.049	.	.
	5.0		5.886	0.201	3.319	0.247	.	.
	7.0		3.349	0.054	3.899	0.019	.	.
04SEP86	0.5		10.760	0.322	1.624	0.000	.	.
	1.0		10.484	0.276	1.624	0.116	.	.
	2.0		8.599	0.598	2.417	0.058	.	.
	3.0		8.829	0.506	2.571	0.019	.	.
	4.0		6.783	0.805	2.803	0.213	.	.
	5.0		5.633	0.621	2.939	0.387	.	.
	6.0		3.702	0.130	3.873	0.316	.	.

Date	Depth	Flag	Part. Nitr (μg/L)	S.E.	Part. Phos (μg/L)	S.E.
04AUG86	6.0		.	.	9.700	.
29AUG86	0.5		.	.	10.820	.
	3.0		183.105	29.949	14.043	2.283
	5.0		.	.	18.920	.
	7.0		.	.	17.550	.
04SEP86	0.5		.	.	14.220	.
	1.0		.	.	14.620	.
	2.0		.	.	12.420	.
	3.0		.	.	11.420	.
	4.0		.	.	15.420	.

Appendix C. Continued.

Date	Depth	Flag	Chlorophyll (µg/L)	S.E.	Phaeopigments (µg/L)	S.E.	Part. carbon (µg/L)	S.E.
10SEP86	0.5		6.321	0.277	1.649	0.019	.	.
	1.0		7.983	0.138	1.804	0.019	.	.
	2.0		11.420	0.115	2.386	0.058	.	.
	3.0		11.143	0.531	2.153	0.058	.	.
	4.0		9.321	0.369	2.406	0.039	.	.
	5.0		6.275	0.092	3.705	0.019	.	.
	6.0		5.537	0.231	3.414	0.078	.	.
12SEP86	0.5		7.122	0.046	2.936	0.058	.	.
	3.0		9.157	0.740	3.734	0.778	.	.
		Asc	10.125	0.319	1.927	0.171	.	.
		Desc	13.345	0.696	4.586	1.659	.	.
		Refo	8.297	1.625	2.391	0.585	.	.
		Reff	10.589	0.029	2.147	0.098	.	.
	7.0		6.059	0.092	5.717	0.156	.	.
16SEP86	0.5		7.636	0.023	1.280	0.039	1368.653	139.098
	3.0	Asc1	7.429	3.498	5.785	1.847	.	.
		Desc1	13.490	0.308	5.899	0.454	.	.
		Asc2	10.724	0.434	3.962	0.170	.	.
		Desc2	15.951	0.938	7.513	1.750	.	.
		Asc3	11.707	0.029	3.500	0.000	.	.
		Desc3	13.913	0.347	5.088	0.032	.	.
		Asc4	10.782	0.607	3.670	0.365	.	.
		Desc4	13.451	0.116	6.709	0.097	.	.
		Asc5	11.129	0.896	3.403	0.097	.	.
		Desc5	11.447	1.349	3.760	0.583	.	.
		Asc6	9.568	0.318	2.674	0.146	.	.
		Desc6	13.798	0.000	6.936	0.000	.	.
		Asc7	9.799	0.202	2.650	0.219	.	.
		Desc7	12.179	0.154	4.764	0.616	.	.
		Asc8	12.483	0.857	4.014	0.103	.	.
		Desc8	13.297	0.116	5.412	0.616	.	.
		Refo	10.666	0.087	4.157	0.073	.	.
		Reff	10.464	0.184	4.425	0.309	.	.
	6.0		6.160	0.208	3.337	0.078	.	.
	7.0		5.237	0.023	4.055	0.058	.	.

Date	Depth	Flag	Part. Nitr (µg/L)	S.E.	Part. Phos (µg/L)	S.E.
16SEP86	3.0		196.876	15.862	33.452	2.689
	6.0		.	.	23.275	.
	7.0		.	.	38.025	.

Appendix C. Continued.

Date	Depth	Flag	Chlorophyll (µg/L)	S.E.	Phaeopigments (µg/L)	S.E.	Part. carbon (µg/L)	S.E.
18SEP86	0.5		7.248	0.114	2.153	0.038	.	.
	3.0	Asc1	10.811	0.482	3.841	0.502	.	.
		Desc1	13.682	1.734	3.922	1.458	.	.
		Asc2	21.703	0.571	7.787	0.034	.	.
		Desc2	12.102	1.310	4.408	0.259	.	.
		Asc3	10.329	0.231	3.322	0.146	.	.
		Desc3	11.100	.	4.991	0.324	.	.
		Asc4	9.905	.	3.273	.	.	.
		Asc5	10.069	0.503	2.395	0.016	.	.
		Desc5	11.093	.	3.850	0.470	.	.
		Asc6	10.580	0.674	3.338	0.065	.	.
		Desc6	11.177	0.848	3.079	1.394	.	.
		Asc7	10.464	0.366	2.593	0.486	.	.
		Desc7	5.589	0.270	1.977	0.032	.	.
		Asc8	10.079	0.096	3.338	0.454	.	.
		Desc8	11.447	0.424	2.722	0.259	.	.
		Refo	7.997	0.096	3.128	0.049	1187.601	161.262
		Reff	10.219	0.795	4.082	0.137	.	.
	6.0		4.413	0.389	4.095	0.058	.	.
	7.0		4.298	0.274	4.499	0.077	.	.

Date	Depth	Flag	Part. Nitr (µg/L)	S.E.	Part. Phos (µg/L)	S.E.
18SEP86	3.0		188.180	20.666	26.594	3.087

Appendix C. Continued.

Date	Depth	Flag	Chlorophyll (μg/L)	S.E.	Phaeopigments (μg/L)	S.E.	Part. carbon (μg/L)	S.E.
23SEP86	0.5		7.019	0.023	2.019	0.096		
	1.0		6.630	0.229	1.769	0.077		
	2.0		6.745	0.114	2.730	0.231		
		Asc1	7.608	0.290	2.686	0.586		
		Desc1	11.268	5.227	2.735	1.368		
		Asc2	7.434	0.174	3.370	0.147		
		Desc2	17.134	0.058	3.028	0.586		
		Asc3	7.550	0.407	2.466	0.171		
		Desc3	17.134	.	5.861	.		
		Asc4	8.334	0.145	2.369	0.073		
		Desc4	17.976	0.784	3.028	1.221		
		Asc5	7.376	0.407	2.686	0.391		
		Desc5	16.379	0.058	4.908	0.024		
		Asc6	8.102	0.378	2.759	0.269		
		Desc6	16.262	0.407	4.982	0.684		
		Asc7	8.683	0.378	2.418	0.513		
		Desc7	16.088	0.465	4.835	0.195		
		Asc8	7.928	0.203	2.735	0.000		
		Desc8	16.872	0.087	4.860	0.220		
		Refo	11.877	0.145	4.200	0.049		
		Reff	8.741	1.249	4.860	2.027		
	3.0		8.665	0.114	3.595	0.250		
	4.0		7.865	0.366	3.557	0.519		
	5.0		4.504	0.114	2.884	0.115		
	6.0		3.315	0.069	2.326	0.019		
25SEP86	0.5		7.423	0.116	1.886	0.097		
	2.0		10.106	0.116	3.247	0.097		
		Asc	12.487	0.058	1.074	0.440		
		Desc	18.586	0.697	3.810	0.814		
		Refo	10.454	0.058	4.420	0.220		
		Reff	11.761	0.319	1.709	0.293		
	5.0		7.677	0.139	3.539	0.311		
	7.0		3.677	0.023	3.753	0.097		

Appendix C. Continued.

Date	Depth	Flag	Chlorophyll (μg/L)	S.E.	Phaeopigments (μg/L)	S.E.	Part. carbon (μg/L)	S.E.
02OCT86	0.5		7.654	0.116	2.353	0.019	.	.
	3.0	Asc1	5.001	2.341	4.594	1.483	.	.
		Desc1	36.653	0.578	15.946	1.167	.	.
		Asc2	27.866	4.972	11.473	0.972	.	.
		Desc2	10.406	4.008	6.190	0.486	.	.
		Asc3	8.990	0.029	2.844	0.219	.	.
		Desc3	37.694	0.925	14.293	0.875	.	.
		Asc4	6.677	0.087	2.747	0.024	.	.
		Desc4	13.066	0.809	3.760	0.259	.	.
		Asc5	8.108	0.337	3.808	0.463	.	.
		Desc5	10.729	0.449	5.249	0.652	.	.
		Asc6	8.414	0.459	2.933	0.154	.	.
		Desc6	12.932	0.775	4.563	0.858	.	.
		Asc7	7.955	1.101	3.370	0.129	.	.
		Desc7	33.288	3.916	26.037	6.072	.	.
		Asc8	8.444	0.000	3.988	0.592	.	.
		Desc8	13.707	0.571	5.489	0.137	.	.
		Refo	8.643	0.491	3.038	0.267	1605.674	256.774
		Reff	8.325	0.636	2.722	0.000	.	.
	4.0		7.261	0.277	3.286	0.175	.	.
	6.0		7.238	0.069	3.034	0.272	.	.
21OCT86	0.0		5.762	0.366	0.846	0.461	.	.
	2.0	Asc1	7.068	0.459	1.441	0.720	.	.
		Desc1	16.889	0.245	4.631	0.720	.	.
		Asc2	5.844	0.031	1.878	0.180	.	.
		Desc2	17.746	1.346	3.602	0.309	.	.
		Asc3	6.272	0.092	2.033	0.334	.	.
		Desc4	17.501	1.020	6.827	1.818	.	.
		Asc5	10.066	0.887	2.264	0.823	.	.
		Desc5	17.664	0.367	4.219	0.377	.	.
		Asc6	6.701	3.457	7.358	5.197	.	.
		Desc6	19.173	0.816	3.774	0.755	.	.
		Asc7	8.108	0.031	2.135	0.077	.	.
		Desc7	23.267	2.025	0.000	0.000	.	.
		Asc8	6.540	0.200	1.753	0.072	.	.
		Desc8	17.897	0.076	3.650	0.576	.	.
		Refo	7.083	0.057	2.402	0.672	1151.320	176.108
		Reff	7.825	0.057	2.017	0.144	.	.
	6.0		4.916	0.343	2.711	0.173	.	.

Date	Depth	Flag	Part. Nitr (μg/L)	S.E.	Part. Phos (μg/L)	S.E.
02OCT86	0.5		.	.	15.525	.
	3.0		236.287	35.720	26.106	3.337
	4.0		.	.	20.275	.
	6.0		.	.	18.025	.

Appendix C. Continued.

Date	Depth	Flag	Chlorophyll (µg/L)	S.E.	Phaeopigments (µg/L)	S.E.	Part. carbon (µg/L)	S.E.
23OCT86	0.5		8.741	0.115	2.296	0.328	.	.
	1.0		9.314	0.459	2.662	0.077	.	.
	2.0		6.448	0.549	1.980	0.135	.	.
	3.0		5.093	0.046	1.968	0.039	.	.
	4.0		3.353	0.015	2.044	0.109	.	.
27OCT86	0.0		13.192	0.298	2.238	0.077	.	.
	1.0	Asc1	13.792	0.660	1.736	0.338	.	.
		Desc1	28.580	2.286	3.653	0.769	.	.
		Asc2	10.946	0.429	1.778	0.577	.	.
		Desc2	33.838	0.457	4.230	0.769	.	.
		Asc3	9.889	0.457	1.730	0.096	.	.
		Desc3	29.380	1.029	4.230	0.192	.	.
		Asc4	11.441	1.004	4.196	1.109	.	.
		Desc4	28.008	1.258	4.134	0.865	.	.
		Asc5	9.717	0.057	2.163	0.240	.	.
		Desc5	28.923	1.029	4.903	2.019	.	.
		Asc6	10.289	0.000	1.995	0.120	.	.
		Desc6	22.940	4.359	1.736	1.736	.	.
		Asc7	14.108	1.204	1.133	0.072	.	.
		Desc7	31.095	3.658	1.250	0.673	.	.
		Refo	15.176	0.543	2.211	0.000	1236.576	222.674
		Reff	13.219	2.724	2.025	0.820	.	.
	3.0		7.410	0.115	1.601	0.019	.	.
	6.0		3.902	0.076	2.724	0.122	.	.
29OCT86	0.5		11.471	0.642	2.296	0.058	.	.
	1.0	Asc1	12.064	0.000	1.362	0.235	.	.
		Desc1	19.437	1.489	0.971	0.157	.	.
		Asc2	10.947	0.000	1.479	0.211	.	.
		Desc2	21.783	0.112	1.722	0.219	.	.
		Asc3	11.673	0.279	1.573	0.164	.	.
		Desc3	22.900	1.899	1.785	0.094	.	.
		Asc4	12.930	0.475	2.067	0.564	.	.
		Desc4	22.118	0.819	1.753	0.250	.	.
		Asc5	11.590	0.028	1.973	0.094	.	.
		Desc5	20.368	0.707	2.254	0.250	.	.
		Asc6	12.567	0.670	2.043	0.305	.	.
		Desc6	24.352	0.223	3.476	1.033	.	.
		Asc7	13.321	0.642	2.043	0.070	.	.
		Desc8	21.334	4.817	5.691	1.254	.	.
		Refo	13.764	0.229	2.074	0.145	1209.372	179.064
		Reff	13.126	0.782	1.292	0.446	.	.
	3.0		12.480	0.413	2.720	0.019	.	.
	6.0		4.955	0.092	3.145	0.058	.	.

Appendix C. Continued.

Date	Depth Flag	Chlorophyll (μg/L)	S.E.	Phaeopigments (μg/L)	S.E.
30OCT86	0.5	11.769	0.849	2.141	0.212
	1.0	12.779	0.528	3.125	0.232
	2.0	12.389	0.459	2.489	0.135
	3.0	8.879	0.161	2.431	0.116
	4.0	8.282	0.069	2.180	0.058

Date	Depth Flag	Part. Nitr (μg/L)	S.E.	Part. Phos (μg/L)	S.E.
21OCT86	0.0	.	.	13.220	.
	2.0	168.149	25.961	12.820	.
27OCT86	1.0	200.966	29.430	.	.
29OCT86	1.0	178.497	21.921	.	.

Appendix D. Algal assemblage composition by date, Walker Branch embayment, 1986.

----------------------Date=17APR86 Depth (m)=0.5------------------

Division[a] Name	Common[b] Name	Reference Biovolume[c]	Ascending Biovolume	Descending Biovolume
CHLOR	CHLAMYDOMONAS	18760403	18760403	.
CHLOR	PALMELLACEAE	1086651	.	1086651
CHLOR	OOCYSTACEAE.III	2944176	.	.
CHLOR	HYALORPHIDIUM	1887048	1887048	.
CHLOR	CRUCIGENIA.I	111160	.	111160
CHLOR	SCENEDESUMS	2512318	.	.
CHLOR	DESMIDIUM	9197467	9197467	.
CHROM	MELOSIRA	9469049365	.	208736559
CHROM	PENNATE.GEN	146879596	82089751	103121010
CYANO	APHANACAPSA-COELO.	435435	.	.
CYANO	ANABAENA	120011272	108503342	131519202
CYANO	LYNGBYA	172360	180568	164152

---------------------Date=24APR86 Depth (m)=1---------------------

Division[a] Name	Common[b] Name	Reference Biovolume[c]	Ascending Biovolume	Descending Biovolume
CHLOR	GREEN.FLAG	6362752	.	.
CHLOR	CHLAMYDOMONAS	60480652	35716920	.
CHLOR	PANDORINA	34737219	.	34737219
CHLOR	GREEN.GENERAL	27646614	.	.
CHLOR	TETRAEDRON	157322	.	.
CHLOR	HYALORPHIDIUM	15459281	18398721	12519840
CHLOR	ACTINASTRUM	3562024	.	.
CHLOR	CRUCIGENIA.I	1046610	.	513044
CHLOR	SCENEDESUMS	1656879	3251235	62524
CHLOR	DESMIDIUM	6011960	9105493	2918427
CHROM	DYNOBRYON	10259763	.	10259763
CHROM	CENTRIC.GEN	1292485	1058413	1526558
CHROM	MELOSIRA	3117560794	1386010753	4849110835
CHROM	PENNATE.GEN	25677445	36716507	14638382
CHROM	ASTERIONELLA	24356493	21783203	26929783
CYANO	APHANACAPSA-COELO.	1170651	2090090	251213
CYANO	ANABAENA	4016710	5425167	2608253
CYANO	LYNGBYA	108341	108341	.
CYANO	OSCILLATORIA	2669533851	2567750944	2771316757
EUGLE	EUGLENOID	15870096	15870096	.
PYRRH	CRYPTOMONAS	12343225	19557687	5128764
PYRRH	DINOFLAG.I	82560358	18000581	147120135

Apendix D. Continued.

-----------------------Date=28APR86 Depth (m)=2------------------

Division[a] Name	Common[b] Name	Reference Biovolume[c]	Ascending Biovolume	Descending Biovolume
CHLOR	CHLAMYDOMONAS	111436792	.	.
CHLOR	GREEN.GENERAL	142705318	142705318	.
CHLOR	GLOEOCYSTACEAE.I	186897704	.	186897704
CHLOR	HYALORPHIDIUM	4245859	.	.
CHLOR	TREUBARIA	1970357	.	.
CHLOR	ACTINASTRUM	1852252	1852252	.
CHLOR	CRUCIGENIA.I	133391	.	133391
CHLOR	SCENEDESUMS	10403952	.	.
CHROM	MELOSIRA	100193548	.	.
CHROM	PENNATE.GEN	5373147	5373147	.
CYANO	APHANACAPSA-COELO.	5747748	.	.
CYANO	ANABAENA	37976170	37976170	.
CYANO	OSCILLATORIA	576433885	576433885	.
PYRRH	CRYPTOMONAS	90676548	.	90676548
PYRRH	DINOFLAG.I	9000291	.	.

----------------------Date=01MAY86 Depth (m)=2-------------------

Division[a] Name	Common[b] Name	Reference Biovolume[c]	Ascending Biovolume	Descending Biovolume
CHLOR	GREEN.FLAG	2757193	.	.
CHLOR	CHLAMYDOMONAS	86347895	59528201	113167590
CHLOR	PANDORINA	174246371	.	.
CHLOR	TETRAEDRON	263896	.	263896
CHLOR	CHODATELLA	2529453	2529453	.
CHLOR	OOCYSTACEAE.III	440679	93890	787468
CHLOR	CRUCIGENIA.I	943339	1026088	860590
CHLOR	SCENEDESUMS	1462249	1875713	1048786
CHROM	DYNOBRYON	5129882	5129882	.
CHROM	MELOSIRA	527797900	32113317	1023482484
CHROM	PENNATE.GEN	13707859	4305407	23110311
CHROM	ASTERIONELLA	5019171	.	5019171
CYANO	APHANACAPSA-COELO.	2560749	3014553	2106946
CYANO	ANABAENA	4375135	.	4375135
CYANO	OSCILLATOIRACEAE	604650929	604650929	.
CYANO	LYNGBYA	3049600	2604341	3494858
CYANO	OSCILLATORIA	1352337561	.	1352337561
PYRRH	CRYPTOMONAS	37748806	32482172	43015440
PYRRH	DINOFLAG.I	352446244	95195381	609697106

Appendix D. Continued.

Division[a] Name	Common[b] Name	Reference Biovolume[c]	Ascending Biovolume	Descending Biovolume
-----Date=09MAY86	Depth (m)=2-----			
CHLOR	CHLAMYDOMONAS	130925880	31870954	.
CHLOR	GREEN.GENERAL	26646677	.	10164196
CHLOR	GLOEOCYSTACEAE.I	133563961	65601160	.
CHLOR	TETRAEDRON	1111194	.	163615
CHLOR	PALMELLACEAE	8810685	.	.
CHLOR	CHODATELLA	1315315	1315315	.
CHLOR	HYALORPHIDIUM	6938728	.	3113630
CHLOR	ACTINASTRUM	926126	.	.
CHLOR	CRUCIGENIA.I	3407920	1734089	1734089
CHLOR	SCENEDESUMS	17522776	11054199	1882955
CHLOR	PEDIASTRUM	61374600	61374600	.
CHLOR	DESMIDIUM	5859390	.	5859390
CHROM	DYNOBRYON	11864882	16005231	7724532
CHROM	CENTRIC.GEN	5966345	5292066	6640624
CHROM	MELOSIRA	261960352	233784946	290135758
CHROM	PENNATE.GEN	24498993	17014967	31983020
CHROM	ASTERIONELLA	3862824	6223772	1501876
CHROM	FRAGILLARIA	85847	85847	.
CYANO	APHANACAPSA-COELO.	3211294	3396396	3026192
CYANO	MERISMOPEDIA	163108	63935	262281
CYANO	ANABAENA	128318817	151904679	104732956
CYANO	OSCILLATORIA	229440515	104806161	354074868
CYANO	OSCILLATORX	300992	.	300992
PYRRH	CRYPTOMONAS	7050103	10667829	3432377
PYRRH	DINOFLAG.I	36001162	36001162	.

Division[a] Name	Common[b] Name	Reference Biovolume[c]	Ascending Biovolume	Descending Biovolume
-----Date=28MAY86	Depth (m)=1.5-----			
CHLOR	GREEN.FLAG	64408021	49850044	78965998
CHLOR	CHLAMYDOMONAS	751166521	.	.
CHLOR	PANDORINA	234823598	126443476	343203720
CHLOR	GLOEOCYSTACEAE.I	16990700	.	.
CHLOR	TETRAEDRON	981691	327230	.
CHLOR	CHODATELLA	422216216	.	151261261
CHLOR	SCENEDESUMS	7152717	650247	.
CHLOR	PEDIASTRUM	17535600	.	8767800
CHLOR	DESMIDIACEAE.I	2712947	.	.
CHROM	DYNOBRYON	8002616	10670154	5335077
CHROM	MELOSIRA	83494624	.	16698925
CHROM	PENNATE.GEN	10746295	.	.

Appendix D. Continued.

---------------------Date=28MAY86 Depth (m)=1.5------------------

Division[a] Name	Common[b] Name	Reference Biovolume[c]	Ascending Biovolume	Descending Biovolume
CYANO	APHANACAPSA-COELO.	1567568	.	1045045
CYANO	MERISMOPEDIA	415577	63935	.
PYRRH	CRYPTOMONAS	53339146	55117117	51561174
PYRRH	DINOFLAG.I	36001162	.	.
PYRRH	CERATIUM	225049404	225049404	.

---------------------Date=03JUN86 Depth (m)=0.5------------------

Division[a] Name	Common[b] Name	Reference Biovolume[c]	Ascending Biovolume	Descending Biovolume
CHLOR	GREEN.FLAG	14599065	6217199	.
CHLOR	CHLAMYDOMONAS	126327401	.	45400174
CHLOR	PHACOTACEAE.I	115310745	6084358	.
CHLOR	PANDORINA.I	301232986	132818777	469647196
CHLOR	PANDORINA.II	384613775	.	384613775
CHLOR	GREEN.GENERAL	12567730	23915756	1219704
CHLOR	GLOEOCYSTACEAE.I	50972101	.	50972101
CHLOR	GLOEOCYSTIS	8764202	9652204	7876199
CHLOR	TETRAEDRON	337256	20051	654461
CHLOR	PALMELLACEAE	159802	159802	.
CHLOR	OOCYSTACEAE.III	206301	119664	292938
CHLOR	GLOEOTHAENIUM	3064367	3064367	.
CHLOR	HYALORPHIDIUM	8763674	15262891	2264458
CHLOR	CRUCIGENIA.I	163470	163470	.
CHLOR	SCENEDESUMS	79687	79687	.
CHLOR	PEDIASTRUM	2679766	537243	4822290
CHLOR	CHAETOSPHAERIDACEAE.I	671093	389265	952921
CHLOR	DESMIDIUM	3719564	3719564	.
CHLOR	DESMIDIACEAE.I	3923134	3324690	4521578
CHROM	CENTRIC.GEN	4710977	5188300	4233653
CHROM	MELOSIRA	11067131	20464369	1669892
CHROM	PENNATE.GEN	4389826	4389826	.
CYANO	APHANACAPSA-COELO.	3851042	3521904	4180180
CYANO	MERISMOPEDIA	412678	489697	335658
CYANO	OSCILLATORX	13177	13177	.
EUGLE	EUGLENOID	43253791	38897294	47610288
PYRRH	CRYPTOMONAS	13849004	15252207	12445801
PYRRH	DINOFLAG.I	54001744	.	54001744

Appendix D. Continued.

----------------------Date=05JUN86 Depth (m)=2--------------------

Division[a] Name	Common[b] Name	Reference Biovolume[c]	Ascending Biovolume	Descending Biovolume
CHLOR	GREEN.FLAG	25972755	5293810	.
CHLOR	CHLAMYDOMONAS	153741500	.	128977768
CHLOR	PANDORINA.I	150527947	.	.
CHLOR	PANDORINA.II	1322109852	1442301656	1201918047
CHLOR	GREEN.GENERAL	53582256	50414414	56750097
CHLOR	GLOEOCYSTIS	10091380	7876199	12306561
CHLOR	TETRAEDRON	349046	16362	681730
CHLOR	PALMELLACEAE	6791570	.	6791570
CHLOR	HYALORPHIDIUM	2193694	849172	3538216
CHLOR	CRUCIGENIA.I	555798	.	555798
CHLOR	SCENEDESUMS	2600988	2600988	.
CHLOR	PEDIASTRUM	13745353	8767800	18722906
CHLOR	DESMIDIUM	13784704	21246149	6323259
CHLOR	DESMIDIACEAE.I	3636102	6330209	941995
CHROM	DYNOBRYON	272311	266754	277869

----------------------Date=20JUN86 Depth (m)=3--------------------

Division[a] Name	Common[b] Name	Reference Biovolume[c]	Ascending Biovolume	Descending Biovolume
CHLOR	PEDIASTRUM	39634035	.	.
CHLOR	DESMIDIUM	9291319	9291319	.
CHLOR	DESMIDIACEAE.I	20909991	.	15373365
CHROM	DYNOBRYON	13392132	2721978	.
CHROM	CENTRIC.GEN	7020088	.	7020088
CHROM	MELOSIRA	1901973447	.	.
CHROM	PENNATE.GEN	19829472	12793208	26865737
CHROM	ASTERIONELLA	9335658	.	9335658
CHROM	FRAGILLARIA	6543654	10511894	2575414
CYANO	APHANACAPSA-COELO.	16664736	20527671	12801802
CYANO	MERISMOPEDIA	690562	1125385	255740
CYANO	ANABAENA	22143539	22143539	.
CYANO	OSCILLATORIA	160417593	160417593	.
CYANO	OSCILLATORX	296248	296248	.
EUGLE	EUGLENOID	145745779	145745779	.
PYRRH	CRYPTOMONAS	83455806	83455806	.
PYRRH	DINOFLAG.I	18367940	18367940	.
PYRRH	CERATIUM	677444635	229642249	1125247021

Appendix D. Continued.

---------------------Date=26JUN86 Depth (m)=4---------------------

Division[a] Name	Common[b] Name	Reference Biovolume[c]	Ascending Biovolume	Descending Biovolume
CHLOR	GREEN.FLAG	41799041	43673932	39924150
CHLOR	CHLAMYDOMONAS	693384481	.	.
CHLOR	PHACOTACEAE.I	59578030	59578030	.
CHLOR	PANDORINA	90316768	.	90316768
CHLOR	GLOEOCYSTACEAE.I	135925603	.	.
CHLOR	GLOEOCYSTIS	36755594	5250799	.
CHLOR	TETRAEDRON	5890148	.	1636152
CHLOR	PALMELLACEAE	5215926	.	.
CHLOR	CHODATELLA	2630631	2630631	.
CHLOR	GLOEOTHAENIUM	25005231	.	25005231
CHLOR	TREUBARIA	78814298	.	23644289
CHLOR	CRUCIGENIA.I	400174	.	.
CHLOR	SCENEDESUMS	16256176	3251235	.
CHLOR	PEDIASTRUM	65758500	.	30687300
CHLOR	CHAETOSPHAERIDACEAE.I	635280	635280	.
CHLOR	DESMIDIACEAE.I	32555362	.	10851787
CHLOR	STARASTRUM	347283	.	.
CHROM	DYNOBRYON	2667539	2667539	.
CHROM	MELOSIRA	1502903226	.	634559140
CHROM	PENNATE.GEN	46567277	38507556	54626998
CHROM	ASTERIONELLA	6223772	3111886	9335658
CHROM	FRAGILLARIA	3433885	2575414	4292357
CYANO	APHANACAPSA-COELO.	21945946	.	21945946
CYANO	MERISMOPEDIA	407585	287707	527463
CYANO	ANABAENA	18988085	13562918	24413252
PYRRH	CRYPTOMONAS	51561174	32003487	71118861
PYRRH	CERATIUM	1350296425	.	1350296425

Appendix D. Continued.

---------------Date=01JUL86 Depth (m)=4---------------------------

Division[a] Name	Common[b] Name	Reference Biovolume[c]
CHLOR	GREEN.FLAG	13535310
CHLOR	CHLAMYDOMONAS	37520805
CHLOR	PHACOTACEAE.I	28209294
CHLOR	GREEN.GENERAL	9240179
CHLOR	GLOEOCYSTACEAE.I	115845684
CHLOR	GLOEOCYSTIS	4475113
CHLOR	TETRAEDRON	3904454
CHLOR	SPHAEROCYSTIS	4070566
CHLOR	CHODATELLA	1494676
CHLOR	OOCYSTACEAE.III	554807
CHLOR	HYALORPHIDIUM	4181528
CHLOR	KIRCHNERIELLA	1756889
CHLOR	TREUBARIA	4478085
CHLOR	ACTINASTRUM	4735872
CHLOR	CRUCIGENIA.I	3486368
CHLOR	SCENEDESUMS	5172419
CHLOR	PEDIASTRUM	14945114
CHLOR	CHAETOSPHAERIDACEAE.I	721910
CHLOR	DESMIDIUM	10347151
CHLOR	DESMIDIACEAE.I	102763
CHROM	OPHIOCYTIUM	295897
CHROM	CENTRIC.GEN	1202742
CHROM	MELOSIRA	398497067
CHROM	PENNATE.GEN	83446606
CHROM	FRAGILLARIA	21461784
CYANO	APHANACAPSA-COELO.	16031941
CYANO	MERISMOPEDIA	581226
CYANO	LYNGBYA	738686
CYANO	OSCILLATORIA	178646865
CYANO	OSCILLATORX	48876
EUGLE	EUGLENOID	18034200
PYRRH	CRYPTOMONAS	36367599
PYRRH	CERATIUM	255737959

Appendix D. Continued.

----------------------Date=11JUL86 Depth (m)=3--------------------

Division[a] Name	Common[b] Name	Reference Biovolume[c]	Ascending Biovolume	Descending Biovolume
CHLOR	GREEN.FLAG	43406696	40365301	46448092
CHLOR	CHLAMYDOMONAS	252399571	.	.
CHLOR	PHACOTACEAE.I	47738806	47738806	.
CHLOR	PANDORINA	985147520	.	776724208
CHLOR	GLOEOCYSTACEAE.I	1006372253	326744238	.
CHLOR	TETRAEDRON	15631547	.	5562918
CHLOR	PALMELLACEAE	57174569	5015313	.
CHLOR	CHODATELLA	3945946	.	3945946
CHLOR	OOCYSTACEAE.III	2685266	.	.
CHLOR	GLOEOTHAENIUM	49529592	75015693	24043491
CHLOR	TREUBARIA	6744685	5911072	7578298
CHLOR	CRUCIGENIA.I	22302025	.	.
CHLOR	SCENEDESUMS	10266400	13655187	6877613
CHLOR	PEDIASTRUM	66938781	56990700	25291731
CHLOR	CHAETOSPHAERIDACEAE.I	6902566	.	.
CHLOR	DESMIDIACEAE.I	14642957	13912548	15373365
CHROM	DYNOBRYON	33344231	33344231	.
CHROM	CENTRIC.GEN	2340722	2035410	2646033
CHROM	MELOSIRA	471744624	208736559	734752688
CHROM	PENNATE.GEN	209036098	137773009	280299186
CHROM	FRAGILLARIA	1700434	825453	2575414
CYANO	APHANACAPSA-COELO.	3582294	3768191	3396396
CYANO	MERISMOPEDIA	78689	61476	95902
CYANO	ANABAENA	5373002	2608253	8137751
CYANO	LYNGBYA	1010484	937563	1083406
PYRRH	CRYPTOMONAS	12069691	18805468	5333915
PYRRH	DINOFLAG.I	8654126	8654126	.
PYRRH	CERATIUM	225049404	.	225049404

Appendix D. Continued.

----------------------Date=17JUL86 Depth (m)=2----------------------

Division[a] Name	Common[b] Name	Reference Biovolume[c]	Ascending Biovolume	Descending Biovolume
CHLOR	GREEN.FLAG	9453232	10353540	8552924
CHLOR	CHLAMYDOMONAS	75807341	.	.
CHLOR	PHACOTACEAE.I	22797715	35463113	10132318
CHLOR	PANDORINA.I	75571174	.	.
CHLOR	GREEN.GENERAL	8712168	5808112	11616225
CHLOR	GLOEOCYSTACEAE.I	34674899	.	.
CHLOR	GLOEOCYSTIS	28129281	4018469	.
CHLOR	TETRAEDRON	16528477	.	5843401
CHLOR	PALMELLACEAE	7983560	.	.
CHLOR	SPHAEROCYSTIS	38379624	58483236	18276011
CHLOR	CHODATELLA	12079426	1342158	.
CHLOR	OOCYSTACEAE.III	398555	.	199278
CHLOR	GLOEOTHAENIUM	153093251	51031084	.
CHLOR	HYALORPHIDIUM	16174700	.	4043675
CHLOR	KIRCHNERIELLA	2479108	2704482	2253735
CHLOR	TREUBARIA	4021138	.	.
CHLOR	ACTINASTRUM	47251	.	47251
CHLOR	CRUCIGENIA.I	11841895	9391847	14291942
CHLOR	SCENEDESUMS	3649346	2654069	4644622
CHLOR	PEDIASTRUM	11407087	4920704	17893470
CHLOR	DESMIDIUM	3097106	3097106	.
CHLOR	DESMIDIACEAE.I	8766325	8304939	9227710
CHLOR	STARASTRUM	1771851	1063111	2480591
CHROM	DYNOBRYON	2721978	.	2721978
CHROM	CENTRIC.GEN	8100101	5400068	10800135
CHROM	MELOSIRA	153357472	85198596	221516348
CHROM	PENNATE.GEN	138897686	106000866	171794507
CHROM	FRAGILLARIA	26717732	16643833	36791630
CYANO	APHANACAPSA-COELO.	23993381	24526567	23460195
CYANO	MERISMOPEDIA	424058	424058	424058
CYANO	ANABAENA	11071770	11071770	.
CYANO	LYNGBYA	221103	221103	.
CYANO	OSCILLATORX	148124	153610	142638
EUGLE	EUGLENOID	89066865	113357828	64775902
PYRRH	CRYPTOMONAS	39913646	47170673	32656620
PYRRH	DINOFLAG.I	41327865	45919850	36735880

Appendix D. Continued.

---------------------Date=24JUL86 Depth (m)=2---------------------

Division[a] Name	Common[b] Name	Reference Biovolume[c]	Ascending Biovolume	Descending Biovolume
CHLOR	GREEN.FLAG	11972606	19631212	4314001
CHLOR	CHLAMYDOMONAS	212865351	.	.
CHLOR	PHACOTACEAE.I	20349434	34753851	5945018
CHLOR	PANDORINA	36126707	.	.
CHLOR	GLOEOCYSTACEAE.I	237359355	.	.
CHLOR	TETRAEDRON	2631888	3108689	2155086
CHLOR	PALMELLACEAE	7823888	.	.
CHLOR	SPHAEROCYSTIS	5719058	.	.
CHLOR	CHODATELLA	1315315	.	.
CHLOR	OOCYSTACEAE.III	3180201	3515257	2845146
CHLOR	GLOEOTHAENIUM	54947117	59883772	50010462
CHLOR	HYALORPHIDIUM	6891776	.	.
CHLOR	KIRCHNERIELLA	352627	352627	.
CHLOR	TREUBARIA	1771630	1572903	1970357
CHLOR	CRUCIGENIA.I	9674888	8678460	10671316
CHLOR	CRUCIGENIA.II	144577	144577	.
CHLOR	SCENEDESUMS	4223815	2595407	5852223
CHLOR	PEDIASTRUM	10950343	8748985	13151700
CHLOR	CHAETOSPHAERIDACEAE.I	1079022	887484	1270561
CHLOR	DESMIDIACEAE.I	19435023	7219000	31651046
CHLOR	STARASTRUM	138615	138615	.
CHROM	MELOSIRA	30029397	26660944	33397849
CHROM	PENNATE.GEN	133194865	55045934	211343795
CYANO	APHANACAPSA-COELO.	3860612	5631133	2090090
CYANO	MERISMOPEDIA	67090	38279	95902
CYANO	LYNGBYA	433362	.	433362
CYANO	OSCILLATORX	290323	.	290323
PYRRH	CRYPTOMONAS	5146960	8515949	1777972
PYRRH	DINOFLAG.I	27869999	28739125	27000872
PYRRH	CERATIUM	89826586	89826586	.

Appendix D. Continued.

Division[a] Name	Common[b] Name	Reference Biovolume[c]	Ascending Biovolume	Descending Biovolume
----------Date=01AUG86	Depth (m)=3----------			
CHLOR	GREEN.FLAG	10216536	13905841	6527232
CHLOR	CHLAMYDOMONAS	103548434	.	.
CHLOR	PHACOTACEAE.I	29515883	53965607	5066159
CHLOR	PANDORINA.I	38066074	.	.
CHLOR	GREEN.GENERAL	16526965	18118785	14935146
CHLOR	GLOEOCYSTACEAE.I	251769917	.	.
CHLOR	TETRAEDRON	1535254	1067056	2003452
CHLOR	PALMELLACEAE	1330593	.	.
CHLOR	SPHAEROCYSTIS	29241618	.	.
CHLOR	OOCYSTACEAE.III	1935376	1379781	2490970
CHLOR	GLOEOTHAENIUM	79874740	.	.
CHLOR	HYALORPHIDIUM	8062234	8614786	7509682
CHLOR	KIRCHNERIELLA	6080185	.	.
CHLOR	TREUBARIA	8566772	.	8566772
CHLOR	CRUCIGENIA.I	6619270	5989004	7249536
CHLOR	CRUCIGENIA.II	375639	554419	196859
CHLOR	SCENEDESUMS	5502867	4644622	6361112
CHLOR	PEDIASTRUM	9238476	8946735	9530217
CHLOR	CHAETOSPHAERIDACEAE.I	648245	648245	.
CHLOR	DESMIDIUM	15990495	15485532	16495458
CHLOR	DESMIDIACEAE.I	7382168	7382168	.
CHLOR	STARASTRUM	1527644	35437	3019850
CHROM	CENTRIC.GEN	8687065	7020088	10354043
CHROM	MELOSIRA	26670865	17039719	36302010
CHROM	PENNATE.GEN	168884251	134328684	203439818
CHROM	AMORPHA	7385321	6661270	8109372
CHROM	FRAGILLARIA	6131938	6131938	.
CYANO	APHANACAPSA-COELO.	10852079	11196911	10507246
CYANO	MERISMOPEDIA	482384	391438	573329
CYANO	OSCILLATORX	328568	318192	338943
EUGLE	EUGLENOID	75513211	64775902	86250521
PYRRH	CRYPTOMONAS	51193590	59870470	42516710
PYRRH	DINOFLAG.I	23858357	18367940	29348774

Appendix D. Continued.

---------------------Date=04AUG86 Depth (m)=3---------------------

Division[a] Name	Common[b] Name	Reference Biovolume[c]
CHLOR	GREEN.FLAG	18865003
CHLOR	CHLAMYDOMONAS	22627679
CHLOR	PHACOTACEAE.I	16331697
CHLOR	PANDORINA.I	19806309
CHLOR	GREEN.GENERAL	19615116
CHLOR	GLOEOCYSTACEAE.I	186301539
CHLOR	GLOEOCYSTIS	1439364
CHLOR	TETRAEDRON	1255819
CHLOR	SPHAEROCYSTIS	58916089
CHLOR	CHODATELLA	1442232
CHLOR	OOCYSTACEAE.III	2355496
CHLOR	GLOEOTHAENIUM	54836033
CHLOR	HYALORPHIDIUM	2793328
CHLOR	KIRCHNERIELLA	1695244
CHLOR	TREUBARIA	4320959
CHLOR	ACTINASTRUM	507745
CHLOR	CRUCIGENIA.II	198586
CHLOR	SCENEDESUMS	5703921
CHLOR	PEDIASTRUM	28841448
CHLOR	CHAETOSPHAERIDACEAE.I	2786318
CHLOR	DESMIDIUM	9984093
CHLOR	DESMIDIACEAE.I	5949445
CHLOR	STARASTRUM	380793
CHROM	OPHIOCYTIUM	1142059
CHROM	CENTRIC.GEN	6963245
CHROM	PENNATE.GEN	200314703
CYANO	APHANACAPSA-COELO.	30079422
CYANO	MERISMOPEDIA	928879
CYANO	OSCILLATORIA	57459518
CYANO	OSCILLATORX	377287
EUGLE	EUGLENOID	34802842
PYRRH	CRYPTOMONAS	42889664
PYRRH	DINOFLAG.I	29606219
PYRRH	CERATIUM	24676470

Appendix D. Continued.

---------------------Date=29AUG86 Depth (m)=3---------------------

Division[a] Name	Common[b] Name	Reference Biovolume[c]	Ascending Biovolume	Descending Biovolume
CHLOR	GREEN.FLAG	13385726	18499873	8271578
CHLOR	CHLAMYDOMONAS	156853608	.	.
CHLOR	PHACOTACEAE.I	42916801	16015599	69818003
CHLOR	PANDORINA	523509494	.	.
CHLOR	GLOEOCYSTACEAE.I	722789875	1233195995	212383755
CHLOR	TETRAEDRON	5475832	.	.
CHLOR	PALMELLACEAE	8281333	8412783	8149884
CHLOR	SPHAEROCYSTIS	5777578	5777578	.
CHLOR	OOCYSTACEAE.III	13007987	.	.
CHLOR	GLOEOTHAENIUM	39070673	.	.
CHLOR	HYALORPHIDIUM	26137141	.	15522494
CHLOR	KIRCHNERIELLA	2805355	1380413	.
CHLOR	TREUBARIA	12513359	.	6355992
CHLOR	CRUCIGENIA.I	9735425	.	4733245
CHLOR	CRUCIGENIA.II	282985	.	.
CHLOR	SCENEDESUMS	10815601	9439070	12192132
CHLOR	PEDIASTRUM	63416296	.	6849844
CHLOR	CHAETOSPHAERIDACEAE.I	4538861	4610906	4466816
CHLOR	DESMIDIACEAE.II	25265565	27734342	22796789
CHLOR	DESMIDIUM	60351425	68535966	52166885
CHLOR	DESMIDIACEAE.I	10870931	17502883	4238979
CHLOR	STARASTRUM	560133	560133	.
CHROM	MELOSIRA	53867499	53867499	.
CHROM	PENNATE.GEN	399758732	420318784	379198680
CYANO	APHANACAPSA-COELO.	10534728	10534728	.
CYANO	MERISMOPEDIA	1551646	1804614	1298678
CYANO	OSCILLATOIRACEAE	2702033838	.	2702033838
CYANO	LYNGBYA	1373370	1223200	1523540
CYANO	OSCILLATORX	1201548	1092612	1310484
EUGLE	EUGLENOID	25196977	25596929	24797025
PYRRH	CRYPTOMONAS	55337571	74560096	36115046
PYRRH	DINOFLAG.I	14289776	14516598	14062954

Appendix D. Continued.

---------------------Date=04SEP86 Depth (m)=3---------------------

Division[a] Name	Common[b] Name	Reference Biovolume[c]
CHLOR	GREEN.FLAG	6288334
CHLOR	CHLAMYDOMONAS	31678750
CHLOR	PANDORINA.I	19806309
CHLOR	PANDORINA.II	10543141
CHLOR	GREEN.GENERAL	5795375
CHLOR	GLOEOCYSTACEAE.I	1863015
CHLOR	GLOEOCYSTIS	1439364
CHLOR	TETRAEDRON	2332235
CHLOR	SPHAEROCYSTIS	3927739
CHLOR	OOCYSTACEAE.III	535340
CHLOR	GLOEOTHAENIUM	27418016
CHLOR	HYALORPHIDIUM	4655547
CHLOR	KIRCHNERIELLA	968711
CHLOR	ACTINASTRUM	4569701
CHLOR	CRUCIGENIA.I	2340201
CHLOR	CRUCIGENIA.II	794343
CHLOR	SCENEDESUMS	6416911
CHLOR	PEDIASTRUM	19708322
CHLOR	CHAETOSPHAERIDACEAE.I	1044869
CHLOR	DESMIDIUM	89856835
CHLOR	DESMIDIACEAE.I	1983148
CHLOR	STARASTRUM	380793
CHROM	OPHIOCYTIUM	6566838
CHROM	CENTRIC.GEN	6963245
CHROM	MELOSIRA	54930673
CHROM	PENNATE.GEN	111940570
CYANO	APHANACAPSA-COELO.	8594120
CYANO	MERISMOPEDIA	1770128
CYANO	ANABAENA	47589185
CYANO	LYNGBYA	1306740
CYANO	OSCILLATORIA	57459518
CYANO	OSCILLATORX	259385
EUGLE	EUGLENOID	17401421
PYRRH	CRYPTOMONAS	58485905
PYRRH	DINOFLAG.I	9868740

Appendix D. Continued.

--------------------Date=10SEP86 Depth (m)=3--------------------

Division[a] Name	Common[b] Name	Reference Biovolume[c]
CHLOR	GREEN.FLAG	14214860
CHLOR	CHLAMYDOMONAS	50444638
CHLOR	PHACOTACEAE.I	49648358
CHLOR	PANDORINA.I	2007039
CHLOR	GREEN.GENERAL	12648778
CHLOR	GLOEOCYSTACEAE.I	37757112
CHLOR	GLOEOCYSTIS	2917111
CHLOR	TETRAEDRON	1817947
CHLOR	SPHAEROCYSTIS	31840873
CHLOR	OOCYSTACEAE.III	1301947
CHLOR	GLOEOTHAENIUM	916858471
CHLOR	KIRCHNERIELLA	245407
CHLOR	ACTINASTRUM	1029029
CHLOR	CRUCIGENIA.I	6817786
CHLOR	CRUCIGENIA.II	804934
CHLOR	SCENEDESUMS	11559947
CHLOR	PEDIASTRUM	34097000
CHLOR	DESMIDIUM	40468856
CHLOR	CLOSTERIUM	578966
CHLOR	DESMIDIACEAE.I	2009590
CHLOR	STARASTRUM	38587
CHROM	OPHIOCYTIUM	12151506
CHROM	CENTRIC.GEN	5880074
CHROM	MELOSIRA	18554361
CHROM	PENNATE.GEN	252736930
CYANO	APHANACAPSA-COELO.	18578579
CYANO	MERISMOPEDIA	3143466
CYANO	LYNGBYA	1564920
CYANO	OSCILLATORX	262843
PYRRH	CRYPTOMONAS	57290193
PYRRH	DINOFLAG.I	10000323
PYRRH	CERATIUM	250054894

Appendix D. Continued.

---------------------Date=12SEP86 Depth (m)=3---------------------

Division[a] Name	Common[b] Name	Reference Biovolume[c]
CHLOR	GREEN.FLAG	13234525
CHLOR	CHLAMYDOMONAS	32101133
CHLOR	PHACOTACEAE.I	38615390
CHLOR	PANDORINA.I	20070393
CHLOR	GREEN.GENERAL	4065679
CHLOR	GLOEOCYSTACEAE.I	18878556
CHLOR	GLOEOCYSTIS	1458555
CHLOR	TETRAEDRON	1272563
CHLOR	SPHAEROCYSTIS	7960218
CHLOR	OOCYSTACEAE.III	2061416
CHLOR	GLOEOTHAENIUM	27783590
CHLOR	HYALORPHIDIUM	12580322
CHLOR	KIRCHNERIELLA	2454067
CHLOR	TREUBARIA	4378572
CHLOR	CRUCIGENIA.I	3705318
CHLOR	CRUCIGENIA.II	603700
CHLOR	SCENEDESUMS	4334980
CHLOR	PEDIASTRUM	24355000
CHLOR	CHAETOSPHAERIDACEAE.I	1411734
CHLOR	DESMIDIUM	47213665
CHLOR	DESMIDIACEAE.I	2009590
CHLOR	STARASTRUM	771739
CHROM	DYNOBRYON	296393
CHROM	OPHIOCYTIUM	12151506
CHROM	CENTRIC.GEN	14112177
CHROM	MELOSIRA	37108722
CHROM	PENNATE.GEN	158209338
CYANO	APHANACAPSA-COELO.	12482482
CYANO	LYNGBYA	3490975
CYANO	OSCILLATORIA	5822564
CYANO	OSCILLATORX	143369
PYRRH	CRYPTOMONAS	39510478
PYRRH	DINOFLAG.I	10000323

Appendix D. Continued.

---------------------Date=16SEP86 Depth (m)=3---------------------

Division[a] Name	Common[b] Name	Reference Biovolume[c]	Ascending Biovolume	Descending Biovolume
CHLOR	GREEN.FLAG	19564580	14130612	24998547
CHLOR	CHLAMYDOMONAS	298368570	.	.
CHLOR	PHACOTACEAE.I	73179611	38787780	107571442
CHLOR	PANDORINA	429004650	.	.
CHLOR	GLOEOCYSTACEAE.I	132739847	132739847	.
CHLOR	GLOEOCYSTIS	32817495	.	32817495
CHLOR	TETRAEDRON	14981019	.	.
CHLOR	PALMELLACEAE	10594849	8149884	13039814
CHLOR	SPHAEROCYSTIS	20335870	16791085	23880655
CHLOR	OOCYSTACEAE.III	33423423	.	.
CHLOR	GLOEOTHAENIUM	250052310	.	250052310
CHLOR	HYALORPHIDIUM	53544997	.	.
CHLOR	KIRCHNERIELLA	1794536	1380413	2208660
CHLOR	TREUBARIA	21961276	.	.
CHLOR	CRUCIGENIA.I	38627942	24455100	.
CHLOR	CRUCIGENIA.II	4471157	.	848954
CHLOR	SCENEDESUMS	58793168	30344861	.
CHLOR	PEDIASTRUM	68041782	94984501	41099063
CHLOR	CHAETOSPHAERIDACEAE.I	10141326	14823210	5459441
CHLOR	DESMIDIACEAE.II	3826604	5210695	2442513
CHLOR	DESMIDIUM	98326673	111289354	85363993
CHLOR	DESMIDIACEAE.I	5180975	7535963	2825986
CHLOR	STARASTRUM	1700239	2315218	1085259
CHROM	DYNOBRYON	57518799	106701540	8336058
CHROM	CENTRIC.GEN	14057051	.	14057051
CHROM	MELOSIRA	27831541	27831541	.
CHROM	PENNATE.GEN	210308345	282090235	138526455
CYANO	APHANACAPSA-COEL.	35188626	48333333	22043919
CYANO	MERISMOPEDIA	4358895	6420130	2297661
CYANO	ANABAENA	13562918	13562918	.
CYANO	OSCILLATOIRACAE	8687448189	14672862540	2702033838
CYANO	LYNGBYA	1828248	1625109	2031386
CYANO	OSCILLATORX	1761313	1792115	1730511
PYRRH	CRYPTOMONAS	102696376	174833866	30558885
PYRRH	DINOFLAG.I	88596611	135004359	42188862

Appendix D. Continued.

Date=18SEP86 Depth (m)=3

Division[a] Name	Common[b] Name	Reference Biovolume[c]	Ascending Biovolume	Descending Biovolume
CHLOR	GREEN.FLAG	4666108	5942226	3389991
CHLOR	CHLAMYDOMONAS	69410308	.	.
CHLOR	PHACOTACEAE.I	60867652	96300694	25434610
CHLOR	GREEN.GENERAL	20074144	.	.
CHLOR	GLOEOCYSTACEAE.I	1830894	1830894	.
CHLOR	GLOEOCYSTIS	8211331	.	141455
CHLOR	TETRAEDRON	5219918	1341108	.
CHLOR	PALMELLACEAE	1336047	.	.
CHLOR	SPHAEROCYSTIS	29741135	.	7720039
CHLOR	OOCYSTACEAE.III	1442059	600283	.
CHLOR	GLOEOTHAENIUM	157696218	.	.
CHLOR	HYALORPHIDIUM	12473260	11895725	13050795
CHLOR	KIRCHNERIELLA	2356612	.	.
CHLOR	TREUBARIA	4246460	4246460	.
CHLOR	ACTINASTRUM	474450	.	474450
CHLOR	CRUCIGENIA.I	6197349	.	.
CHLOR	CRUCIGENIA.II	692344	1366133	18556
CHLOR	SCENEDESUMS	16403207	.	.
CHLOR	PEDIASTRUM	43716640	44917008	42516272
CHLOR	CHAETOSPHAERIDACEAE.I	2053708	.	2053708
CHLOR	CHAETOSPHAERIDIUM	521079	521079	.
CHLOR	DESMIDIUM	56271284	37317593	75224975
CHLOR	DESMIDIACEAE.I	2412232	926553	3897912
CHLOR	STARASTRUM	542936	711645	374227
CHROM	DYNOBRYON	18260161	16398802	20121519
CHROM	OPHIOCYTIUM	12394349	14406792	10381906
CHROM	CENTRIC.GEN	12690750	5422199	19959302
CHROM	MELOSIRA	17994531	.	17994531
CHROM	PENNATE.GEN	65564965	39454463	91675466
CHROM	AMORPHA	5955463	2866530	9044396
CYANO	APHANACAPSA-COELO.	8210567	9101314	7319820
CYANO	MERISMOPEDIA	1447791	1293765	1601817
CYANO	LYNGBYA	111005	111005	.
CYANO	OSCILLATORIA	5369168	5369168	.
CYANO	OSCILLATORX	304300	330513	278087
EUGLE	EUGLENOID	25231569	16260344	34202793
PYRRH	CRYPTOMONAS	11071491	16395229	5747753
PYRRH	DINOFLAG.I	18443218	18443218	.

Appendix D. Continued.

---------------------Date=23SEP86 Depth (m)=3--------------------

Division[a] Name	Common[b] Name	Reference Biovolume[c]
CHLOR	GREEN.FLAG	13907963
CHLOR	CHLAMYDOMONAS	45655847
CHLOR	PHACOTACEAE.I	32952450
CHLOR	PANDORINA.I	19981586
CHLOR	GREEN.GENERAL	3597946
CHLOR	GLOEOCYSTACEAE.I	18795023
CHLOR	GLOEOCYSTIS	1452102
CHLOR	TETRAEDRON	1085942
CHLOR	PALMELLACEAE	5769829
CHLOR	SPHAEROCYSTIS	15849992
CHLOR	OOCYSTACEAE.III	1404202
CHLOR	GLOEOTHAENIUM	165963923
CHLOR	HYALORPHIDIUM	10959075
CHLOR	KIRCHNERIELLA	488642
CHLOR	ACTINASTRUM	1024476
CHLOR	CRUCIGENIA.I	1328012
CHLOR	CRUCIGENIA.II	400686
CHLOR	SCENEDESUMS	16543895
CHLOR	PEDIASTRUM	24247235
CHLOR	CHAETOSPHAERIDACEAE.I	1756860
CHLOR	DESMIDIUM	57077203
CHLOR	DESMIDIACEAE.I	4001396
CHLOR	STARASTRUM	38416
CHROM	DYNOBRYON	8852451
CHROM	OPHIOCYTIUM	16130318
CHROM	CENTRIC.GEN	2927028
CHROM	MELOSIRA	1847226
CHROM	PENNATE.GEN	111940570
CYANO	APHANACAPSA-COELO.	28033565
CYANO	MERISMOPEDIA	1025505
CYANO	LYNGBYA	4434294
CYANO	OSCILLATORX	392521
EUGLE	EUGLENOID	1755542
PYRRH	CRYPTOMONAS	49169566
PYRRH	DINOFLAG.I	9956074
PYRRH	CERATIUM	248948456

Appendix D. Continued.

---------------------Date=25SEP86 Depth (m)=2---------------------

Division[a] Name	Common[b] Name	Reference Biovolume[c]	Ascending Biovolume	Descending Biovolume
CHLOR	GREEN.FLAG	77229330	22320131	.
CHLOR	CHLAMYDOMONAS	140451170	.	79033186
CHLOR	PHACOTACEAE.I	197530796	7388149	.
CHLOR	PANDORINA.I	57649001	.	57649001
CHLOR	PANDORINA.II	204581795	.	.
CHLOR	GREEN.GENERAL	36156529	2420047	.
CHLOR	GLOEOCYSTIS	12003157	.	4189467
CHLOR	TETRAEDRON	6334495	1460850	.
CHLOR	SPHAEROCYSTIS	14471749	.	3810743
CHLOR	OOCYSTACEAE.III	1162453	.	.
CHLOR	ANKISTRODESMUS	12730586	9033742	16427430
CHLOR	GLOEOTHAENIUM	79803929	.	.
CHLOR	HYALORPHIDIUM	30164453	9687971	.
CHLOR	KIRCHNERIELLA	7281082	.	3994386
CHLOR	TREUBARIA	293208	.	.
CHLOR	CRUCIGENIA.I	4241125	4115268	4366982
CHLOR	SCENEDESUMS	23099581	.	.
CHLOR	PEDIASTRUM	30772247	41973511	19570982
CHLOR	CHAETOSPHAERIDACEAE.I	2093867	.	.
CHLOR	DESMIDIUM	38420043	9033227	67806860
CHLOR	DESMIDIACEAE.I	4134472	5382831	2886114
CHLOR	STARASTRUM	812570	516790	1108349
CHROM	DYNOBRYON	17026842	.	17026842
CHROM	OPHIOCYTIUM	774969	774969	.
CHROM	CENTRIC.GEN	12553242	3150039	21956445
CHROM	MELOSIRA	30189609	24849590	35529627
CHROM	PENNATE.GEN	50472494	46641904	54303085
CHROM	AMORPHA	10414139	6938822	13889456
CYANO	APHANACAPSA-COELO.	17917870	21382990	14452751
CYANO	MERISMOPEDIA	1038355	1379548	697163
CYANO	LYNGBYA	195867	161221	230512
CYANO	OSCILLATORX	513395	512033	514756
PYRRH	CRYPTOMONAS	44246632	31749491	56743772
PYRRH	DINOFLAG.I	31573968	53573158	9574777
PYRRH	CERATIUM	239414260	.	239414260

Appendix D. Continued.

----------------------Date=02OCT86 Depth (m)=3----------------------

Division[a] Name	Common[b] Name	Reference Biovolume[c]	Ascending Biovolume	Descending Biovolume
CHLOR	GREEN.FLAG	8566348	4917286	12215411
CHLOR	CHLAMYDOMONAS	105153849	.	.
CHLOR	PHACOTACEAE.I	55340526	.	.
CHLOR	TETRAEDRON	1431287	2344804	517770
CHLOR	PALMELLACEAE	51804953	.	.
CHLOR	CHODATELLA	8344665	6283353	10405976
CHLOR	OOCYSTACEAE.III	2170918	.	.
CHLOR	GLOEOTHAENIUM	118947725	.	39817247
CHLOR	HYALORPHIDIUM	15495918	13972571	17019265
CHLOR	KIRCHNERIELLA	701169	.	.
CHLOR	TREUBARIA	3137512	3137512	.
CHLOR	CRUCIGENIA.I	8474762	3376999	.
CHLOR	SCENEDESUMS	30931689	.	10354252
CHLOR	PEDIASTRUM	13961465	.	.
CHLOR	CHAETOSPHAERIDACEAE.I	5041959	5057965	5025953
CHLOR	DESMIDIACEAE.II	19866219	.	.
CHLOR	DESMIDIUM	21672316	19332256	24012375
CHLOR	DESMIDIACEAE.I	7172623	.	.
CHROM	OPHIOCYTIUM	41115569	44084918	38146221
CHROM	CENTRIC.GEN	2104048	837352	3370743
CHROM	MELOSIRA	26590644	.	26590644
CHROM	PENNATE.GEN	73921570	72265431	75577709
CYANO	APHANACAPSA-COELO.	12638616	15708747	9568486
CYANO	MERISMOPEDIA	710637	632268	789006
CYANO	ANABAENA	4319401	.	4319401
CYANO	LYNGBYA	1719163	1885675	1552652
CYANO	OSCILLATORX	1526848	1752416	1301281
PYRRH	CRYPTOMONAS	53550229	75957644	31142813
PYRRH	DINOFLAG.I	14331673	.	14331673

Appendix D. Continued.

---------------------Date=21OCT86 Depth (m)=2---------------------

Division[a] Name	Common[b] Name	Reference Biovolume[c]	Ascending Biovolume	Descending Biovolume
CHLOR	GREEN.FLAG	1723077	636275	2809878
CHLOR	CHLAMYDOMONAS	65721156	.	.
CHLOR	PHACOTACEAE.I	4773881	.	.
CHLOR	PANDORINA	123737513	17368609	230106416
CHLOR	GLOEOCYSTACEAE.I	693238890	216442043	.
CHLOR	TETRAEDRON	2664459	.	1101256
CHLOR	PALMELLACEAE	8776798	.	.
CHLOR	CHODATELLA	3359177	2529453	4188902
CHLOR	OOCYSTACEAE.III	2895652	.	.
CHLOR	HYALORPHIDIUM	13777545	9525965	18029124
CHLOR	KIRCHNERIELLA	212371	.	.
CHLOR	TREUBARIA	6275024	.	.
CHLOR	CRUCIGENIA.I	2981864	.	.
CHLOR	CRUCIGENIA.II	720980	288392	1153568
CHLOR	SCENEDESUMS	19517765	.	.
CHLOR	CHAETOSPHAERIDACEAE.I	1527116	1527116	.
CHLOR	CHAETOSPHAERIDIUM	1214745	.	1214745
CHLOR	DESMIDIACEAE.II	501028	501028	.
CHLOR	DESMIDIUM	12129132	14592136	9666128
CHROM	DYNOBRYON	17872900	10259763	25486037
CHROM	OPHIOCYTIUM	3446237	1502247	5390227
CHROM	CENTRIC.GEN	4213429	.	4213429
CHROM	MELOSIRA	101095585	16056658	186134511
CHROM	PENNATE.GEN	33889308	29276764	38501852
CHROM	ASTERIONELLA	22298547	.	22298547
CYANO	APHANACAPSA-COELO.	4160211	.	4160211
CYANO	MERISMOPEDIA	153690	153690	.
CYANO	ANABAENA	13041267	13041267	.
CYANO	LYNGBYA	3622854	.	3622854
CYANO	OSCILLATORX	310174	310174	.
EUGLE	EUGLENOID	25270853	.	25270853
PYRRH	CRYPTOMONAS	53792132	.	53792132
PYRRH	DINOFLAG.I	68819591	8654126	128985057

Appendix D. Continued.

---------------------Date=27OCT86 Depth (m)=1---------------------

Division[a] Name	Common[b] Name	Reference Biovolume[c]	Ascending Biovolume	Descending Biovolume
CHLOR	GREEN.FLAG	9968312	2333009	17603615
CHLOR	CHLAMYDOMONAS	361137751	67465294	.
CHLOR	PHACOTACEAE.I	4773881	.	4773881
CHLOR	PANDORINA	208423312	.	.
CHLOR	GLOEOCYSTACEAE.I	49011636	49011636	49011636
CHLOR	GLOEOCYSTIS	8835479	.	.
CHLOR	TETRAEDRON	629289	.	.
CHLOR	PALMELLACEAE	1253828	1253828	1253828
CHLOR	CHODATELLA	11382536	.	.
CHLOR	OOCYSTACEAE.III	1549192	1314466	1783918
CHLOR	HYALORPHIDIUM	20140612	2177363	.
CHLOR	TREUBARIA	1894574	.	1894574
CHLOR	ACTINASTRUM	1335759	.	.
CHLOR	CRUCIGENIA.I	1282610	1282610	.
CHLOR	SCENEDESUMS	18131888	.	6877613
CHLOR	CHAETOSPHAERIDACEAE.I	916270	.	.
CHLOR	DESMIDIUM	8755281	8755281	8755281
CHLOR	DESMIDIACEAE.I	869534	.	869534
CHROM	DYNOBRYON	32061761	25649409	38474113
CHROM	OPHIOCYTIUM	500749	.	500749
CHROM	CENTRIC.GEN	6869509	11703608	2035410
CHROM	MELOSIRA	96339950	48169975	144509926
CHROM	PENNATE.GEN	14638382	12916220	16360545
CHROM	ASTERIONELLA	17953189	17953189	.
CYANO	APHANACAPSA-COELO.	879245	1256064	502426
CYANO	MERISMOPEDIA	122952	.	122952
CYANO	ANABAENA	13041267	20866027	5216507
CYANO	LYNGBYA	1562605	2083473	1041737
CYANO	OSCILLATORX	134409	155087	113730
EUGLE	EUGLENOID	30519415	.	30519415
PYRRH	CRYPTOMONAS	83769812	83769812	.
PYRRH	DINOFLAG.I	86541256	.	86541256
PYRRH	CERATIUM	216393658	.	216393658

Appendix D. Continued.

---------------------Date=29OCT86 Depth (m)=1---------------------

Division[a] Name	Common[b] Name	Reference Biovolume[c]	Ascending Biovolume	Descending Biovolume
CHLOR	GREEN.FLAG	16881973	16591956	17171989
CHLOR	CHLAMYDOMONAS	290595462	.	.
CHLOR	PANDORINA.I	49691049	39963172	59418927
CHLOR	GREEN.GENERAL	37529887	.	.
CHLOR	GLOEOCYSTACEAE.I	37260308	37260308	.
CHLOR	TETRAEDRON	539796	.	180990
CHLOR	SPHAEROCYSTIS	7924996	.	.
CHLOR	OOCYSTACEAE.III	698311	540078	856544
CHLOR	ANKISTRODESMUS	7514794	.	.
CHLOR	HYALORPHIDIUM	5292766	3414068	.
CHLOR	KIRCHNERIELLA	488642	.	488642
CHLOR	ACTINASTRUM	2543216	.	.
CHLOR	SCENEDESUMS	1791940	2157899	1425980
CHLOR	PEDIASTRUM	4849447	.	.
CHLOR	CHAETOSPHAERIDACEAE.I	2456521	348290	.
CHLOR	DESMIDIUM	29981730	.	3357483
CHROM	DYNOBRYON	11803268	.	.
CHROM	OPHIOCYTIUM	4282721	4282721	.
CHROM	CENTRIC.GEN	9019867	12185679	5854056
CHROM	MELOSIRA	174676301	183102245	166250357
CHROM	ASTERIONELLA	5118234	5118234	.
CYANO	APHANACAPSA-COELO.	719979	572941	867017
CYANO	MERISMOPEDIA	105156	105156	.
CYANO	OSCILLATORX	76793	117902	35684
EUGLE	EUGLENOID	271338971	174014209	368663732
PYRRH	CRYPTOMONAS	102635000	140366173	64903828
PYRRH	DINOFLAG.I	169253253	.	169253253
PYRRH	CERATIUM	497896912	.	497896912

[a]Division abbreviations follow the conventions of Bourelly (1968, 1969, 1972). CHLOR: Chlorphyta, CHROM:Chromophyta, CYANO:Cyanophyta, EULGE: Euglenophyta, PYRRH:Pyrrhophyta.

[b]Common names follow the conventions established by Bourelly and other investigators where feasable; however, where there was no applicable taxonomic classification, morphological descriptions suffice.

[c]Biovolume units: 1 unit=0.0037 mm^3, based upon geometric estimates of cell volume, derived from an occular micrometer (see text). No reference sample was analysed for 03Jun86.

Appendix E. Particle-associated radionuclide removal rate data.

Date	dt[a]	Particle concentration (mg·L^{-1})	Radionuclide concentration by volume (pCi·g^{-1}) ^{7}Be	(s.d.)	^{210}Pb	(s.d.)	Volume ratio ^{7}Be:^{210}Pb
19MAR	0	17.3	0.32	0.01	0.022	0.003	14.5
20MAR	1	19.7	0.18	0.01	0.021	0.004	8.5
21MAR	2	13.9	0.13	0.01	0.022	0.003	5.9
24MAR	5	12.1	0.10	0.01	0.008	0.003	12.5
26MAR	7	12.7	0.08	0.01	0.020	0.003	4.0
27MAR	8	11.1	0.06	0.00	0.014	0.003	4.2
01APR	13	10.0	0.03	0.00	0.009	0.003	3.8
04APR	16	6.9	0.06	0.01	0.009	0.003	6.7
Removal rates[b] for 19MAR through 04APR ^{7}Be: 11.1%·d^{-1}, ^{210}Pb: 6.4%·d^{-1}							
09APR	1	7.3	0.15	0.01	0.013	0.003	11.5
10APR	2	5.5	0.11	0.01	0.006	0.004	18.3
11APR	3	6.4	0.08	0.01	0.003	0.003	26.7
14APR	6	8.7	0.07	0.00	0.004	0.004	17.5
17APR	9	12.3	0.03	0.00	0.003	0.003	10
Removal rates for 08APR through 17APR ^{7}Be: 17.9%·d^{-1}, ^{210}Pb: 13.3%·d^{-1}							
27OCT	2		4.7	0.08		0.015	5.3
28OCT	3		8.8	0.07		0.019	3.6
29OCT	4		4.5	0.04		0.010	4
31OCT	6		3.4	0.03		0.009	3.3
03NOV	9		6.8	0.02		0.013	1.5
Removal rates for 25OCT through 03NOV[c] ^{7}Be: 17.7 %·d^{-1}, ^{210}Pb: 4.5%·d^{-1}							

[a]dt: elapsed time, in days, since precipitation event.

[b]Removel rates calculated from linear regression of natural log transformed data.

[c]Yield corrected data for this sampling period are not yet available.

Appendix F. Results from multiple-stepwise regression procedures using standard deviation transformed data. These multiple regressions used the equation which optimized the number of predictor variables, the significance of the coefficient of multilpe regression, and the C_p statistic for all criterion (particulate matter) variables.

Variable	Regression Coeff	Partial Correl	Partial R^2	F^a	P > F
Predictor variables for chlorophyll concentration:					
H descending assemblage	- 0.3923	- 0.5899	0.2393	18.69	0.0001
Assemblage net algal flux	- 0.2035	- 0.4610	0.1260	9.45	0.0041
SD descending assemblage	0.3018	0.5352	0.1874	14.05	0.0006
ORP	- 0.6062	- 0.5812	0.2382	17.86	0.0002
regression[b]	R^2=0.5331, M.S.=0.0296, F=9.9, P > F=0.0001				
Predictor variables for phaeopigment concentration:					
DOC concentration	- 0.4881	- 0.6938	0.4427	33.42	0.0001
Date	- 45.415	- 0.6793	0.4088	30.86	0.0001
Particulate nutrient concentration	- 0.1308	- 0.3389	0.0618	4.67	0.0374
regression[b]	R^2=0.5231, M.S.=0.0207, F=13.16, P > F=0.0001				
Predictor variables for particulate carbon concentration:					
Chlorophyll concentration	0.1596	0.7426	0.2632	20.90	0.0003
Assemblage biovolume	0.0612	0.5399	0.0880	6.99	0.0170
Conductivity	- 0.3270	- 0.8112	0.4121	32.72	0.0001

Appendix F. Continued.

Variable	Regression Coeff	Partial Correl	Partial R^2	F^a	P > F
Predictor variables for particulate carbon (continued):					
PAR	0.0910	0.6976	0.2029	16.11	0.0009
regression[b]	R^2=0.7859,	M.S.=0.0051,	F=15.60 P > F=0.0001		
Predictor variables for particulate nitrogen concentration:					
Chlorophyll concentration	0.2312	0.8295	0.3722	35.29	0.0001
SD descending assemblage	0.0386	0.8295	0.3722	2.24	0.1540
Assemblage net algal flux	0.0424	0.3710	0.0269	2.55	0.1296
PAR	0.1371	0.7932	0.2864	27.15	0.0001
Conductivity	- 0.2401	- 0.6734	0.1401	13.28	0.0022
regression[b]	R^2=0.8312,	M.S.=0.0061,	F=15.76 P > F=0.0001		
Predictor variables for particulate phosphorus concentration:					
Phaeopigment concentration	0.3523	0.4926	0.1729	8.65	0.0066
Conductivity	- 0.4065	- 0.5254	0.2058	10.30	0.0034
SRP concentration	- 0.0569	- 0.2201	0.0274	1.37	0.2512
N^2	- 0.1006	- 0.2630	0.0401	2.01	0.1680
regression[b]	R^2=0.4605,	M.S.=0.0097,	F=5.76, P > F=0.0011		

Appendix F. Continued.

Variable	Regression Coeff	Partial Correl	Partial R^2	F^a	P > F
Predictor variables for total biovolume:					
Particulate nutrient concentration	0.6955	0.5223	0.2254	6.75	0.0182
Chlorophyll ascent rate	- 0.3212	- 0.3402	0.0786	2.36	0.1422
Phaeopigment concentration	1.0705	0.4653	0.1661	4.97	0.0387
pH	0.3403	0.2305	0.0337	1.01	0.3283
regression[b]	R^2=0.3991,	M.S.=0.0525,	F=2.99,	P > F=0.0468	
Predictor variables for mean size of algal cells:					
Conductivity	4.3421	0.6427	0.3054	10.55	0.0054
Phaeopigment sinking rate	1.1376	0.6905	0.3956	13.67	0.0022
N^2	1.9091	0.6942	0.4038	13.96	0.0020
Date	196.97	0.5997	0.2437	8.42	0.0109
ORP	- 2.6562	- 0.5457	0.1841	6.36	0.0235
Particulate nutrient sinking rate	- 0.4374	- 0.3728	0.0700	2.42	0.1405
SRP concentration	- 0.2627	- 0.3494	0.0603	2.09	0.1691
regression[b]	R^2=0.5659	M.S.=0.0573	F=2.79	P > F=0.0450	
Predictor variables for H_{ref}:					
Chlorophyll ascent rate	0.3323	0.6226	0.1959	10.13	0.0058

Appendix F. Continued.

Variable	Regression Coeff	Partial Correl	Partial R^2	F^a	P > F
Predictor variables for H_{ref} (continued):					
Phaeopigment concentration	- 0.2578	- 0.4208	0.0666	3.44	0.0820
N^2	0.3141	0.6415	0.2164	11.19	0.0041
Chlorophyll sinking rate	- 0.4582	0.5822	0.1587	8.20	0.0112
NO_3-N concentration	- 0.1370	- 0.4780	0.0916	4.47	0.0448
Total phosphorus concentration	0.2902	0.5866	0.1623	8.39	0.0105
regression[b]	R^2=0.6138,	M.S.=0.0101	F=5.95	P > F=0.0020	
Predictor variables for SD_{ref}:					
Chlorphyll ascent rate	- 1.3180	- 0.8059	0.4221	22.24	0.0005
pH	1.1948	0.7095	0.2309	12.17	0.0045
Conductivity	2.3947	0.4978	0.0750	3.95	0.0701
Chlorophyll sinking rate	1.1837	0.6539	0.1701	8.96	0.0112
DOC concentration	- 1.0305	- 0.8506	0.6247	32.91	0.0001
Total phosphorus concentration	- 0.7701	- 0.7108	0.2377	12.26	0.0044
Particulate nutrient concentration	0.5905	0.7151	0.2383	12.56	0.0040
regression[b]	R^2=0.7722,	M.S.=0.0421,	F=5.81,	P > F=0.0041	

Appendix F. Continued.

Variable	Regression Coeff	Partial Correl	Partial R^2	F^a	P > F
Predictor variables for chlorophyll ascent rate:					
Chlorophyll concentration	- 0.2279	- 0.1366	0.0123	0.99	0.3301
Date	78.722	0.5096	0.2285	13.49	0.0014
ORP	- 1.2593	- 0.5185	0.2396	11.46	0.0027
regression[b]	R^2=0.3487, M.S.=0.0730, F=7.12, P > F=0.0016				
Predictor variables for chlorophyll sinking rates:					
Conductivity	0.8183	0.2350	0.0383	3.85	0.0639
Date	90.057	0.4556	0.1727	11.97	0.0025
SRP concentration	- 0.2392	- 0.3021	0.0658	3.56	0.0738
NH_3-N concentration	0.0444	0.0377	0.0009	1.64	0.2150
ORP	- 1.1284	- 0.3722	0.1055	5.73	0.0266
regression[b]	R^2=0.3444, M.S.=0.0378, F=3.95, P > F=0.0118				
Predictor variables for phaeopigment sinking rates:					
SD_{ref}	0.5062	0.3685	0.0875	3.14	0.0915
Total phosphorus concentration	0.2657	0.3427	0.0741	2.66	0.1185
PAR	- 0.2802	- 0.3081	0.5847	2.10	0.1630
Conductivity	- 0.6415	- 0.3375	0.0716	2.57	0.1245
SD descending assemblage	- 0.6079	- 0.4384	0.1327	4.76	0.0412
regression[b]	R^2=0.4425, M.S.=0.0430, F=3.17, P > F=0.0286				

Appendix F. Continued.

Variable	Regression Coeff	Partial Correl	Partial R^2	F[a]	P > F
Predictor variables for particulate carbon sinking rates:					
Date	64.487	0.7564	0.1730	14.71	0.0028
Chlorophyll sinking rate	0.5349	0.7263	0.1444	12.28	0.0049
Chlorophyll ascent rate	- 0.6409	- 0.8295	0.2855	24.28	0.0005
SD descending assemblage	- 0.5403	- 0.8622	0.3756	31.94	0.0001
Net algal flux	0.1472	0.5184	0.0475	4.04	0.0695
regression[b]	R^2=0.8706, M.S.=0.0377, F=14.81, P > F=0.0001				
Predictor variables for particulate nitrogen sinking rates:					
Chlorophyll sinking rate	0.5188	0.7319	0.1385	12.69	0.0045
Date	61.464	0.7560	0.1601	14.67	0.0028
Chlorophyll ascent rate	- 0.5761	- 0.8136	0.2351	21.55	0.0007
Net algal flux	0.0797	0.3253	0.0142	1.30	0.2781
SD descending assemblage	- 0.4778	- 0.8448	0.2992	27.43	0.0003
regression[b]	R^2=0.8799, M.S.=0.0374, F=16.13, P > F=0.0001				
Predictor variables for particulate phosphorus sinking rates:					
Chlorophyll sinking rate	0.6808	0.8851	0.5855	39.80	0.0001
Chlorophyll ascent rate	- 0.4884	- 0.7569	0.2172	14.76	0.0027

Appendix F. Continued.

Variable	Regression Coeff	Partial Correl	Partial R^2	F[a]	P > F
Predictors of particulate phosphorus sinking (continued):					
H descending assemblage	0.2773	0.5602	0.1315	5.03	0.0464
pH	0.1717	0.4294	0.0365	2.47	0.1431
regression[b]	R^2=0.8382, M.S.=0.0262, F=11.39, P > F=0.0005				
Predictors of total net algal flux:					
Chlorophyll ascent rates	- 1.0209	- 0.7830	0.4251	20.60	0.0006
NH_3-N concentration	- 0.2097	- 0.3333	0.0335	1.62	0.2247
Dissolved oxygen	- 1.0869	- 0.6438	0.1900	9.21	0.0096
Total phosphorus concentration	- 0.4825	- 0.6065	0.1561	7.57	0.0165
Date	116.59	0.7978	0.4697	22.76	0.0004
regression[b]	R_2=0.7318, M.S.=0.0849, F= 7.09, P > F=0.0021				
Predictor variables for descending assemblage H:					
NO_3-N concentration	- 0.2137	- 0.5571	0.1213	5.85	0.0310
Date	31.276	0.5665	0.1274	6.15	0.0277
N^2	0.3270	0.7047	0.2657	12.82	0.0034
Phaeopigment concentration	- 0.2050	- 0.3241	0.0316	1.53	0.2385
ORP	- 0.3670	- 0.5078	0.0936	4.52	0.0533
regression[b]	R^2=0.7305, M.S.=0.0165, F=7.05, P > F=0.0022				

Appendix F. Continued.

Variable	Regression Coeff	Partial Correl	Partial R^2	F^a	P > F
Predictor variables for descending SD:					
Chlorophyll ascent rate	- 0.6052	- 0.5328	0.1582	5.16	0.0408
Particulate nutrient concentration	1.1922	0.7025	0.3888	12.67	0.0035
Chlorophyll sinking rate	0.9538	0.5864	0.2091	6.81	0.0216
NH_3-N concentration	- 0.4456	- 0.5950	0.2187	7.13	0.0193
Particulate nutrient sinking rate	- 0.8348	- 0.5729	0.1704	5.55	0.0348
Conductivity	- 4.1028	- 0.5729	0.1949	6.35	0.0265
regression[b]	R^2=0.6010, M.S.=0.0405, F= 3.26, P > F=0.0349				

[a]F probability associated with Type II sum of squares (F=Type II sum of squares/Mean Square error). Type II sum of squares is the sum of squares added to error sum of squares if this variable is removed from the regression model.

[b]Anova statistics for the multivariate regression: R_2 is the coefficient of multiple determination, M.S. is the means square due to regression, F is the ratio of M.S. regression and M.S. error, and P > F is the probability of getting a larger F by chance.

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