

734

Observations of Dissolved Nutrients, Phytoplankton Biomass, Sedimentation and Sediment Organic Matter in St. Georges Bay, 1978

B.T. Hargrave and N.J. Prouse

Marine Ecology Laboratory
Bedford Institute of Oceanography
Ocean Science and Surveys
Department of Fisheries and Oceans
Dartmouth, Nova Scotia
B2Y 4A2

March 1981

**Canadian Technical Report of
Fisheries and Aquatic Sciences
No. 1001**



Government of Canada
Fisheries and Oceans

Gouvernement du Canada
Pêches et Océans

Canadian Technical Report of
Fisheries and Aquatic Sciences 1001

March 1981

OBSERVATIONS OF DISSOLVED NUTRIENTS, PHYTOPLANKTON
BIOMASS, SEDIMENTATION AND SEDIMENT ORGANIC MATTER

by

B.T. Hargrave and N.J. Prouse

Marine Ecology Laboratory
Bedford Institute of Oceanography
Ocean Science and Surveys, Atlantic
Department of Fisheries and Oceans
Dartmouth, Nova Scotia
B2Y 4A2

This is the 80th Technical Report from the
Marine Ecology Laboratory, Dartmouth, N.S.

Minister of Supply and Services Canada 1981

Cat. No. 97-6/1001

ISSN 0706-6457

Table of Contents

Acknowledgements	iv
Abstract	v
Introduction	1
Sampling and Analytical Methods	1
Results and Discussion	2
1. Temperature and Salinity	2
2. Dissolved Inorganic Nutrients	5
3. Phytoplankton Production	19
4. Suspended and Sedimented Particulate Organic Matter	21
5. Sedimentary Organic Matter and Plant Pigments	43
Conclusions	49
References	53
Appendices	54
I. Temperature, salinity, density, dissolved nutrients, plant pigments, carbon and nitrogen in suspended matter	54
II. Sedimentation of dry matter, organic carbon, nitrogen and plant pigments	94
III. Sedimentary Organic Matter	97

ACKNOWLEDGEMENTS

We thank the captain and crew of the Navicula for their interest in our work and willingness to help in sampling. Staff and pilots of the CSS helicopter group, Halifax Search and rescue operations, made our winter sampling programme possible and we appreciate their assistance. M. Hodgson and G. Phillips conducted analyses for dissolved nutrients, carbon and nitrogen. K. Drinkwater kindly read the draft of this report.

ABSTRACT

Hargrave, B.[#]T., and N.[#]J. Prouse.[#] 1981.^{##} Observations of dissolved nut-
rients, phytoplankton biomass, sedimentation and sediment organic
matter in St. Georges Bay, 1978.^{##} Can. Tech. Rep. Fish. Aquat.
Sci. 1001, ⁹¹98 p. ()

Profiles of temperature, salinity, dissolved nutrients, suspended particulate carbon, nitrogen and plant pigments were derived from samples collected from January to November, 1978, at a central station in St. Georges Bay. High levels of dissolved nitrate, nitrite, ammonia and silicate in the water column occurred during January and February which coincided with seasonal maxima of chlorophyll a and organic matter. Sedimentation of particulate organic matter and concentrations in surface sediments during the summer were similar to levels observed during 1977.

RÉSUMÉ

Hargrave, B.T., and N. Prouse. 1981. Observations of dissolved nutrients, phytoplankton biomass, sedimentation and sediment organic matter in St. Georges Bay, 1978. Can. Tech. Rep. Fish. Aquat. Sci. 1001 p. 98.

Des échantillons recueillis entre janvier et novembre 1978 à une station centrale de la baie St-Georges ont servi à dresser les profils suivants : température, salinité, éléments nutritifs dissous, carbone particulaire en suspension, azote et phytocarbènes. On a observé de hauts niveaux de nitrates, nitrites, ammoniac et silicate dissous dans la colonne d'eau en janvier et février, coïncidant avec les maxima de chlorophylle a et de

matière organique. La sédimentation de la matière organique particulaire et les concentrations dans les sédiments superficiels étaient semblables aux niveaux observés en 1977.

INTRODUCTION

Annual observations in St. George's Bay between April and November in 1976 and 1977 were extended in 1978 to cover the period of January to November. Previous studies in this coastal embayment were carried out by ship. During winter, however, ice cover and poor weather prevented regular sampling. Accordingly, a helicopter provided by the Canadian Coast Guard Base, Dartmouth, was used to collect water samples. While many types of samples can not easily be collected from a helicopter (plankton tows and sediments cores can only be taken with difficulty), we were able to collect water samples from discrete depths. Analysis of these samples and those collected during the routine shipboard sampling schedule (24/4 - 1/11, 1978) are summarized in this report along with measures of sedimentation and organic matter in surface sediments during summer and fall periods. The data, when combined with that reported previously (Prouse and Hargrave 1977, Marine Ecology Laboratory 1980) complete the description of seasonal patterns of distribution of dissolved nutrients and phytoplankton biomass over a full annual period.

SAMPLING AND ANALYTICAL METHODS

Water samples were collected at monthly intervals during winter and early spring and on a weekly basis thereafter. A helicopter was used for collection of water samples by a hand-held line and messenger released bottle in January, February, March and early April. A central station near the position of station 7 (Marine Ecology Laboratory 1980) was chosen, depending on ice conditions, for sampling. It was not possible to routinely measure temperature because of limitations of space and time involved

with use of the helicopter for sampling. Nansen reversing bottles were used from the research vessel NAVICULA after 24/4. Salinity was analyzed later using an auto-lab salinometer (± 0.01 ‰).

Plant pigments, particulate organic carbon and nitrogen and dissolved nutrients were analyzed as described previously (Marine Ecology Laboratory 1980). Phytoplankton production was only measured on three occasions during 1978, however, sediment traps were exposed at 22 and 25 m for seven day periods from May through October. Estimates of particulate deposition rates were derived as described by Prouse and Hargrave (1977).

RESULTS AND DISCUSSION

1. Temperature and Salinity

The characteristic summer maxima of temperature in the surface waters of St. Georges Bay was achieved in mid-August (19.6°C , Aug. 14) (Fig. 1) similar to observations in 1977. In contrast to 1977, a

Month	Mixed-Layer Depth (m)
June	15
July	20
August	20-25
September	25-30
October	34

thermocline was established at 15 m by late May and this progressively deepened throughout the summer. Over the five month interval of observations the thermocline deepened at a rate of 0.15 m d^{-1} . Drinkwater and Taylor (1979) calculated a rate of mixed-layer thickening of 0.14 m d^{-1} in 1977.

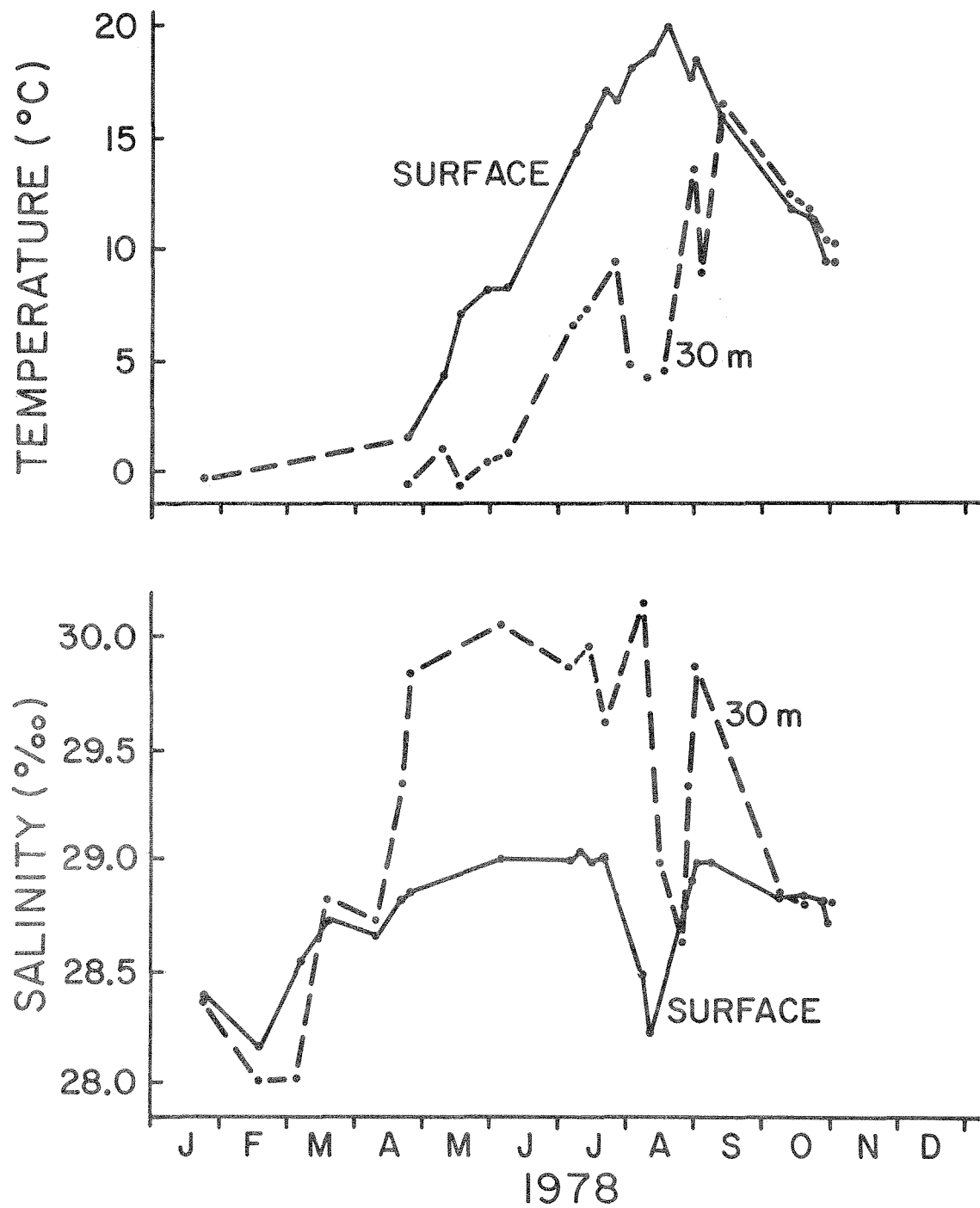


Fig. 1. Time series of temperature and salinity at 0 and 30 m at station 7 in St. Georges Bay during 1978.

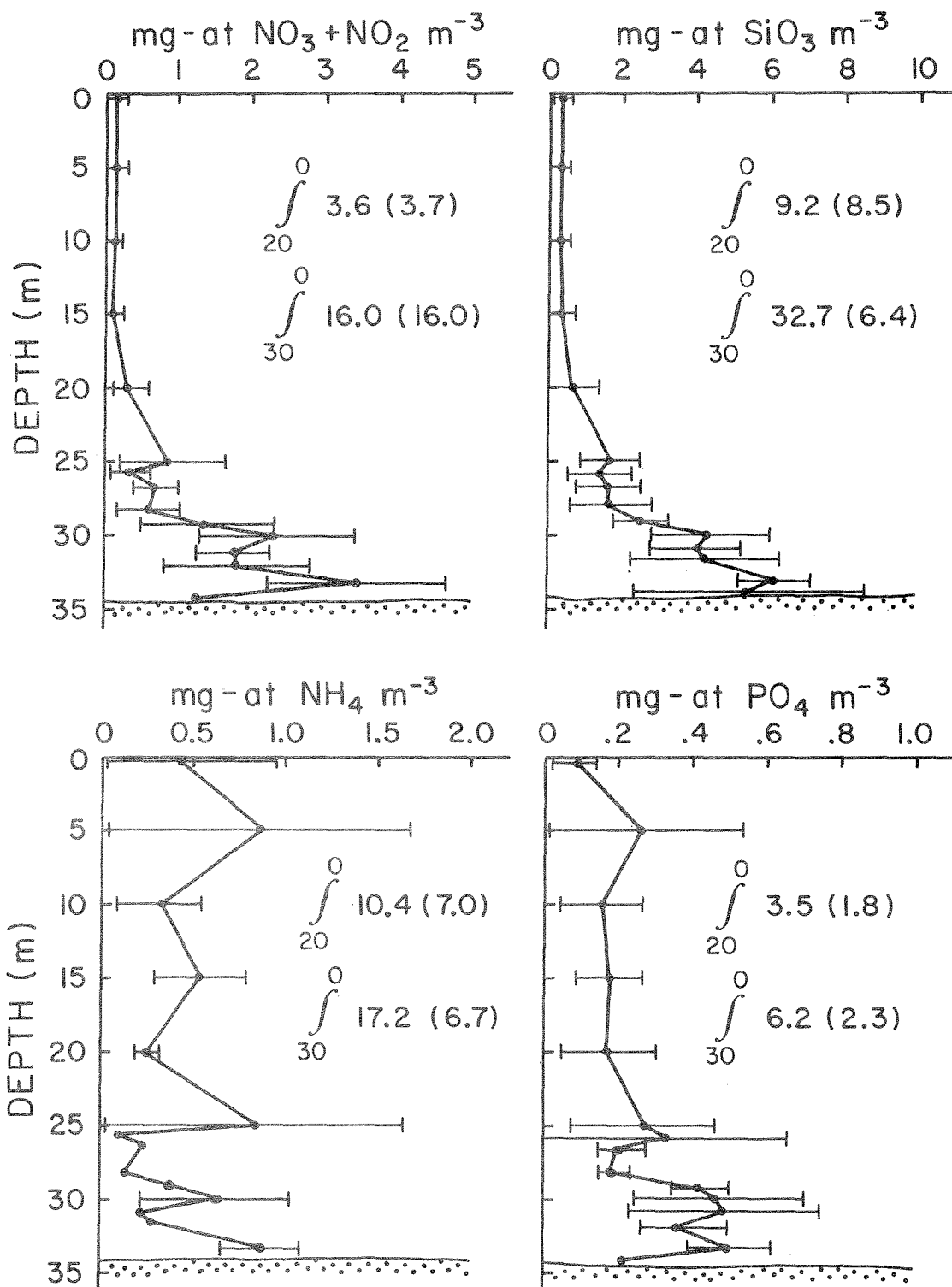
The progressive deepening of the thermocline is a regular summer occurrence in the Bay. Superimposed on this trend, however, are intermittent events which result in large temperature changes in near-bottom water. In 1978 a rapid cooling occurred in late July with a correspondingly rapid heating in late August (Fig. 1). Fluctuations in salinity (increases and decreases respectively) occurred during these events. A separate investigation of time series temperature recordings at specific depths will be used to further quantify these high frequency events (K. Drinkwater, pers. comm.). Despite these intervals of marked temperature change, warming of bottom layers of water (below 30 m) above 10°C is restricted to September and October.

The annual cycle of salinity in St. Georges Bay demonstrated that minimum values occurred during February and August (Fig. 1). Maximum annual values also occurred at 30 m during August probably due to the advection of deep water into the Bay. Freshwater discharge from the St. Lawrence River is probably the source for the low salinity water during summer.

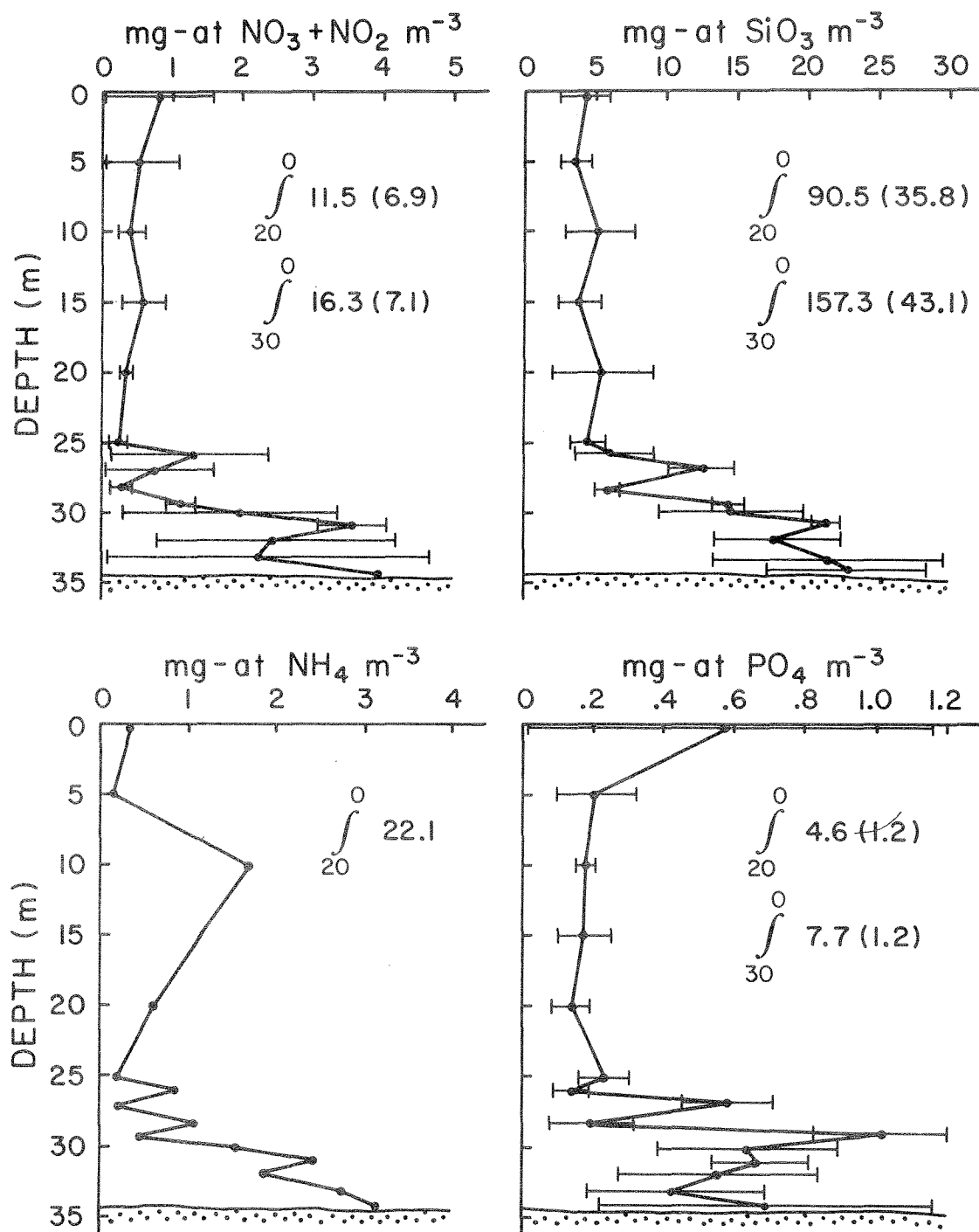
2. Dissolved Inorganic Nutrients

Observations during 1977 demonstrated the presence of steep concentrations gradients for some nutrients above the bottom during periods of stratification in St. Georges Bay. Information was not available concerning the persistence (over daily or tidal periods) of these gradients nor were closely spaced samples collected to demonstrate the shape of the near-bottom concentration gradient. Measurements were made on two dates to provide this information during 1978 (Fig. 2a, b).

Fig. 2a, b. Vertical profiles of dissolved inorganic nutrients at Station 7 in St. Georges Bay measured on six occasions between 5-8/6 and on five occasions between 28/8 and 1/9 in 1978. Means and one standard deviation (horizontal bars) plotted for depths where replicate samples were collected. Integrals (mg-at m^{-2}) (and one standard deviation) calculated between 0-20 m and 0-30 m from average values in each profile.



5-8 JUN 78



28-31 AUG - 1 SEP 78

The water column was stratified with the thermocline at 15 m in June (5-8) and 25 m in late August (28-31, Sep 1) when replicate profiles were measured. Six and five profiles of 15 depths each were sampled over the two collection periods respectively and average and standard deviations of dissolved nutrient concentrations calculated (Fig. 2a, b). Analytical variation (σ/\bar{x}) varied from 0.08 for ammonia to 0.04 for nitrate. Variation in excess of this amount is thus attributable to sampling effects. The same Nansen water bottles were used throughout the study and all samples were treated in a similar way during collection. However, environmental heterogeneity could produce variation.

Largest variance in replicate profiles was observed in near-bottom samples (25-34 m) (Fig. 2a, b) where concentration gradients over depth were greatest. Thus, small differences in bottle position on the hydrowire (± 0.25 m) could make a substantial difference in the concentrations of dissolved nutrients measured. Water bottle depth was always determined relative to the surface, with no correction for tidal amplitude or boat motion (often ± 0.5 m). The cumulative effect of these factors is to make absolute depth determination for water samples ± 1 m. Where steep concentration gradients exist near bottom within this depth interval, details of concentration profiles cannot be interpreted unambiguously. The overlapping ranges of standard deviations for concentrations measured near the bottom illustrate this fact.

These variations in determining concentration profiles of dissolved nutrients provide error limits around integrals calculated from profiles measured at regular sampling intervals during the year. Values for coefficients of determination for integrals calculated over the two intensive

sampling periods, for example, varied from 0.16 to 1.02 (Table 1). Integral concentration of dissolved nutrients above and below 20 m (Table 2, Fig. 3) must be considered in terms of this level of uncontrolled variation. Thus, maximum concentrations of silicate, ammonia and nitrate between January and March are significantly greater than concentration during May and June, but variations in concentrations between January and March are not significant.

Low concentrations of dissolved inorganic nutrients during early summer correspond to observations in 1977 (Marine Ecology Laboratory 1980). This period is preceeded, however, by high concentrations of all four nutrients during winter (Fig. 3). The abrupt decrease in concentrations during April implies that this marks the occurrence of the spring phytoplankton bloom. Reductions in concentration occurred between January and February also, with the most significant decrease in dissolved nitrate. Late summer through fall increases in all four nutrients are similar to increases observed at this time during 1977.

Comparison of ratios of integrated nutrient concentrations above and below the thermocline before, during and after summer stratification should indicate if biological production by phytoplankton in the mixed-layer is responsible for maintaining reduced levels of dissolved nutrients during summer. Where ratios in shallow and deeper water are similar, relative changes in concentration of different nutrients may have also been similar. However, if phytoplankton alter relative concentrations, changes in ratios will occur. These comparisons (Tables 3a, b) show that ratios above and below 20 m are most similar during periods of no stratification (prior to early May and after August).

Table 1. Integral concentrations (mg-at m⁻²) of various dissolved inorganic nutrients in St. Georges Bay on two dates in 1978. Integrals calculated from four to six separate profiles of concentration measured on consecutive days.

	0 - 20			0 - 30		
	\bar{x}	σ	c.v.	\bar{x}	σ	c.v.
5-8/6/78						
NO ₃ + NO ₂	3.6	3.7	1.00	16.0	16.0	1.00
SiO ₃	8.0	8.1	1.02	30.6	7.2	0.23
NH ₄	10.4	7.0	0.67	17.2	6.7	0.39
PO ₄	3.5	1.8	0.52	6.2	2.3	0.37
28-31/8/78 1/9/78						
NO ₃ + NO ₂	11.5	6.9	0.60	16.3	7.1	0.43
SiO ₃	90.5	35.8	0.40	157.3	43.2	0.27
PO ₄	4.6	1.2	0.27	7.7	1.2	0.16

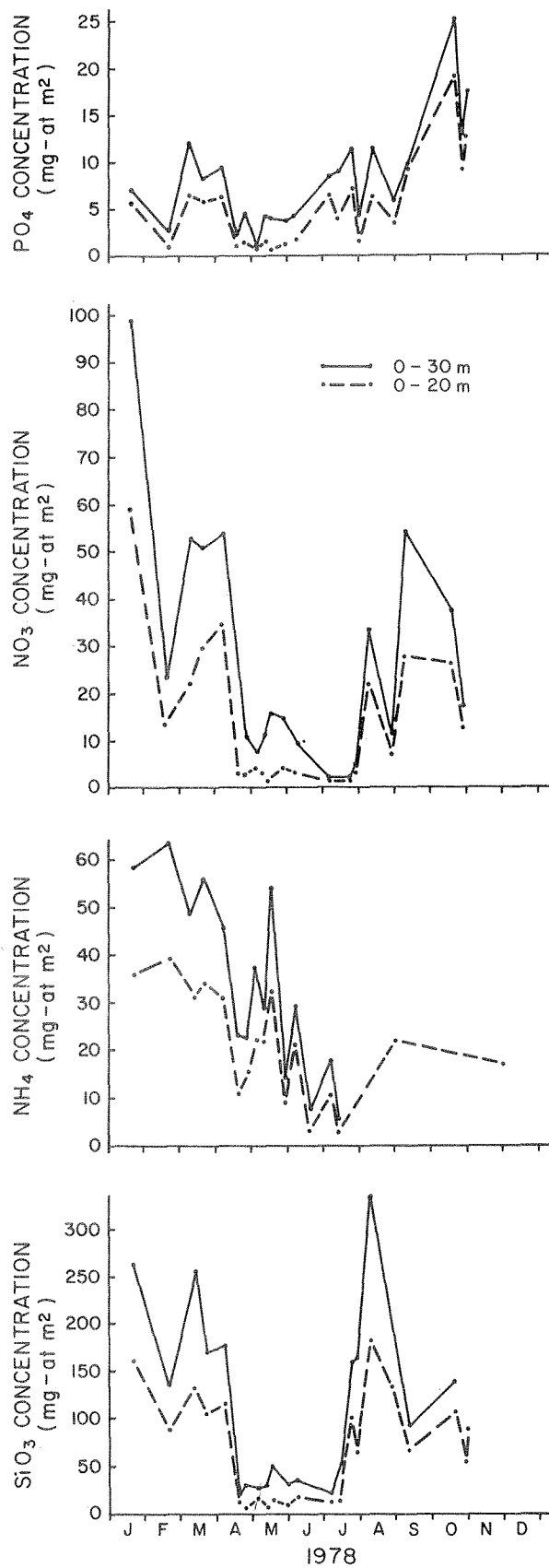


Fig. 3. Seasonal changes in total concentrations of dissolved nutrients integrated to 20 and 30 m at station 7 in St. Georges Bay in 1978.

Table 2. Integrated concentrations of dissolved nutrients above and below 20 m at station 7 in St. Georges Bay during 1978. * indicates periods of mixing and numbers in parentheses are concentrations of each nutrient above and below 20 m as a percentage of the total concentration integrated to 30 m depth.

\bar{X}_s average percentage during stratification; \bar{X}_m during mixing.

Date 1978	mg-at m ⁻²							
	NO ₃		SiO ₃		PO ₄		NH ₄	
	0-20	20-30	0-20	20-30	0-20	20-30	0-20	20-30
*18/1	58.3		164.0		5.5		36.0	
*17/2	13.5		85.4		1.9		39.4	
* 7/3	21.2 (40)	31.2 (60)	132.0 (52)	123.9 (48)	6.6 (55)	5.5 (35)	31.1 (64)	17.8 (36)
*20/3	29.6		106.2		5.8		34.7	
* 4/4	34.3 (64)	19.6 (36)	117.4 (67)	58.6 (33)	6.1 (67)	3.0 (33)	31.4 (68)	14.5 (33)
*18/4	2.6		14.6		2.0		10.9 (47)	12.4 (53)
*24/4	2.5 (25)	7.6 (75)	7.9 (26)	22.1 (73)	2.4 (50)	2.4 (50)	15.5 (70)	6.7 (30)
* 2/5	4.3 (64)	2.4 (36)	19.2 (70)	8.0 (30)	1.3 (59)	0.9 (41)	23.4 (62)	14.1 (38)
8/5	3.0 (28)	7.9 (72)	6.7 (23)	22.6 (37)	2.7 (60)	1.8 (40)	22.0 (76)	7.0 (24)
16/5	1.3 (8)	14.1 (92)	12.1 (24)	38.5 (76)	1.3 (28)	3.3 (72)	32.8 (61)	21.4 (39)
29/5	4.3 (29)	10.6 (71)	7.8 (23)	26.0 (77)	2.4 (60)	1.6 (40)	9.2 (62)	5.6 (38)
5/6	3.2 (33)	6.5 (67)	19.4 (51)	18.5 (49)	3.6 (82)	0.8 (18)	21.7 (74)	7.8 (26)
6/6	1.4 (14)	8.5 (86)	17.4 (46)	20.8 (54)	5.8 (68)	2.7 (32)	10.5 (82)	2.3 (18)
19/6							3.3 (42)	4.6 (58)
4/7	1.4 (74)	0.5 (26)	13.4 (54)	11.4 (46)	6.7 (82)	1.5 (18)	10.5 (59)	7.2 (41)

Table 2. - Cont'd.

Date 1978	NO ₃		mg-at m ⁻² SiO ₃		PO ₄		NH ₄	
	0-20	20-30	0-20	20-30	0-20	20-30	0-20	20-30
10/7			15.6 (30)	36.8 (70)	3.8 (46)	4.5 (54)	3.0 (54)	2.6 (46)
25/7	1.1 (85)	0.2 (15)	101.2 (63)	60.1 (37)	7.2 (65)	3.9 (35)		
31/7	3.6 (73)	1.3 (27)	67.6 (41)	98.4 (59)	2.2 (71)	0.9 (29)		
8/8	21.3 (65)	11.5 (35)	185.4 (55)	149.6 (45)	6.2 (56)	4.9 (44)		
*31/8	7.3 (70)	3.2 (30)	132.3 (61)	90.0 (39)	3.9 (70)	1.7 (30)	22.1	
*11/9	27.5 (63)	15.9 (37)	63.1 (68)	29.9 (32)	9.0 (94)	0.6 (6)		
*22/10	25.6 (70)	10.8 (30)	109.8 (79)	28.4 (21)	18.6 (74)	6.6 (26)		
*30/10	11.0	5.3	56.8	26.2	8.5	4.1	8.8	3.8
* 1/11	12.2 (73)	4.4 (27)	88.9 (75)	30.2 (25)	12.4 (71)	5.0 (29)	17.6	
\bar{X}_s	(45)	(55)	(41)	(59)	(62)	(38)	(67)	(33)
\bar{X}_m	(59)	(41)	(62)	(38)	(68)	(32)	(62)	(38)

Table 3a. Ratios of dissolved nutrient concentrations above 20 m (mg-at m⁻²) in St. Georges Bay during 1978. Absolute values given in Table 1.

* indicate periods of mixing, \bar{X}_m average during periods of mixing, \bar{X}_s average during period of stratification, N = NO₃ + NH₄ concentrations.

Date	SiO ₃ :NO ₃	NO ₃ :PO ₄	NH ₄ :NO ₃	N:PO ₄	N:SiO ₃
*18/1	2.81	10.60	0.62	17.15	0.39
*17/2	6.33	7.11	2.92	27.84	0.62
* 7/3	6.23	3.21	1.47	7.92	0.40
*20/3	3.59	5.10	1.17	11.09	0.61
* 4/4	3.42	5.62	0.92	10.77	0.56
*18/4	5.62	1.30	4.19	6.75	0.93
*24/4	3.16	1.04	6.20	7.50	2.28
* 2/5	4.46	3.31	5.44	21.30	1.13
8/5	2.23	1.11	7.33	9.26	3.73
16/5	9.31	1.00	25.23	26.23	2.82
29/5	1.81	1.79	2.14	5.63	1.73
5/6	6.06	0.89	6.78	6.92	1.28
6/6	12.43	0.24	7.50	2.05	0.68
4/7	9.57	0.21	7.50	1.78	0.89
25/7	92.00	0.15	-	-	-
31/7	18.78	1.64	-	-	-
8/8	8.70	3.44	-	-	-
*31/8	19.08	1.87	3.03	7.54	0.21
*11/9	2.29	3.06	-	-	-
*22/10	4.29	1.38	-	-	-
*30/10	5.16	1.29	0.80	2.33	0.34
* 1/11	7.29	0.98	1.44	2.40	0.34

Table 3a. - Cont'd.

Date	SiO ₃ :NO ₃	NO ₃ :PO ₄	NH ₄ :NO ₃	N:PO ₄	N:SiO ₃
\bar{X}_S	17.88 (28.27)	1.16 (1.04)	9.41 (8.02)	8.65 (9.08)	1.86 (1.19)
\bar{X}_m	5.67 (4.30)	3.53 (2.89)	2.56 (1.96)	11.14 (7.93)	0.71 (0.59)
\bar{X}_Z	10.66 (18.78)	2.56 (2.57)	4.98 (5.82)	10.26 (8.16)	1.11 (0.99)

(Numbers in parentheses are 1 s.d. of mean values above)

Table 3b. Ratios of dissolved nutrient concentrations between 20 and 30 m (mg-at m⁻²) in St. Georges Bay during 1978. Absolute value given in Table 1. * indicates periods of mixing, \bar{X}_s average during periods of stratification, \bar{X}_m average during periods of mixing, \bar{X} average of all observations. $N = NO_3 + NH_4$ concentration.

Date	SiO ₃ :NO ₃	NO ₃ :PO ₄	NH ₄ :NO ₃	N:PO ₄	N:SiO ₃
* 7/3	3.97	5.67	0.57	8.91	0.40
* 4/4	2.99	6.53	0.74	11.37	0.58
*24/4	2.91	3.17	0.88	5.96	0.65
* 2/5	3.33	2.67	5.87	18.33	2.06
8/5	2.86	4.39	0.89	8.28	0.66
16/5	2.73	4.27	1.52	10.76	0.92
29/5	2.45	6.63	0.53	10.13	0.62
6/6	2.45	3.15	0.27	4.00	0.52
4/7	22.80	0.33	14.40	5.13	0.68
25/7	300.50	0.05	-	-	-
31/7	75.69	1.44	-	-	-
8/8	13.01	2.35	-	-	-
*31/8	28.13	1.88	-	-	-
*11/9	1.88	26.50	-	-	-
*22/10	2.63	1.64	-	-	-
*30/10	4.94	1.29	0.72	2.22	0.35
* 1/11	6.86	0.88	-	-	-
\bar{X}_s	47.26 (97.88)	3.42 (2.74)	3.14 (5.54)	9.36 (4.96)	0.70 (0.14)
\bar{X}_m	6.40 (8.28)	5.58 (8.08)	1.76 (2.30)	9.35 (6.07)	0.81 (0.71)
\bar{X}	26.83 (70.59)	4.33 (6.04)	2.51 (4.24)	9.36 (5.20)	0.75 (0.46)

(numbers in parentheses are 1 s.d. of mean values above)

Absolute concentrations and ratios for integral concentrations of nutrients in 1977 and 1978 were generally similar for corresponding times of the year. Unfortunately some samples to be analyzed for ammonia collected after 10/7/78 were lost and data is not available to confirm the peak of ammonia observed in early August 1977. Concentrations measured in late August and October 1978 (Table 2), however, showed a two to seven fold increase over concentrations measured earlier in the summer consistent with the trend of increased concentrations of nutrients during late summer and fall. The increased abundance of all dissolved nutrients over this period implies that mechanisms of supply and/or regeneration exceed utilization. Thus, while nutrient (particularly nitrate) limitations to phytoplankton primary production may occur earlier in the summer, other mechanisms such as increased grazing or deep mixing below optimal light levels must limit photosynthesis during the fall months.

3. Phytoplankton Production

Phytoplankton production was not measured routinely during 1978 in St. Georges Bay. Collection of water samples by helicopter during winter months necessitated delays of up to three hours. In situ incubations were not possible and it was decided that laboratory measurements could not be directly compared to in situ incubations carried out in 1977 (Marine Ecology Laboratory 1980).

Although no regular measurements were performed, in situ incubations were carried out on three dates (Table 4). Rates of phytoplankton production integrated to 20 and 30 m are similar to rates observed in 1977 at corresponding dates. The integrals show that 90-95% of photosynthetic

Table 4. Phytoplankton production (^{14}C uptake) ($\text{mg C m}^{-3} \text{ h}^{-1}$) at station 7 in St. Georges Bay on three occasions during 1978. In situ incubation between 0900 and 1400 h.

Date Depth (m)	6/6	31/8	30/10
0	0.88	5.87	6.31
5	0.86	3.12	3.18
10	1.23	4.21	3.69
15	1.46	1.80	2.07
20	0.04	0.81	0.92
25	0.14	0.63	0.80
30	0.10	0.00	0.14
Dark bottle	2.50	2.70	3.83
Integral ($\text{mg C m}^{-2} \text{ h}^{-1}$)			
0-20 m	20.1	62.3	62.8
0-30 m	21.1	67.5	69.4
Chlorophyll <u>a</u> (mg m^{-2})			
0-20 m	5.5	35.4	16.7
0-30 m	12.3	54.5	24.6
Specific Production ($\text{mg C (mg Chl } \underline{a})^{-1} \text{ h}^{-1}$)			
0-20 m	3.6	1.8	3.8
0-30 m	1.7	1.2	2.8

production occurred above 20 m in St. Georges Bay on these occasions. Similar observations during 1977 indicated that 85% of phytoplankton production integrated to 30 m depth between May and October occurred in the upper 15 m. The measurement in June ($20 \text{ mg Cm}^{-2} \text{ h}^{-1}$, $400 \text{ mg Cm}^{-2} \text{ d}^{-1}$, assuming average hourly rates between 0900 and 1400 extend over 10 h) is lower than rates observed in late August and October ($60\text{--}70 \text{ mg Cm}^{-2} \text{ h}^{-1}$, $400 \text{ mg Cm}^{-2} \text{ d}^{-1}$ assuming production occurs over 6 h). Specific production ($\text{mg C (mg chl } \underline{a})^{-1} \text{ h}^{-1}$) varied between 1.2 and 3.8 for integrals of production and chlorophyll a standing stock calculated over 20 m and 30 m (Table 4). Similar values were observed during 1977 when measurements throughout the period of May to November at station 7 showed considerable variation ($1\text{--}12 \text{ mg C (mg chl } \underline{a})^{-1} \text{ h}^{-1}$).

4. Suspended and Sedimented Particulate Organic Matter

Concentrations of suspended particulate organic carbon, nitrogen and plant pigments (chlorophyll a and pheopigments) measured in St. Georges Bay between 19/1 and 11/1, 1978, are listed in Appendix I. Rates of dry matter deposition in cylindrical traps suspended at 22 and 25 m at station 7 are presented with corresponding concentrations of particulate organic carbon, nitrogen and plant pigments in settled material in Appendix I. It was not possible to expose traps prior to the end of April, thus rates of sedimentation or chemical composition of settled material cannot be compared with material in suspension over the entire period of observations.

Rates of sedimentation of dry matter (Fig. 4) were minimal during mid-summer with similar values at 22 m and 25 m. The occurrence of peak deposition rates ($5\text{--}14 \text{ g m}^{-2} \text{ d}^{-1}$) during May and October correspond to

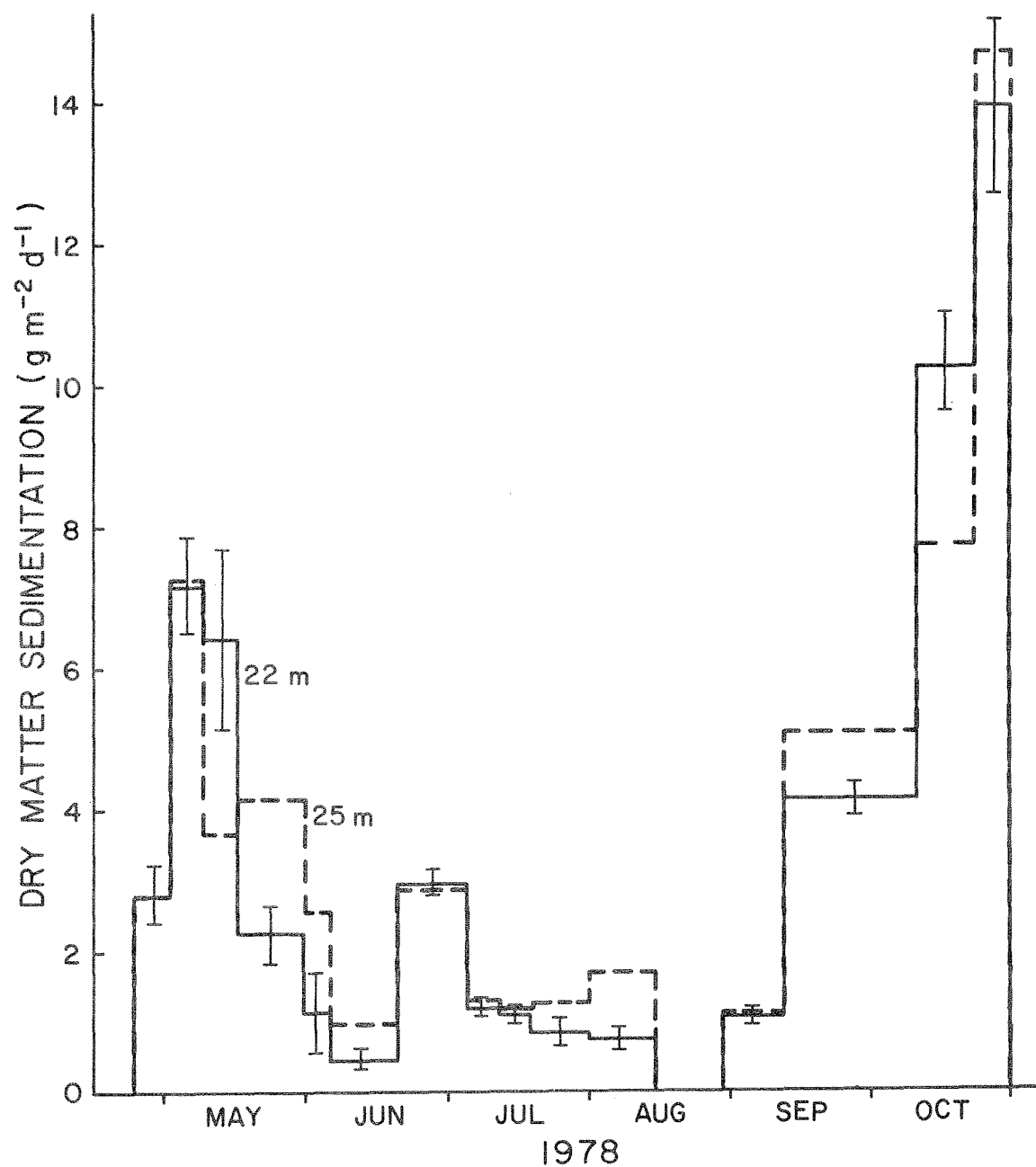


Fig. 4. Sedimentation of dry material in cylinder moored at 22 and 25 m at station 7 in St. Georges Bay during 1978. Vertical bars indicate one standard deviation of an average value derived from four separate replicate cylinders exposed simultaneously at the same depth.

maximum rates observed during these months in 1977, however rates were up to an order of magnitude greater in the preceeding year. Monthly total deposition rates (Table 5) were calculated from values of average daily sedimentation (Appendix II) summed over appropriate monthly intervals (assuming that deposition was continuous and cumulative). The total dry matter deposition between mid-April and October averaged for both 22 and 25 m was 669 g m^{-2} . A value of 760 g m^{-2} was observed at 25 m between mid-May and mid-November in 1977.

Figures 5 to 8 present measures of organic carbon, nitrogen, chlorophyll a and pheopigment sedimentation with corresponding measures of suspended concentration of these variables measured during 1978. Loss rates of the four substances were calculated as described by Taguchi and Hargrave (1978). Except for increased levels of suspended carbon and nitrogen during February, concentrations of these elements in suspension varied around average (+SD) levels ($5.5 \pm 2.3 \text{ mg C m}^{-2}$, $0.52 \pm 0.32 \text{ mg N m}^{-2}$) throughout the year. Peaks in sedimentation during May, late June, August and September correspond to increases in suspended concentration of carbon and nitrogen which occurred approximately 3 weeks earlier (Figs. 5,6). However, variations in estimates of integral concentrations are sufficiently large so as to limit interpretation of individual fluctuations in measurements. Also, no simple correlation existed between sedimentation rates and suspended concentrations averaged over periods of sediment trap exposure. This is clearly observed during October when high rates of carbon and nitrogen deposition occurred at a time when suspended concentrations did not change.

Table 5. Monthly total sedimentation at station 7 (bottom depth 34 m) in St. Georges Bay during 1978.

Month	Dry Weight g m ⁻² month ⁻¹		Carbon g m ⁻² month ⁻¹		Nitrogen g m ⁻² month ⁻¹		Chlorophyll a mg m ⁻² month ⁻¹		Pheopigments mg m ⁻² month ⁻¹	
Depth	(22 m)	(25 m)	(22 m)	(25 m)	(22 m)	(25 m)	(22 m)	(25 m)	(22 m)	(25 m)
April (15-30)	(41.9)	43.2	(0.8)	0.9	(0.05)	0.10	(10.5)	10.9	(6.3)	6.6
May	132.0	136.0	4.7	5.5	0.60	1.27	21.1	21.9	29.5	30.7
June	45.3	58.6	2.6	3.4	0.41	0.40	8.2	10.1	18.2	24.8
July	35.8	42.8	1.9	2.8	0.24	0.30	3.0	5.6	10.6	16.2
August	28.2	42.5	1.2	1.8	0.17	0.21	5.1	6.1	8.0	13.6
September	90.9	109.0	4.0	7.0	0.73	1.32	13.4	18.4	36.0	29.7
October	272.1	260.0	14.5	12.3	2.40	2.24	40.1	20.9	50.4	33.5
Total	646.2*	692.1	29.7*	33.7	4.60*	5.84	101.4*	93.9	159.0*	155.1

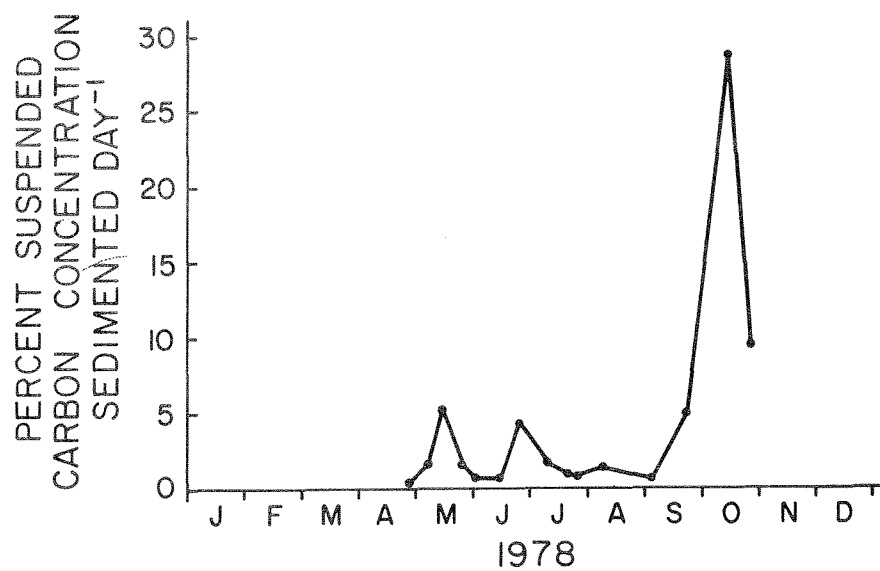
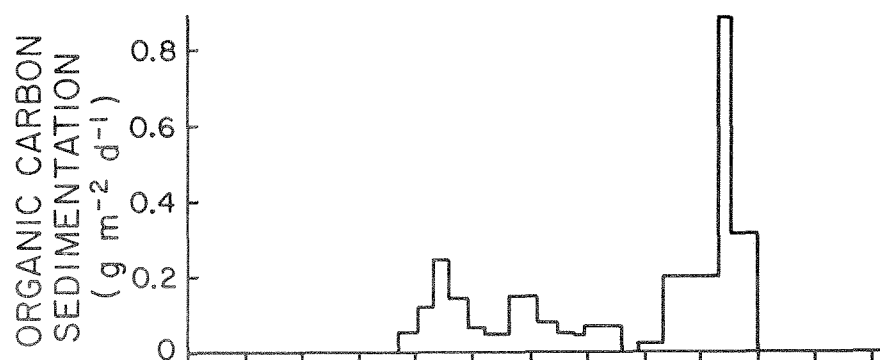
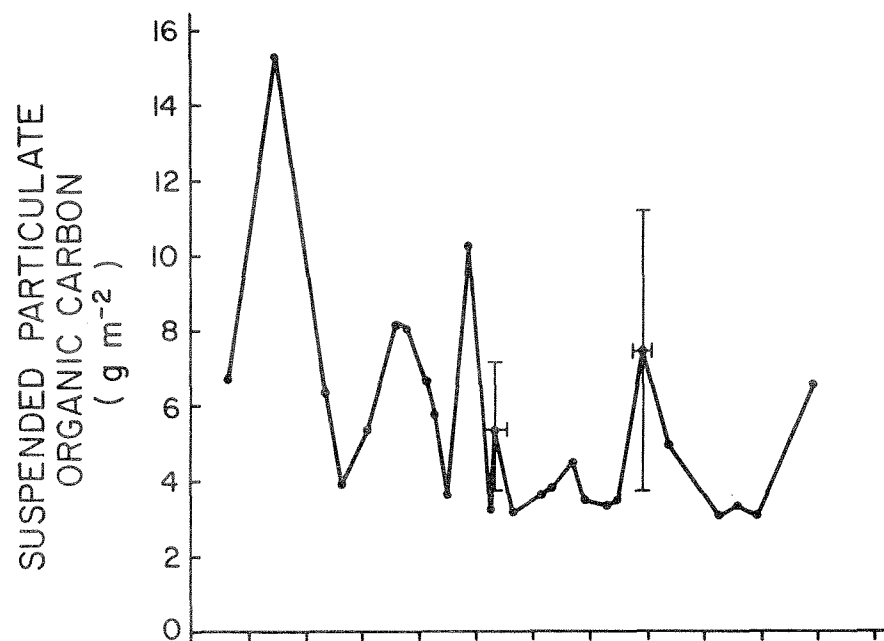
* includes estimated value for April (15-30). Value (in parenthesis) derived from the sedimentation rate in May assuming that the ratio of deposition April/May at 22 m corresponds to that at 25 m.

Table 6. Sedimentation of material in St. Georges Bay, April 15 to November 1, 1977. (n) = number of collection periods, mean \pm 1 s.d.

Station 7

Depth (m)	22	25
Dry weight	(14)	(15)
gm ⁻² d ⁻¹	3.68 ± 4.18	3.90 ± 3.71
Carbon	(15)	(14)
mg C m ⁻² d ⁻¹	165.0 ± 218.8	155.4 ± 150.8
Nitrogen	(17)	(14)
mg N m ⁻² d ⁻¹	22.9 ± 34.5	23.6 ± 29.1
Chlorophyll <u>a</u>	(15)	(14)
g m ⁻² d ⁻¹	581.0 ± 683.7	405.8 ± 308.9
Pheopigments	(15)	(14)
g m ⁻² d ⁻¹	829.5 ± 758.6	741.7 ± 504.8

Fig. 5. Comparison of suspended concentration of particulate organic carbon (integrated to 20 m depth), organic carbon sedimentation at 22 m and daily sedimentation calculated as a percentage of suspended concentration (daily loss rate) at station 7 in St. Georges Bay during 1978. Vertical bars indicate one standard deviation determined from integrals calculated from four to six separate profiles of concentration measured on consecutive days (as described for dissolved inorganic nutrients in Table 1).



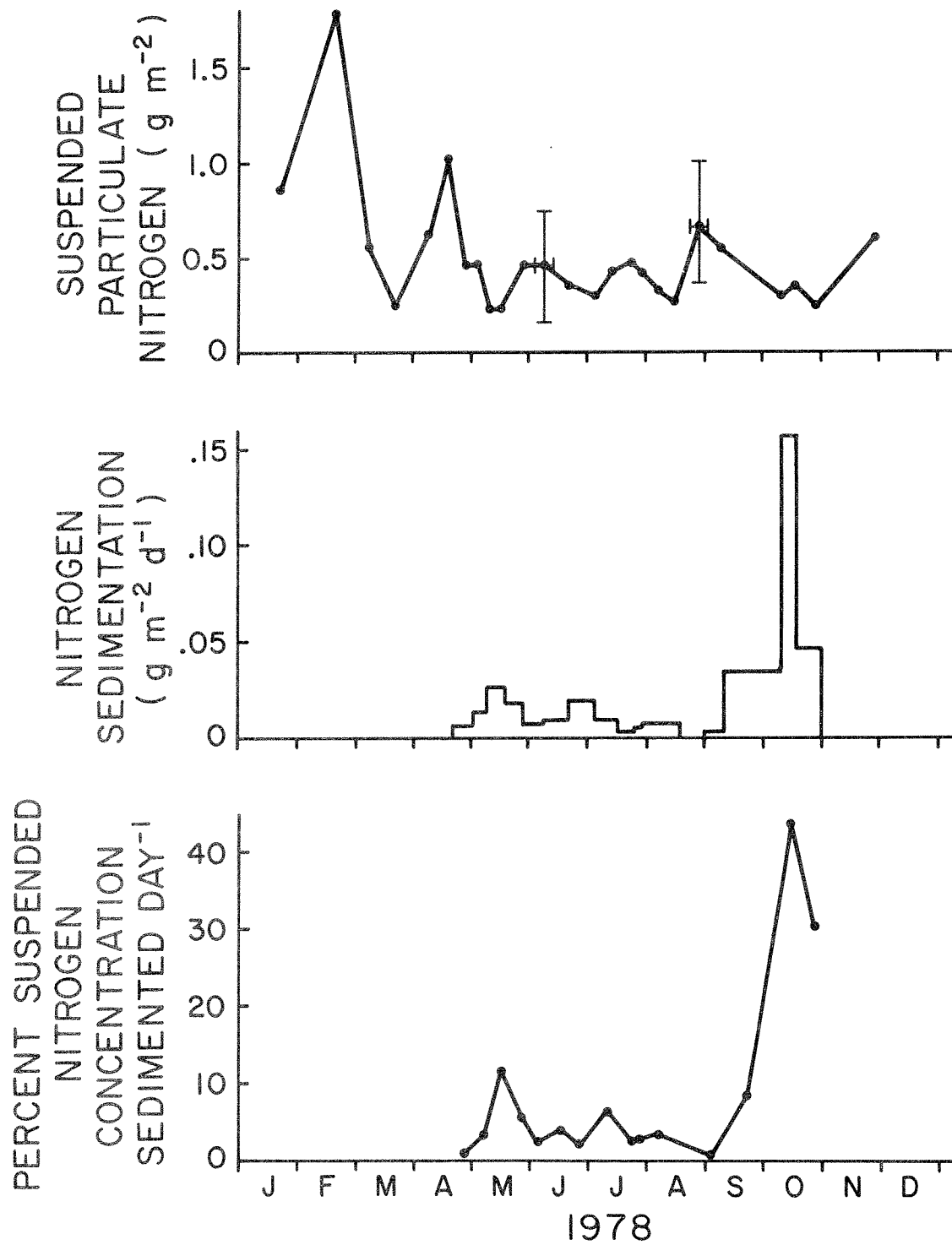


Fig. 6. Comparison of suspended particulate nitrogen concentration (integrated to 20 m depth), nitrogen sedimentation at 22 m and daily sedimentation calculated as a percentage of suspended concentration (daily loss rate) at station 7 in St. Georges Bay during 1978. Vertical bars indicate one standard deviation of the integral value as described in Fig. 5.

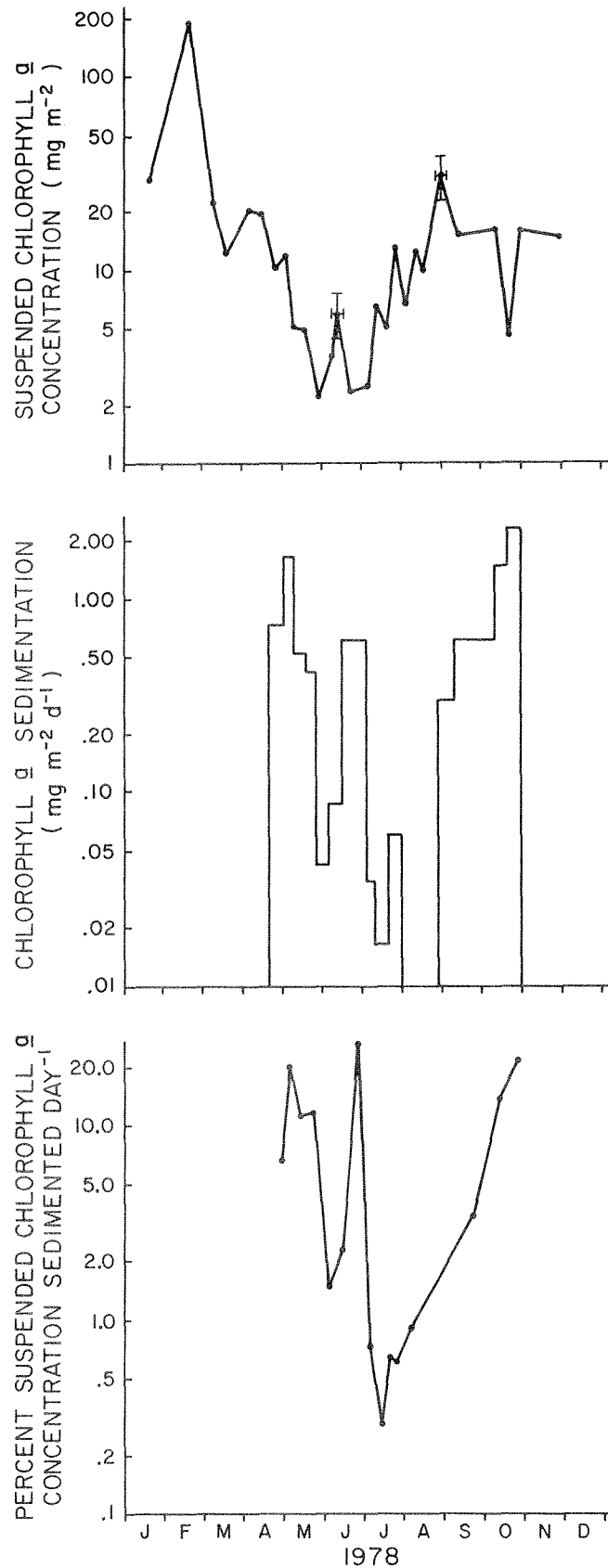
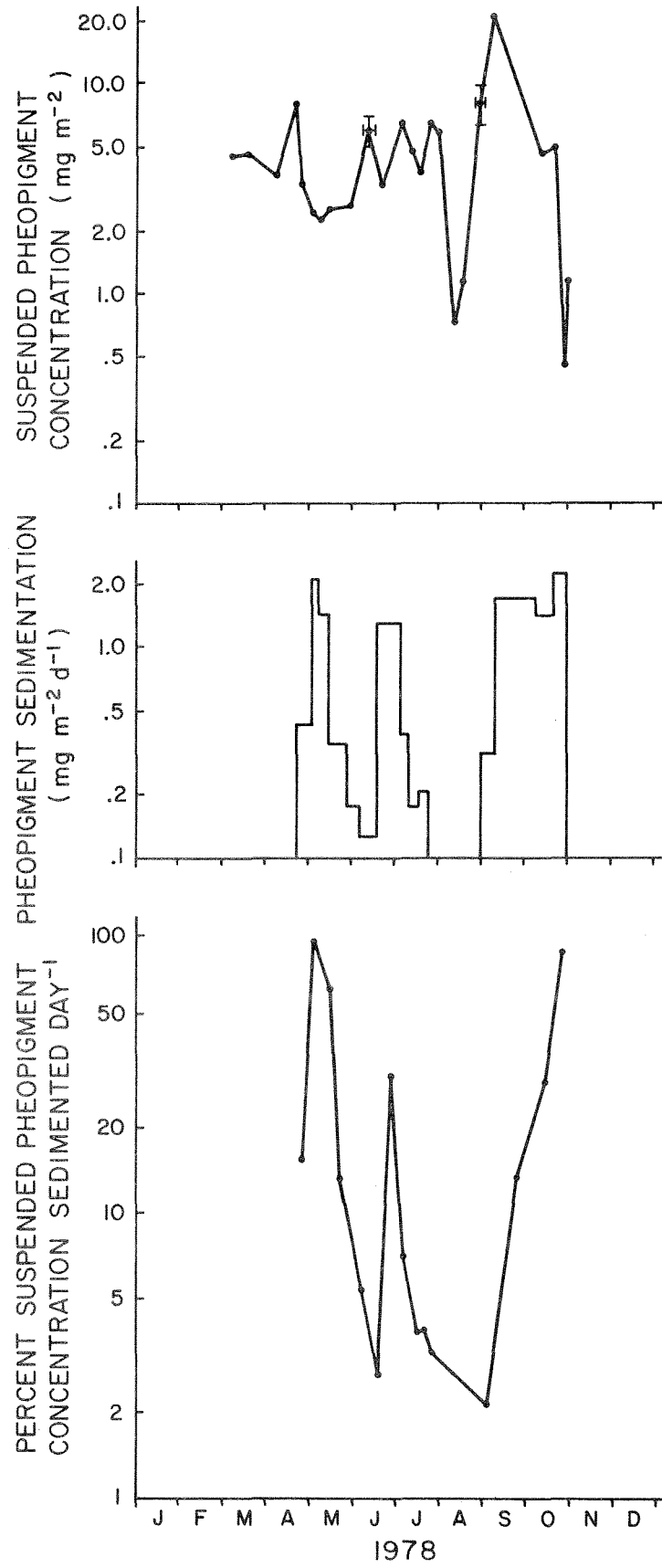


Fig. 7. Comparison of suspended chlorophyll *a* concentration (integrated to 20 m depth), chlorophyll *a* sedimentation at 22 m and daily sedimentation calculated at a percentage of suspended concentration (daily loss rate) at station 7 in St. Georges Bay during 1978. Vertical bars indicate one standard deviation of the integral value as described in Fig. 5.

Fig. 8. Comparison suspended pheopigment concentration (integrated to 20 m depth), pheopigment sedimentation at 22 m and daily sedimentation calculated as a percentage of suspended concentration (daily loss rate) at station 7 in St. Georges Bay during 1978. Vertical bars indicate one standard deviation of the integral value as described in Fig. 5.



Although absolute rates of dry matter, carbon and nitrogen sedimentation as monthly totals (Table 5) or average daily values (Table 6) are not significantly different ($p < 0.05$) from similar values observed in 1977, differences did occur during certain periods. For example, high rates of deposition (up to $110 \text{ g dry matter m}^{-2} \text{ d}^{-1}$) occurred in 1977 during September (Marine Ecology Laboratory 1980), yet maximum rates observed during October in 1978 were an order of magnitude less ($14 \text{ g m}^{-2} \text{ d}^{-1}$) (Fig. 4). Discrepancy was greatest during the fall when isothermal conditions may allow deep mixing and sediment resuspension. Although traps were exposed at 9 and 12 m above bottom (at 34 m) in 1978, observations in 1977 indicated that during periods when little or no stratification existed in the water column resuspension could redistribute previously settled material to these depths.

The importance of resuspension in increasing deposited material collected in sediment traps is shown by calculations of daily loss rates. Values as high as 28% for particulate organic carbon and 44% for nitrogen occurred during October (Figs. 5 and 6). Such high rates could not be sustained without marked decreases in suspended concentration. Concentrations of suspended carbon and nitrogen did not change during this interval of rapid sedimentation, indicating perhaps that resuspended material brought into the water column by mixing events, settles rapidly. Smaller peaks in carbon and nitrogen loss during May, late June and August coincide with increased rates of sedimentation during these intervals. As mentioned above, these higher rates of deposition occur approximately three weeks after peaks in suspended concentrations of carbon and nitrogen in the water column.

Suspended chlorophyll a concentrations in St. Georges Bay during 1978 were maximum during February (Fig. 7). A progressive decrease, by up to an order of magnitude, occurred after this maximum to annual minimum values between May and June. This spring decrease in chlorophyll a concentration, with a subsequent increase throughout late summer to asymptotic levels during fall months, was also observed during 1977 (Marine Ecology Laboratory 1980). Concentrations of suspended pheopigments did not change in a consistent way during the year (Fig. 8). Although highest levels, comparable to those observed for chlorophyll a occurred during September, concentrations of pheopigments were lower than those observed for chlorophyll a earlier in the year (February to mid-May) (Appendix I).

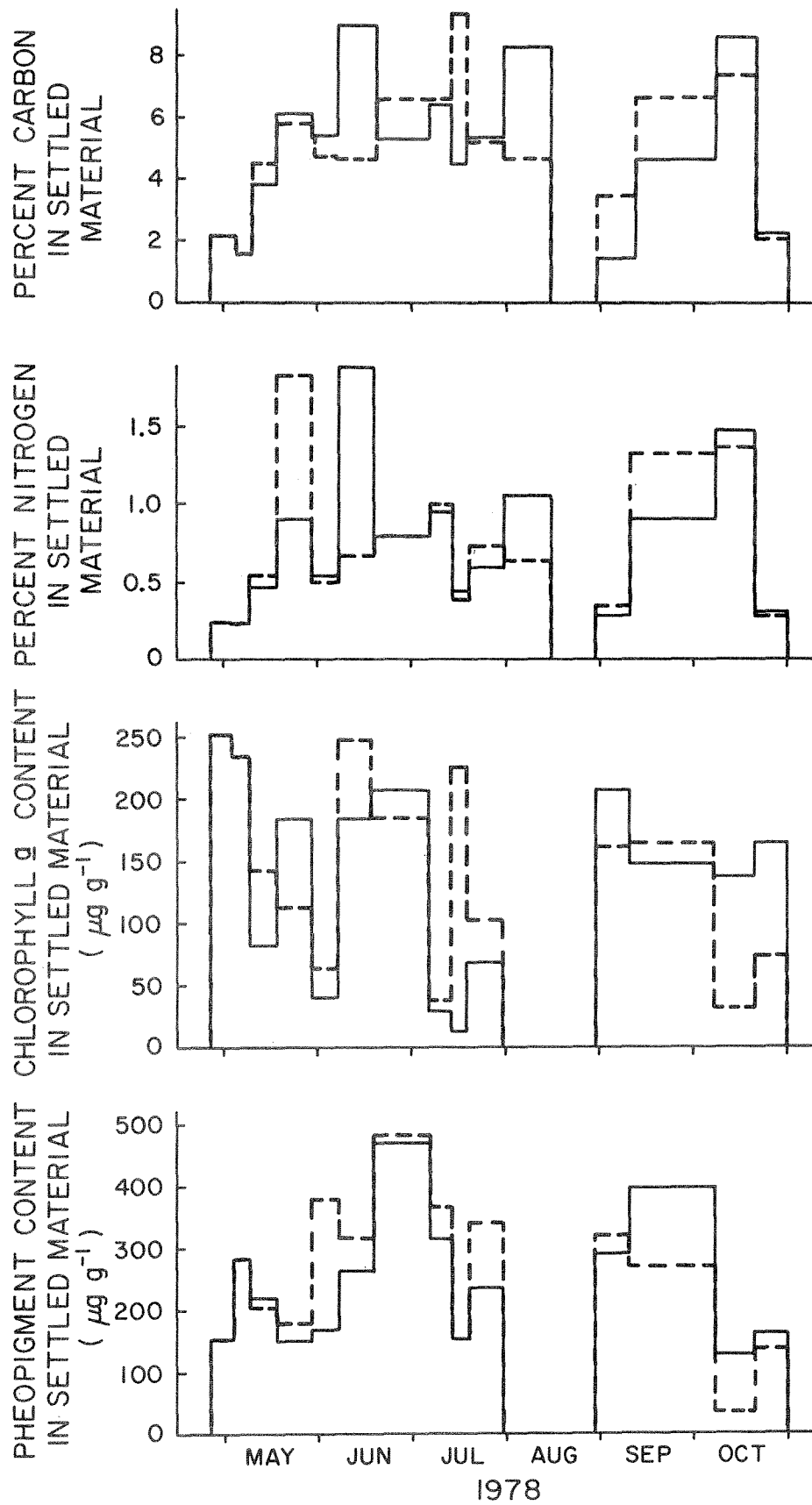
Changes in sedimentation rates of chlorophyll a and pheopigments were similar throughout the period of observation. As with carbon and nitrogen, there was no simple correlation between suspended concentration and deposition rate for either chlorophyll a or pheopigments (Fig. 7 and 8). Loss rates for both pigments were highly variable, with minimum values ($0.28\% \text{ d}^{-1}$) observed for chlorophyll a during July. Loss of suspended pheopigments by deposition always exceeded rates observed for chlorophyll a, with maximum values ($95\% \text{ d}^{-1}$) in early May (Fig. 8) being the highest recorded.

Correlation analyses show that seasonal changes in loss rates of carbon and nitrogen were similar to each other as were these for chlorophyll a and pheopigments (Table 7). Loss rates of pigments, however, were not correlated with those calculated for carbon and nitrogen implying that different mechanisms are involved in determining loss rates of these two classes of compounds. Further analysis of settled material collected in

Table 7. Index of determination (r^2) derived from linear regression analyses comparing loss rate of particulate organic carbon, nitrogen, chlorophyll a and pheopigments deposited at 22 m between April 24 and November 1, 1978, at station 7 in St. Georges Bay.

	Nitrogen	Chlorophyll <u>a</u>	Pheopigments
Carbon	0.90	0.13	0.18
Nitrogen	-	0.23	0.19
Chlorophyll <u>a</u>	-	-	0.59

Fig. 9. Percent dry weight as organic carbon, nitrogen and chlorophyll a and pheopigment content (g g^{-1}) in settled material collected in traps suspended at 22 m and 25 m in St. Georges Bay during 1978.



traps to quantify the amount of deposited material present as fecal pellets or recognizable phytoplankton cell fragments will be required to quantify these separate pathways exist for transporting plant pigments to the benthos.

Differences in the chemical composition of material settled in traps throughout the study (Fig. 9) indicate a progressive increase in organic carbon and nitrogen content from minimum values in early May (1.65% and 0.21% respectively) to maximum values during June (9.98% and 1.84%). Subsequent decreased organic content in material deposited during July and a second increase during October was observed in samples collected at both 22 and 25 m. Seasonal changes in chlorophyll a and pheopigment concentrations in settled material were not similar to those observed for carbon and nitrogen. Minimum values occurred during July, but high concentrations were present before and after this period.

High concentrations of chlorophyll a in material collected in traps before and after July are apparent when chlorophyll a is expressed as a percent of total pigment content (Fig. 10). The mid-July minimum in chlorophyll a corresponds to increased values for the ratios of carbon: nitrogen and carbon: chlorophyll a in deposited material. Thus, enrichment of organic carbon in settled material collected during this interval occurs at a time of reduced chlorophyll a deposition (Fig. 7). Stratification was well established during this period with the thermocline situated at approximately 20 m (Section 1). Maximum plankton biomass observed between April and November also occurred in early July during 1977 (Marine Ecology Laboratory 1980). Feeding by herbivorous zooplankton could reduce or maintain concentrations of suspended chlorophyll a at low levels during this

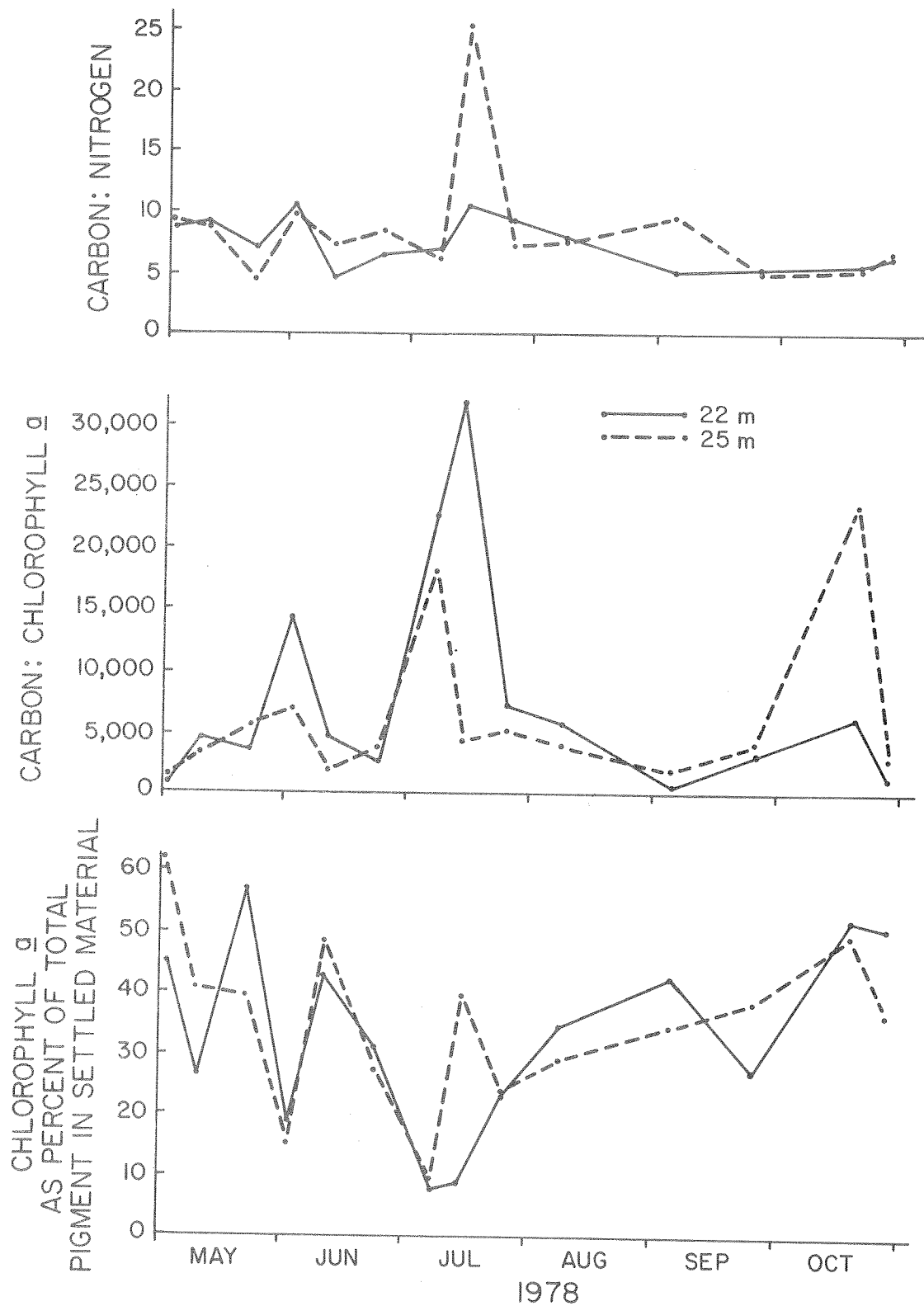


Fig. 10. Ratios of carbon:nitrogen, carbon:chlorophyll a and chlorophyll a calculated as percent of total pigment concentration in particulate matter collected in traps suspended at 22 m and 25 m in St. Georges Bay during 1978.

period (Fig. 7) and thus reduce loss by direct sedimentation. Increased rates of pheopigment deposition during late June and early July (Fig. 8) support this idea.

5. Sedimentary Organic Matter and Plant Pigments

Measures of organic carbon, nitrogen, chlorophyll a and pheopigments in surficial (upper 1-2 cm) sediments in St. Georges Bay between 8/5 and 30/10 are presented in Appendix III. Average values calculated over the period of observation are not significantly different from measurements made during 1977 (Marine Ecology Laboratory 1980). Minimum values for carbon and nitrogen content (0.29% and 0.04% respectively) were observed on the first sampling data (8/5) and maximum values (1.85% and 0.18%) occurred during October (Fig. 11). Throughout the summer however, there was not a continuous increase in sedimentary organic matter measured as organic carbon and nitrogen. Fluctuations occurred with periods of enrichment (June, July, September) separated by intervals of reduced concentration. Carbon:nitrogen ratios in surface sediments also varied between 6.9 and 12.9, indicative of periods of high and low nitrogen content relative to carbon content in the sediment.

The periodic enrichment of bottom sediments with organic supply by deposited material was implied by observations in St. Georges Bay during 1977. Pigment content in absolute amounts and relative to organic carbon illustrates that this was also apparent in 1978 (Fig. 12). Periods of low chlorophyll a in surface sediments correspond to increased values of the ratio of chlorophyll a: organic carbon (early June, Mid July, late October). Carbon:nitrogen ratios were also increased during these times

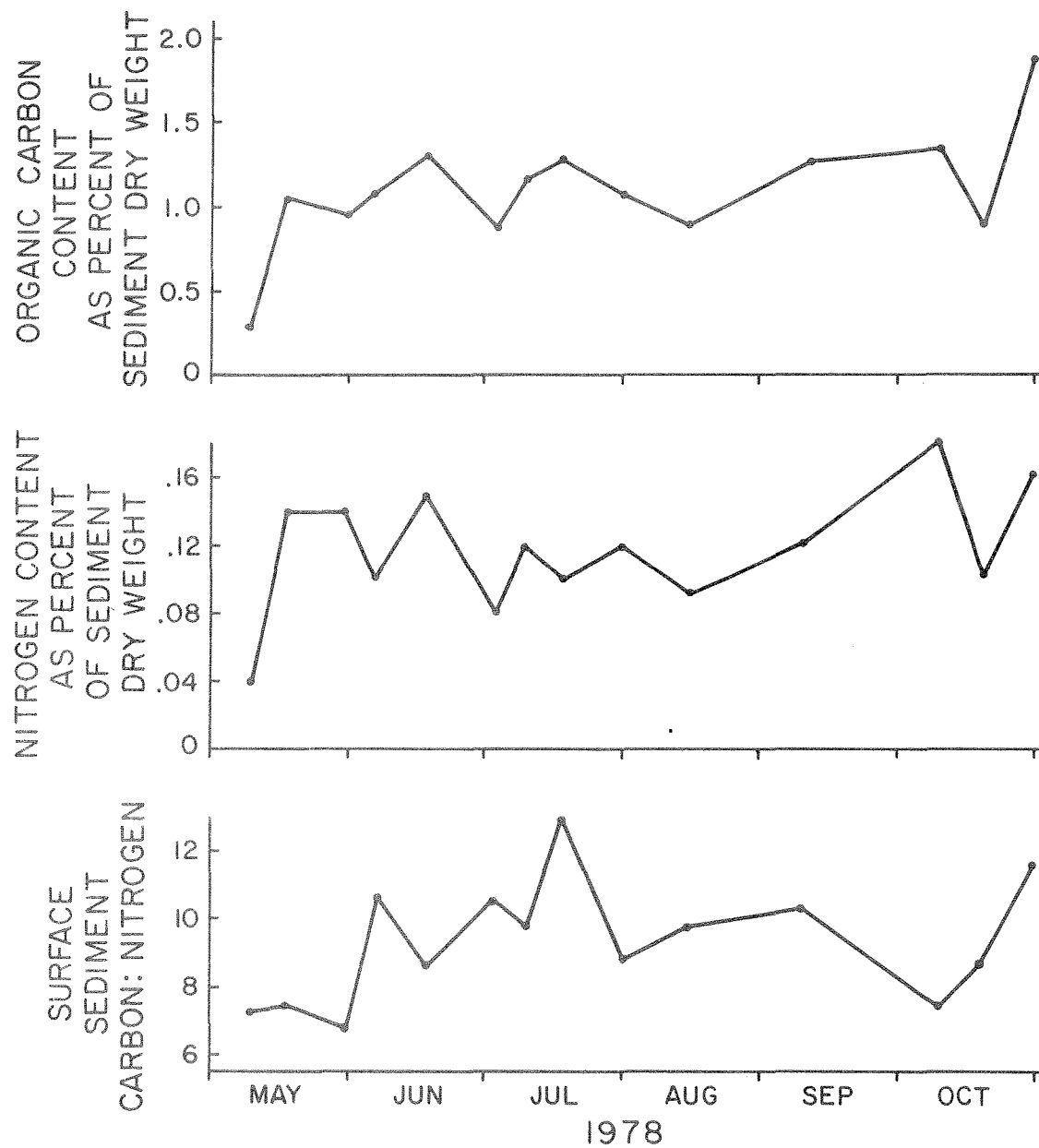


Fig. 11. Seasonal changes in sedimentary organic carbon, nitrogen and carbon:nitrogen ratio in surface sediment (upper 1-2 cm) collected at station 7 in St. Georges Bay during 1978.

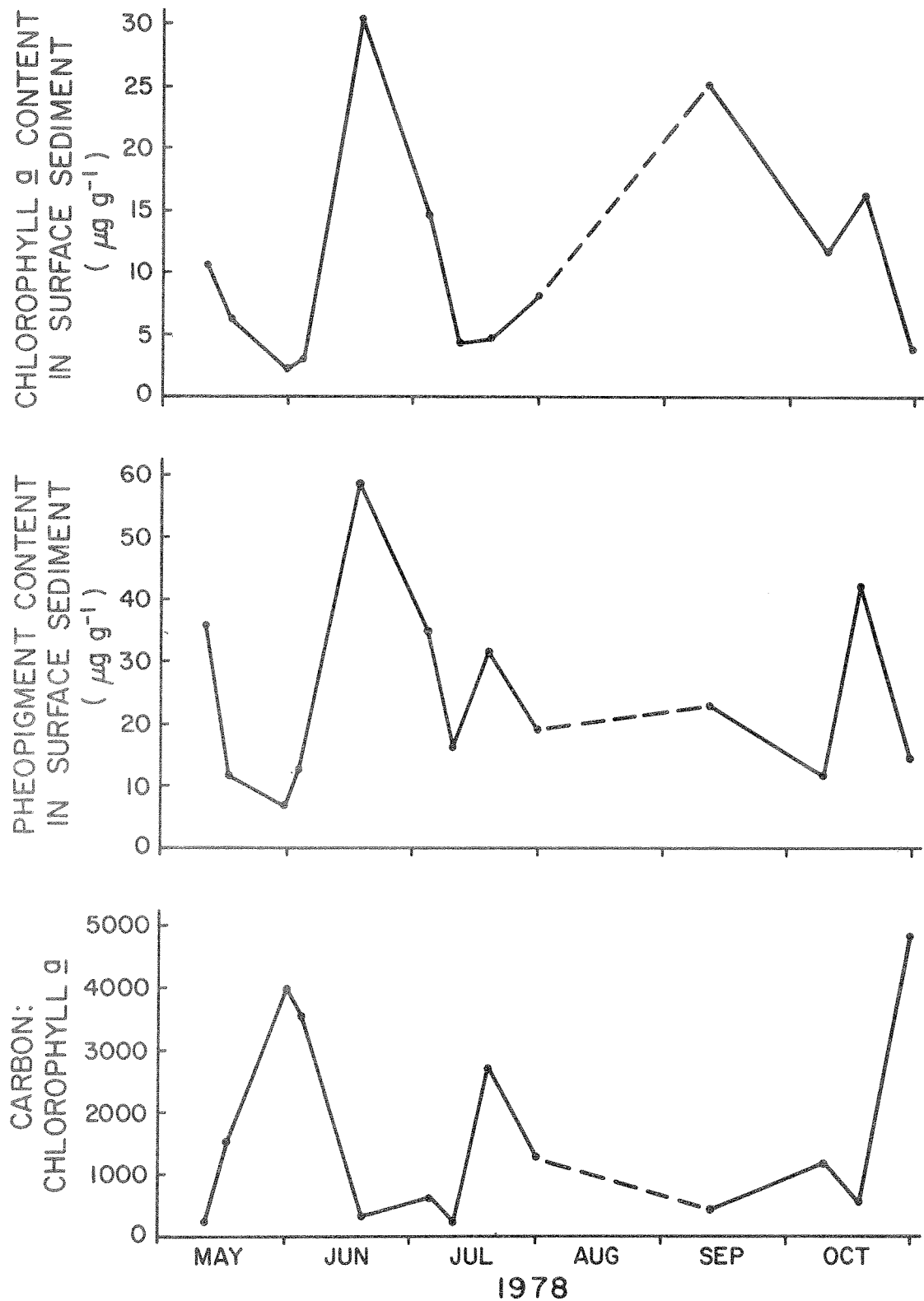


Fig. 12. Seasonal changes in chlorophyll *a* and pheopigment content and the carbon:chlorophyll *a* ratio of surface sediment (upper 1-2 cm) collected at station 7 in St. Georges Bay in 1978.

(Fig. 12). Maximum concentrations of pigments did not persist beyond a few weeks and there appears to be little accumulation of either chlorophyll a or pheopigments in these sediments. Concentrations in the late spring and fall of 1978 are similar and are not significantly different from those observed in 1977. The presence of undergraded chlorophyll a thus serves as an indication for the recent supply of organic matter to the bottom.

CONCLUSIONS

Observations in St. Georges Bay during 1978 can be combined with those made during 1977 to consider seasonal relations between variables throughout the year. This analysis will constitute a separate publication where an assessment of major factors controlling the production of organic matter in the water column, its deposition and rates of decomposition will be discussed. Some general conclusions are summarized here.

Stratification Effects

Stable conditions in the water column during summer which reduce vertical mixing and allow dissolved inorganic nutrients to accumulate close to the bottom (Section 2). Near-bottom concentrations (Fig. 2a,b) are similar to those present in the water column during seasonal maxima during winter (Appendix I). Thus, benthic nutrient regeneration is a major pathway of dissolved inorganic nutrient supply in St. Georges Bay. Remineralization of nutrients in the water column, however, particularly during periods of maximum stratification (June, July) when concentrations are reduced to minimum levels (Fig. 3) must supply nutrients for phytoplankton production. The balance between supply through pelagic and benthic regenerative sources must ultimately depend on the depth of the euphotic mixed-layer relative to total water column depth.

The seasonality in concentrations of suspended chlorophyll a, with highest values during February, minimum levels between May and July and a progressive increase from July through the fall (Fig. 7), shows that nutrient supply throughout the winter permits the initiation of a winter phytoplankton bloom in St. Georges Bay. Water column thermal stratification was not measured during February, however, salinity increased with

depth to 25 m (Appendix I)(Fig. 1). This structure had disappeared by March. Large decreases in dissolved nitrate and silicate between January and February (Fig. 3) preceeded the formation of the chlorophyll a maximum in February. This is clear evidence for an early bloom which was not observed previously. Sampling during the 1976 and 1977 began in April, after nutrients were depleted and when chlorophyll a was either consumed in the water column, sedimented, or removed from the bay by advection.

Plankton Biomass and Sedimentation

The fate of the winter phytoplankton bloom can only be inferred since measures of sedimentation were not made before 24/4. Concentrations of organic carbon and nitrogen in sediments in early May (Figs. 11, 12) and in settled material during late April (Fig. 9) were low. However, chlorophyll a content at this time was the highest observed during the subsequent months (Fig. 9). If material enriched by phytoplankton biomass settled from the water column following the bloom in late February, there was sufficient time for degradation of organic matter to occur before observations began in April. Analyses of net plankton biomass collected during the winter will indicate if standing crop was higher than observed later in the year. Biomass measured in April 1977 (166.5 mg dry weight m^{-3}) (Marine Ecology Laboratory 1980) was the highest value to occur between April and November.

It is possible that direct deposition of material produced during the winter bloom produced the rapid decrease in suspended organic matter and chlorophyll a after February. Grazing by zooplankton during the spring (possibly during and following a second bloom in April) (Fig. 5-7) could

maintain levels of suspended organic matter at low concentrations typical for the summer in St. Georges Bay. This would account for sustained levels of pheopigments ($4 \pm 2 \text{ mg m}^{-2}$) present in the water column from March through July (Fig. 8).

Variations in Organic Supply to Sediments

Absolute rates of sedimentation, daily loss rates of suspended matter and the organic content of settled material (Section 4) show that lowest rates of particle deposition and minimal rates of organic loss from the water column occurred during mid-summer. Highest rates of dry matter and organic deposition during early summer and fall coincide with periods of low stratification when resuspension is most likely to occur. Chlorophyll a levels in settled material are also high during these periods indicating that mixing may transport living phytoplankton to depths where they contact the bottom. The shallow depth of St. Georges Bay (70% of the total area is shallower than 30 m) (Marine Ecology Laboratory 1980) enhances the likelihood of direct sedimentation of living phytoplankton.

Approximately constant levels, of sediment organic matter (1% organic carbon, 0.12% nitrogen) which appear to be maintained despite periods of increased supply (Fig. 11) and despite the changing nature of organic matter settled during the year (Fig. 9), implies that organic matter does not accumulate in these desposits. Resuspension before and after periods of stratification and a sufficient supply of oxygen at the sediment surface ensure that organic matter which reaches the sediment is efficiently oxidized.

Respiration of material suspended in the water column must also be a major pathway of loss for organic matter. Daily loss by sedimentation, particularly during summer stratification is a small fraction (less than 5-10%) of that suspended. Organic matter produced by phytoplankton during July, for example, amounted to 7.4 g C m^{-2} in 1977 while only 1.6 g C m^{-2} sedimented. Deposition rates of 1.9 and 2.8 g C m^{-2} were observed in 1978 at 22 m and 25 m (Table 5). Respiration by pelagic organisms within the relatively deep mixed layer (20 m during July) must account for the difference between these rates of supply and loss of organic matter. If advective transport does not alter steady state conditions within the bay during the summer, it should be possible to use these observations to estimate the fraction of pelagic primary production consumed in the water column and that which enters the sediments to be consumed, or stored, by benthic organisms.

REFERENCES

- Drinkwater, K. and A. Taylor. 1979. Physical oceanographic measurements in St. Georges Bay, Nova Scotia, 1976 and 1977. Fish. Mar. Ser. Tech. Rep. 869, 46 p.
- Marine Ecology Laboratory. 1980. Physical oceanography, dissolved nutrients, phytoplankton biomass and sedimentation in St. Georges Bay, N.S. 1977. Fish. Mar. Ser. Tech. Rep. 934, 162 p.
- Prouse, N.J. and B.T. Hargrave. 1977. Chlorophyll, carbon and nitrogen in suspended and sedimented particulate matter in St. Georges Bay, Nova Scotia. Fish. Mar. Ser. Tech. Rep. 721, 69 p.
- Taguchi, S. and B.T. Hargrave. 1978. Loss rates of suspended material sedimented in a marine bay. J. Fish. Res. Board Can. 35: 1614-1620.

Appendix I

Temperature, salinity, density, dissolved nutrients, plant pigments,
carbon and nitrogen in suspended matter

DATE: January 19, 1978

DEPTH	TEMPERATURE °C	SALINITY ‰	DENSITY	NITRATE + NITRITE mg-at N m ⁻³	AMMONIA mg-at N m ⁻³	PHOSPHATE mg-at P m ⁻³	SILICATE mg-at Si m ⁻³
0	-0.4	28.44	22.9	3.09	4.09	0.27	8.34
5	-0.4	28.47	22.9	2.80	2.00	0.26	7.85
10	-0.4	28.44	22.9	2.79	1.05	0.26	7.85
15	-0.4	28.41	22.8	3.02	1.10	0.32	8.67
20	-0.4	28.49	22.9	3.01	1.13	0.27	8.51
25	-0.4	28.39	22.8	3.00	0.85	0.30	8.34
Integral 0-20				58.30	35.95	5.53	163.98
DEPTH M	CHLOROPHYLL a mg m ⁻³	PHEOPIGMENTS mg m ⁻³	PARTICULATE CARBON mg m ⁻³	PARTICULATE NITROGEN mg m ⁻³			
0	1.75		466.6	39.2			
5	1.85		255.0	31.4			
10	1.56	0.68	387.0	46.8			
15	1.26	1.02	356.8	57.8			
20	0.58	1.85	212.0	30.2			
25	0.68	1.70	370.3	47.5			
Integral 0-20	29.18		6690.5	853.5			

DATE: February 17, 1978

DEPTH	TEMPERATURE °C	SALINITY ‰	DENSITY	NITRATE + NITRITE mg-at N m ⁻³	AMMONIA mg-at N m ⁻³	PHOSPHATE mg-at P m ⁻³	SILICATE mg-at Si m ⁻³
0		28.17		0.34	3.16	0.08	4.19
5		28.28		0.23		0.07	4.19
10		28.31		0.23	1.62	0.04	2.42
15		28.54		0.92	1.30	0.15	5.31
20		28.98		2.30	1.98	0.15	6.12
25		29.02		2.42	1.42	0.18	6.44
Integral 0-20				13.50	39.40	1.88	85.38
DEPTH M	CHLOROPHYLL a mg m ⁻³	PHEOPIGMENTS mg m ⁻³	PARTICULATE CARBON mg m ⁻³	PARTICULATE NITROGEN mg m ⁻³			
0	12.34		736.9	94.1			
5	9.17		1013.9	145.2			
10	10.58		608.4	72.9			
15	10.58		829.6	67.9			
20	4.94	0.08	432.1	38.2			
25	3.88	0.10	701.3	87.2			
Integral 0-20	194.85		15182.0	1768.3			

DATE: March 7, 1978

DEPTH	TEMPERATURE °C	SALINITY ‰	DENSITY	NITRATE + NITRITE mg-at N m ⁻³	AMMONIA mg-at N m ⁻³	PHOSPHATE mg-at P m ⁻³	SILICATE mg-at Si m ⁻³
0		28.56		0.79	3.14		11.46
5		28.24		1.02	1.83	0.24	5.98
10		28.30		0.94	1.05	0.24	5.64
15		28.22		1.08	1.05	0.28	5.69
20		28.98		2.30	1.98	0.15	6.12
25		28.70		2.63	1.14	0.34	8.04
30		29.02		5.63	3.41	0.76	26.79
Integral							
0-20				21.18	31.05	6.60	131.95
0-30				52.40	48.83	12.10	255.88
DEPTH M	CHLOROPHYLL $\frac{a}{\text{mg m}^{-3}}$	PHEOPIGMENTS mg m ⁻³	PARTICULATE CARBON mg m ⁻³	PARTICULATE NITROGEN mg m ⁻³			
0	0.78	0.13	353.7	21.0			
5	1.27		266.0	36.7			
10	0.97	0.22	157.7	14.5			
15	0.97	0.36	134.0	8.9			
20	1.07	0.12	283.1	19.1			
25	0.88	0.01	88.6	8.8			
30	1.95	0.58	286.1	29.4			
Integral							
0-20	20.68	4.40	4376.9	401.3			
0-30	32.63	6.20	6237.9	566.3			

DATE: March 20, 1978

DEPTH	TEMPERATURE °C	SALINITY ‰	DENSITY	NITRATE + NITRITE mg-at N m ⁻³	AMMONIA mg-at N m ⁻³	PHOSPHATE mg-at P m ⁻³	SILICATE mg-at Si m ⁻³
0		28.71		1.89	4.96	0.33	7.31
5		28.75		1.10	1.80	0.26	3.98
10		28.72		1.30	1.05	0.26	4.82
15		28.80		1.68	1.05	0.29	5.86
20		28.82		1.76	1.12	0.38	5.86
Integral 0-20				29.60	34.70	5.83	106.23
DEPTH M	CHLOROPHYLL a mg m ⁻³	PHEOPIGMENTS mg m ⁻³	PARTICULATE CARBON mg m ⁻³	PARTICULATE NITROGEN mg m ⁻³			
0	0.53	0.18	447.8	22.6			
5	0.78	0.07	156.5	10.4			
10	0.71	0.09	144.1	11.4			
15	0.25	0.48	172.4	12.7			
20	0.39	0.32	172.4	12.7			
Integral 0-20	11.00	4.45	3915.7	260.2			

DATE: April 4, 1978

DEPTH	TEMPERATURE °C	SALINITY ‰	DENSITY	NITRATE + NITRITE mg-at N m ⁻³	AMMONIA mg-at N m ⁻³	PHOSPHATE mg-at P m ⁻³	SILICATE mg-at Si m ⁻³
0		28.65		1.65	3.48	0.32	5.98
5		28.60		1.50	1.36	0.26	5.31
10		28.64		1.77	1.04	0.30	6.14
15		28.60		1.80	1.40	0.36	6.03
20		28.76		1.92	1.48	0.29	6.03
25		28.94		1.92	1.20	0.32	5.86
30		28.71		2.08	1.92	0.28	5.69
Integral							
0-20				34.28	31.40	6.13	117.43
0-30				53.88	45.90	9.15	176.03
DEPTH M	CHLOROPHYLL a mg m ⁻³	PHEOPIGMENTS mg m ⁻³	PARTICULATE CARBON mg m ⁻³	PARTICULATE NITROGEN mg m ⁻³			
0	1.17	0.22	136.9	14.1			
5	1.07	0.22	232.4	26.8			
10	1.07	0.07	134.6	13.8			
15	0.88	0.22	276.9	29.4			
20	0.78	0.18	774.5	97.8			
25	0.88	0.03	375.9	39.4			
30	0.88	0.22	648.6	53.5			
Integral							
0-20	19.98	3.55	5490.0	629.6			
0-30	28.53	4.70	9855.0	1204.9			

DATE: April 18, 1978

DEPTH	TEMPERATURE °C	SALINITY ‰	DENSITY	NITRATE + NITRITE mg-at N m ⁻³	AMMONIA mg-at N m ⁻³	PHOSPHATE mg-at P m ⁻³	SILICATE mg-at Si m ⁻³
0		28.07		0.25	1.14	0.07	1.16
5		28.16		0.12	0.67	0.11	0.50
10		28.71		0.12	0.18	0.09	0.50
15		28.81		0.08	0.52	0.10	0.67
20		28.92		0.16	0.49	0.12	1.34
25		29.15		0.68	1.43	0.13	2.01
30		29.36			1.60		
Integral							
0-20				2.63	10.93	1.98	14.60
0-30					23.30		
DEPTH M	CHLOROPHYLL a mg m ⁻³	PHEOPIGMENTS mg m ⁻³	PARTICULATE CARBON mg m ⁻³	PARTICULATE NITROGEN mg m ⁻³			
0	0.99	0.08	352.1	35.1			
5	0.92	0.33	634.7	77.7			
10	0.49	0.42	395.9	44.9			
15	1.07	0.46	274.3	42.5			
20	1.75	0.73	290.2	46.4			
25	1.85	1.01	305.6	49.6			
30	0.88	1.03	479.1	63.3			
Integral							
0-20	19.25	8.08	8125.0	1030.2			
0-30	35.08	17.53	11572.0	1552.9			

DATE: April 24, 1978

DEPTH	TEMPERATURE °C	SALINITY ‰	DENSITY	NITRATE + NITRITE mg-at N m ⁻³	AMMONIA mg-at N m ⁻³	PHOSPHATE mg-at P m ⁻³	SILICATE mg-at Si m ⁻³
0	1.5	28.38	22.7	0.35	1.38	0.24	0.33
5	1.5	28.36	22.7	0.20	0.49	0.16	0.33
10	1.0	28.62	23.0	0.00	0.84	0.07	0.33
15	0.5	29.01	23.3	0.00	0.82	0.07	0.33
20	0.2	29.19	23.4	0.24	0.50	0.10	0.84
25	-0.2	29.43	23.7	0.48	0.60	0.23	1.34
30	-0.6	29.83	24.0	1.84	0.96	0.29	4.02
Integral							
0-20				2.48	15.45	2.35	7.88
0-30				10.08	22.10	4.73	30.00
DEPTH M	CHLOROPHYLL a mg m ⁻³	PHEOPIGMENTS mg m ⁻³	PARTICULATE CARBON mg m ⁻³	PARTICULATE NITROGEN mg m ⁻³	Secchi Depth: 10 m		
0	0.53	0.04	172.5	10.8			
5	0.67	0.06	412.1	35.6			
10	0.28	0.22	188.0	10.7			
15	0.53	0.16	280.6	16.6			
20	0.53	0.35	1287.4	39.1			
25	0.81	0.17	260.3	20.1			
30	0.88	0.65	455.8	26.6			
Integral							
0-20	10.05	3.18	8047.0	438.6			
0-30	17.63	6.53	13697.0	703.2			

DATE: May 2, 1978

DEPTH	TEMPERATURE °C	SALINITY ‰	DENSITY	NITRATE + NITRITE mg-at N m ⁻³	AMMONIA mg-at N m ⁻³	PHOSPHATE mg-at P m ⁻³	SILICATE mg-at Si m ⁻³
0				0.67	2.08	0.04	0.83
5				0.12	0.64	0.07	0.83
10				0.08	0.78	0.04	1.00
15				0.08	0.47	0.06	1.00
20				0.48	3.48	0.15	1.17
25				0.16	0.56	0.08	0.67
30				0.16	1.04	0.05	0.67
Integral							
0-20				4.28	23.35	1.33	19.15
0-30				6.68	37.45	2.23	27.10

DEPTH M	CHLOROPHYLL $\frac{a}{\text{mg m}^{-3}}$	PHEOPIGMENTS mg m ⁻³	PARTICULATE CARBON mg m ⁻³	PARTICULATE NITROGEN mg m ⁻³
0	0.67	0.13	300.4	33.8
5	0.78		383.1	22.6
10	0.42	0.13	267.3	17.2
15	0.53	0.09	457.3	23.7
20	0.56	0.11	203.1	22.9
25	0.39	0.13	370.4	20.7
30	0.71	0.06	679.3	20.7
Integral				
0-20	11.73	2.35	6792.5	459.1
0-30	16.85	3.43	10847.0	670.5

Secchi Depth: 11 m

DATE: May 8, 1978

DEPTH	TEMPERATURE °C	SALINITY ‰	DENSITY	NITRATE + NITRITE mg-at N m ⁻³	AMMONIA mg-at N m ⁻³	PHOSPHATE mg-at P m ⁻³	SILICATE mg-at Si m ⁻³
0	4.2			0.90	2.48	0.47	0.33
5	3.6			0.00	0.45	0.09	0.17
10	3.2			0.00	1.38	0.07	0.33
15	2.6			0.12	1.10	0.07	0.50
20	2.2			0.04	0.45	0.13	0.33
25	1.8			0.00	0.25	0.10	0.33
30	1.0			3.11	1.83	0.37	8.04
Integral							
0-20				2.95	21.98	2.65	6.65
0-30				10.83	28.93	4.40	29.23
DEPTH M	CHLOROPHYLL a mg m ⁻³	PHEOPIGMENTS mg m ⁻³	PARTICULATE CARBON mg m ⁻³	PARTICULATE NITROGEN mg m ⁻³	Secchi Depth: 17 m		
0	0.13	0.03	313.6	15.1			
5	0.15	0.08	329.8	5.2			
10	0.07	0.20	383.4	13.9			
15	0.53	0.02	208.4	15.9			
20	0.39	0.18	169.5	11.2			
25	0.97	0.41	341.8	22.6			
30	0.49	0.09	259.6	12.6			
Integral							
0-20	5.05	2.03	5805.0	240.4			
0-30	12.10	4.75	8580.0	412.7			

DATE: May 16, 1978

DEPTH	TEMPERATURE °C	SALINITY ‰	DENSITY	NITRATE + NITRITE mg-at N m ⁻³	AMMONIA mg-at N m ⁻³	PHOSPHATE mg-at P m ⁻³	SILICATE mg-at Si m ⁻³
0	7.2			0.20	1.38	0.08	0.83
5	6.0			0.00	0.67	0.06	0.50
10	5.1			0.04	2.74	0.06	0.66
15	3.0			0.08	1.43	0.07	0.50
20	2.0			0.08	2.05	0.06	0.67
25	-0.1			1.48	0.64	0.44	4.19
30	-0.6			2.60	5.21	0.38	6.36
Integral 0-20 0-30				1.30 15.40	32.78 54.13	1.30 4.60	12.05 50.58
DEPTH M	CHLOROPHYLL a mg m ⁻³	PHEOPIGMENTS mg m ⁻³	PARTICULATE CARBON mg m ⁻³	PARTICULATE NITROGEN mg m ⁻³	Secchi Depth: 18 m		
0	0.18	0.08	74.9	12.2			
5	0.22	0.08	229.3	14.1			
10	0.13	0.21	118.7	8.8			
15	0.35	0.08	210.7	13.8			
20	0.42	0.20	286.3	10.7			
25	3.66	1.45	299.1	41.7			
30	0.78	0.37	120.3	13.5			
Integral 0-20 0-30	5.00 26.30	2.55 11.23	3696.5 6208.7	240.9 509.8			

DATE: May 29, 1978

DEPTH	TEMPERATURE °C	SALINITY ‰	DENSITY	NITRATE + NITRITE mg-at N m ⁻³	AMMONIA mg-at N m ⁻³	PHOSPHATE mg-at P m ⁻³	SILICATE mg-at Si m ⁻³
0	8.0			1.32	1.67	0.45	0.33
5	7.9			0.08	0.62	0.10	0.33
10	7.7			0.00	0.20	0.06	0.33
15	6.5			0.08	0.07	0.06	0.49
20	3.8			0.08	0.24	0.07	0.50
25	3.0			0.12	0.40	0.08	0.84
30	0.3			3.91	1.20	0.42	8.20
Integral 0-20 0-30				4.30 14.88	9.23 14.83	2.40 4.03	7.83 33.78
Secchi Depth: 17 m							
DEPTH M	CHLOROPHYLL a mg m ⁻³	PHEOPIGMENTS mg m ⁻³	PARTICULATE CARBON mg m ⁻³	PARTICULATE NITROGEN mg m ⁻³			
0	0.08	0.06	1858.1	67.3			
5	0.16	0.11	321.8	8.4			
10	0.09	0.14	332.6	33.0			
15	0.10	0.18	206.7	14.0			
20	0.05	0.12	538.9	14.2			
25	0.24	0.12	194.3	20.1			
30	0.74	0.00	138.4	20.1			
Integral 0-20 0-30	2.08 5.25	2.60 3.51	10293.8 12945.0	480.8 666.8			

DATE: June 5, 1978 (0930)

DEPTH	TEMPERATURE °C	SALINITY ‰	DENSITY	NITRATE + NITRITE mg-at N m ⁻³	AMMONIA mg-at N m ⁻³	PHOSPHATE mg-at P m ⁻³	SILICATE mg-at Si m ⁻³
0	8.0	29.00	22.6	0.31	0.47	0.07	1.32
5	8.0	29.19	22.7	0.16	2.85	0.22	1.15
10	8.0	29.19	22.7	0.12	0.32	0.21	0.66
15	7.6	29.24	22.8	0.08	0.78	0.22	0.66
20	5.5	29.35	23.2	0.23	0.29	0.07	1.48
25	3.6	29.83	23.7	0.27	1.40	0.07	0.99
30	0.9	30.05	24.1	1.83	0.02	0.09	3.95
Integral 0-20 0-30				3.15 9.65	21.65 29.43	3.60 4.35	19.35 37.86
DEPTH M	CHLOROPHYLL a mg m ⁻³	PHEOPIGMENTS mg m ⁻³	PARTICULATE CARBON mg m ⁻³	PARTICULATE NITROGEN mg m ⁻³	Secchi Depth: 14 m		
0	0.27	0.16	241.6	11.4			
5	0.19	0.18	136.5	9.4			
10	0.20	0.20	160.7	7.4			
15	0.13	0.28	139.3	6.2			
20	0.11	0.23	212.6	3.2			
25	0.60		311.6	15.4			
30	0.55	0.07	294.4	7.4			
Integral 0-20 0-30	3.55 8.20	4.28 5.78	3312.5 6127.5	151.9 255.3			

DATE: June 5, 1978 (1700)

DEPTH	TEMPERATURE °C	SALINITY °/°°	DENSITY	NITRATE + NITRITE mg-at N m ⁻³	AMMONIA mg-at N m ⁻³	PHOSPHATE mg-at P m ⁻³	SILICATE mg-at Si m ⁻³
25				0.15		0.12	1.00
26				0.08		0.09	0.80
27				0.41		0.19	1.30
28				0.22		0.22	0.90
29				0.46		0.40	2.00
30				0.38		0.23	1.70
31				1.26		0.78	3.10
32				0.54		0.24	2.80
33				1.58		0.38	4.80
34				1.22		0.22	3.20
DEPTH M	CHLOROPHYLL a mg m ⁻³	PHEOPIGMENTS mg m ⁻³	PARTICULATE CARBON mg m ⁻³	PARTICULATE NITROGEN mg m ⁻³			
25	0.55	0.08					
27	0.79	0.03					
29	0.88	0.06					
31	1.33						
33	1.64						
34	2.41						

DATE: June 6, 1978 (0915)

DEPTH	TEMPERATURE °C	SALINITY ‰	DENSITY	NITRATE + NITRITE mg-at N m ⁻³	AMMONIA mg-at N m ⁻³	PHOSPHATE mg-at P m ⁻³	SILICATE mg-at Si m ⁻³
0	8.05	28.90	22.52	0.27	1.05	0.14	0.68
5		28.87		0.04	0.34	0.15	
10		29.07		0.45	0.62	0.36	0.55
15		29.15		0.27	0.47	0.32	1.02
20		29.34		0.82	0.27	0.30	1.89
25		29.80		0.36	0.07		1.45
30		29.90		1.72	0.50	0.76	3.51
Integral							
0-20				10.48	10.45	5.80	17.35
0-30				18.63	12.73	8.45	38.10
DEPTH M	CHLOROPHYLL a mg m ⁻³	PHEOPIGMENTS mg m ⁻³	PARTICULATE CARBON mg m ⁻³	PARTICULATE NITROGEN mg m ⁻³			
0	0.30	0.32	313.6	15.1			
5	0.24	0.20	329.8	5.2			
10	0.20	0.21	383.4	13.9			
15	0.33	0.37	208.4	15.9			
20	0.37	0.44	169.5	11.2			
25	0.55	0.04	341.8	22.6			
30	1.23	0.00	259.6	12.6			
Integral							
0-20	5.53	5.80	5740.0	239.8			
0-30	12.28	7.10	8610.0	412.5			

DATE: June 6, 1978 (0930)

DEPTH	TEMPERATURE °C	SALINITY ‰	DENSITY	NITRATE + NITRITE mg-at N m ⁻³	AMMONIA mg-at N m ⁻³	PHOSPHATE mg-at P m ⁻³	SILICATE mg-at Si m ⁻³
25		29.80		0.04	0.07	0.13	
26		29.88		0.34	0.08	0.97	
27		29.93		0.58	0.23	0.13	
28		30.00		0.97	0.12	0.21	
29		30.04		1.55	0.37	0.34	
30		30.03		3.29	0.50	0.70	
31		30.12		1.79	0.21	0.36	
32		30.15		2.32	0.27	0.47	
33		30.21		2.76	0.41	0.55	
DEPTH M	CHLOROPHYLL a mg m ⁻³	PHEOPIGMENTS mg m ⁻³	PARTICULATE CARBON mg m ⁻³	PARTICULATE NITROGEN mg m ⁻³			

DATE: June 6, 1978 (1530)

DEPTH	TEMPERATURE °C	SALINITY ‰	DENSITY	NITRATE + NITRITE mg-at N m ⁻³	AMMONIA mg-at N m ⁻³	PHOSPHATE mg-at P m ⁻³	SILICATE mg-at Si m ⁻³
0		29.13		0.15			0.31
5		29.04		0.23		0.83	0.15
10		29.13		0.19		0.07	0.36
15		29.25		0.30		0.20	0.10
20		29.67		0.23			0.26
25		29.95		1.87		0.57	2.60
30		30.03		2.51		0.54	4.59
Integral							
0-20				4.55		5.50	4.48
0-30				20.55		9.70	29.60

DEPTH M	CHLOROPHYLL a mg m ⁻³	PHEOPIGMENTS mg m ⁻³	PARTICULATE CARBON mg m ⁻³	PARTICULATE NITROGEN mg m ⁻³
0	0.85	0.55	301.8	10.9
5	0.63	0.42	448.0	42.1
10	0.30	0.31	403.4	35.9
15	0.19	0.25	239.6	17.3
20	0.14	0.13	345.2	25.5
25	0.57	0.22	431.6	33.2
30	1.09	0.11	538.6	30.7
Integral				
0-20	8.08	6.60	7067.5	567.5
0-30	13.73	8.30	11440.0	874.0

DATE: June 6, 1978 (1545)

DEPTH	TEMPERATURE °C	SALINITY ‰	DENSITY	NITRATE + NITRITE mg-at N m ⁻³	AMMONIA mg-at N m ⁻³	PHOSPHATE mg-at P m ⁻³	SILICATE mg-at Si m ⁻³
25		29.95		1.83		0.57	2.60
26		29.88		0.68		0.10	2.76
27		29.93		1.21		0.32	2.50
28		30.00		0.71		0.15	3.11
29		30.04		2.25		0.50	3.93
30		30.03		2.51		0.54	4.95
31		30.12		2.28		0.31	5.71
32		30.15		2.46		0.42	6.12
33		30.21		4.29		0.49	7.70
DEPTH M	CHLOROPHYLL a mg m ⁻³	PHEOPIGMENTS mg m ⁻³	PARTICULATE CARBON mg m ⁻³	PARTICULATE NITROGEN mg m ⁻³			

DATE: June 6, 1978 (2200)

DEPTH	TEMPERATURE °C	SALINITY ‰	DENSITY	NITRATE + NITRITE mg-at N m ⁻³	AMMONIA mg-at N m ⁻³	PHOSPHATE mg-at P m ⁻³	SILICATE mg-at Si m ⁻³
0	7.99	29.08	22.7	0.00	0.00	0.01	0.00
5		29.11		0.10	0.29	0.09	0.16
10		29.11		0.05	0.25	0.12	0.16
15		29.23		0.00	0.20	0.14	0.16
20		29.78		0.08	0.29	0.00	0.12
25		30.06		1.44	1.67	0.14	2.88
26				0.42		0.14	1.08
27				0.68		0.17	1.08
30		30.20			1.00		
33		30.22			0.80		
Integral							
0-20				0.95	4.43	1.78	2.70
0-30					16.00		
DEPTH M	CHLOROPHYLL a mg m ⁻³	PHEOPIGMENTS mg m ⁻³	PARTICULATE CARBON mg m ⁻³	PARTICULATE NITROGEN mg m ⁻³			
0	0.44	0.35	222.6	21.3			
5	0.33	0.40	212.4	17.6			
10	0.39	0.36	151.0	16.1			
15	0.31	0.44	344.0	14.6			
20	0.25	0.14	461.6	17.8			
25	0.55	0.15	302.8	17.1			
30	0.63	0.24	246.8	16.6			
33	0.55	0.28	468.4	20.1			
Integral							
0-20	6.88	7.23	5247.5	339.3			
0-30	11.83	8.93	8531.8	510.8			

DATE: June 7, 1978 (0300)

DEPTH	TEMPERATURE °C	SALINITY ‰	DENSITY	NITRATE + NITRITE mg-at N m ⁻³	AMMONIA mg-at N m ⁻³	PHOSPHATE mg-at P m ⁻³	SILICATE mg-at Si m ⁻³
0	8.12	29.11	22.7	0.19	0.80	0.10	0.16
5		29.08		0.08	0.56	0.09	0.16
10		29.11		0.00	0.38	0.09	0.16
15		29.23		0.00	0.70	0.07	0.00
20		29.62		0.00	0.25	0.12	0.00
25		29.97		0.86	1.63	0.22	1.81
30		30.25		3.07	0.67	0.37	5.59
33		30.26		3.46	1.02	0.43	6.58
Integral 0-20 0-30				0.88 12.85	10.83 21.28	1.80 4.13	2.00 25.03
DEPTH M	CHLOROPHYLL a mg m ⁻³	PHOTOPIGMENTS mg m ⁻³	PARTICULATE CARBON mg m ⁻³	PARTICULATE NITROGEN mg m ⁻³			
0	0.25	0.27	1076.2	69.1			
5	0.25	0.25	288.2	17.8			
10	0.31	0.26	203.2	12.1			
15	0.33	0.50	275.6	9.2			
20	0.55	0.31	261.6	18.6			
25	0.74	0.07	302.6	24.5			
30	0.88	0.13	250.8	24.8			
33	0.74	0.16	307.4	23.3			
Integral 0-20 0-30	7.08 13.73	6.50 7.95	7179.5 9973.5	414.8 645.8			

DATE: June 8, 1978 (0945)

DEPTH	TEMPERATURE °C	SALINITY ‰	DENSITY	NITRATE + NITRITE mg-at N m ⁻³	AMMONIA mg-at N m ⁻³	PHOSPHATE mg-at P m ⁻³	SILICATE mg-at Si m ⁻³
0	8.36	29.08	22.6	0.08	0.09	0.09	0.10
5	7.70	29.13	22.7	0.23	0.32	0.16	0.10
10	6.95	29.18	22.9	0.04	0.00	0.05	0.10
15	6.90	29.57	23.2	0.00	0.49	0.05	0.10
20	3.45	29.72	23.8	0.04	0.14	0.32	0.10
25	1.70	30.08	24.1	1.52	0.36	0.25	1.32
30	0.15	30.29	24.3	3.69	1.16	0.52	6.91
33	0.20	30.30	24.3	3.81	1.07	0.66	7.24
Integral							
0-20				1.65	4.63	2.38	2.00
0-30				18.38	9.68	5.68	22.57
DEPTH M	CHLOROPHYLL a mg m ⁻³	PHEOPIGMENTS mg m ⁻³	PARTICULATE CARBON mg m ⁻³	PARTICULATE NITROGEN mg m ⁻³	Secchi Depth: 14 m		
0	0.21	0.26	141.8	10.9			
5	0.19	0.26	425.0	34.2			
10	0.28	0.40	520.8	126.1			
15	0.26	0.50	299.8	18.6			
20	0.20	0.16	202.6	19.3			
25	0.44	0.13	317.6	23.0			
30	0.30	0.17	331.2	27.0			
33	0.39	0.12	345.4	25.5			
Integral							
0-20	4.68	6.85	7089.0	970.0			
0-30	8.13	8.33	10011.5	1200.8			

DATE: June 19, 1978

DEPTH	TEMPERATURE °C	SALINITY ‰	DENSITY	NITRATE + NITRITE mg-at N m ⁻³	AMMONIA mg-at N m ⁻³	PHOSPHATE mg-at P m ⁻³	SILICATE mg-at Si m ⁻³
0	11.3				0.50		
5					0.37		
10				0.04	0.01	0.23	0.67
15				0.03	0.00	0.23	0.41
20					0.07		
25					0.07		
30				5.96	1.62	1.11	10.00
Integral							
0-20					3.33		
0-30					7.90		
DEPTH M	CHLOROPHYLL a mg m ⁻³	PHEOPIGMENTS mg m ⁻³	PARTICULATE CARBON mg m ⁻³	PARTICULATE NITROGEN mg m ⁻³	Secchi Depth: 17 m		
0	0.08	0.10	306.9	21.0			
5	0.08	0.10	170.4	22.6			
10	0.04	0.15	161.0	21.8			
15	0.19	0.20	82.9	9.6			
20	0.14	0.22	100.7	14.5			
25	0.05	0.30	91.1	9.2			
30	0.13	0.15	54.1	11.5			
Integral							
0-20	2.10	3.05	3086.9	358.6			
0-30	3.03	5.48	3926.8	469.5			

DATE: July 4, 1978

DEPTH	TEMPERATURE °C	SALINITY ‰	DENSITY	NITRATE + NITRITE mg-at N m ⁻³	AMMONIA mg-at N m ⁻³	PHOSPHATE mg-at P m ⁻³	SILICATE mg-at Si m ⁻³
0	14.5	28.99	21.6	0.19	0.62	0.51	0.65
5	14.10	28.98	21.6	0.05	0.56	0.38	0.48
10		28.98		0.05	0.44	0.31	0.65
15	12.46	29.10	22.0	0.05	0.49	0.27	0.81
20	12.37	29.47	22.3	0.05	0.58	0.24	0.81
25	9.60	29.47	22.7	0.05	0.65	0.10	0.65
30	6.74	29.87	23.4	0.44	0.98	0.17	2.43
Integral							
0-20				1.35	10.45	6.68	13.35
0-3				1.85	17.60	8.20	24.70
DEPTH M	CHLOROPHYLL a mg m ⁻³	PHEOPIGMENTS mg m ⁻³	PARTICULATE CARBON mg m ⁻³	PARTICULATE NITROGEN mg m ⁻³	Secchi Depth: 13 m		
0	0.10	0.10	414.2	30.3			
5	0.02	0.17	155.2	10.3			
10	0.11	0.41	157.0	14.8			
15	0.25	0.41	169.6	16.1			
20	0.11	0.40	104.1	9.5			
25	0.07	0.26	44.8	2.4			
30	0.21	0.24	70.3	6.1			
Integral							
0-20	2.43	6.20	3700.5	305.5			
0-30	3.58	9.10	4360.0	356.3			

DATE: July 10, 1978

DEPTH	TEMPERATURE °C	SALINITY ‰	DENSITY	NITRATE + NITRITE mg-at N m ⁻³	AMMONIA mg-at N m ⁻³	PHOSPHATE mg-at P m ⁻³	SILICATE mg-at Si m ⁻³
0	16.25	28.99	21.1	0.30	0.26	0.10	0.24
5	16.25	29.13	21.2	0.25	0.00	0.09	0.21
10	15.40	29.17	21.4	0.26	0.00	0.16	0.56
15	13.40	29.26	22.9	0.34	0.03	0.29	1.42
20	11.70	29.30	22.2	0.30	0.28	0.35	1.63
25	8.70	29.54	22.9	0.33	0.28	0.45	3.22
30	6.80	29.77	23.5	1.22	0.21	0.54	6.66
Integral							
0-20				5.75	2.95	3.83	15.63
0-30				11.20	5.58	8.30	52.45
DEPTH M	CHLOROPHYLL a mg m ⁻³	PHEOPIGMENTS mg m ⁻³	PARTICULATE CARBON mg m ⁻³	PARTICULATE NITROGEN mg m ⁻³	Secchi Depth: 11 m		
0	0.26	0.07	361.4	26.4			
5	0.32	0.13	133.0	14.1			
10	0.32	0.25	214.3	24.9			
15	0.42	0.25	186.4	25.2			
20	0.21	0.48	150.1	14.5			
25	0.14	0.48	93.7	12.6			
30	0.14	0.41	108.4	13.4			
Integral							
0-20	6.48	4.78	3944.9	423.5			
0-30	8.05	9.15	5057.2	556.4			

DATE: July 17, 1978

DEPTH	TEMPERATURE °C	SALINITY ‰	DENSITY	NITRATE + NITRITE mg-at N m ⁻³	AMMONIA mg-at N m ⁻³	PHOSPHATE mg-at P m ⁻³	SILICATE mg-at Si m ⁻³
0	17.2	28.99	20.9				
5	17.4	29.13	21.0				
10	15.2	29.17	21.5				
15	13.0	29.25	22.0				
20		29.36					
25		29.94					
30		29.94					
Integral							
0-20							
0-30							
DEPTH M	CHLOROPHYLL a mg m ⁻³	PHEOPIGMENTS mg m ⁻³	PARTICULATE CARBON mg m ⁻³	PARTICULATE NITROGEN mg m ⁻³	Secchi Depth: 11 m		
0	0.28	0.13	673.3	21.1			
5	0.35	0.13	2985.0	675.5			
10	0.28	0.29	239.7	12.0			
15	0.11	0.18	194.3	16.9			
20	0.12	0.18					
25	0.07	0.21	117.0	6.3			
30	0.03	0.17	132.6	7.7			
Integral							
0-20	4.70	3.78					
0-30	5.43	5.70	20469.1	3685.3			

DATE: July 25, 1978

DEPTH	TEMPERATURE °C	SALINITY ‰	DENSITY	NITRATE + NITRITE mg-at N m ⁻³	AMMONIA mg-at N m ⁻³	PHOSPHATE mg-at P m ⁻³	SILICATE mg-at Si m ⁻³
0	16.80	28.37	20.5				
5	17.65	29.03	20.8	0.01		0.46	5.31
10		29.04					
15		29.06		0.13		0.35	6.57
20	14.95	29.19	21.5	0.00		0.44	4.85
25	11.19	29.39	22.4	0.03		0.38	3.85
30	9.55	29.60	22.8	0.00		0.36	11.49
Integral							
0-20				1.05		7.18	101.23
0-30				1.24		11.08	161.33
DEPTH M	CHLOROPHYLL a mg m ⁻³	PHEOPIGMENTS mg m ⁻³	PARTICULATE CARBON mg m ⁻³	PARTICULATE NITROGEN mg m ⁻³	Secchi Depth: 11 m		
0	0.49	0.34	186.0	14.0			
5	0.53	0.35	255.3	25.6			
10	0.67	0.33	226.8	26.6			
15	0.81	0.30	226.9	28.8			
20	0.71	0.30	220.4	21.6			
25	0.11	0.45	219.0	30.1			
30	0.21	0.31	348.0	30.1			
Integral							
0-20	13.05	6.50	4561.2	494.1			
0-30	15.90	10.28	7074.9	773.6			

DATE: July 31, 1978

DEPTH	TEMPERATURE °C	SALINITY ‰	DENSITY	NITRATE + NITRITE mg-at N m ⁻³	AMMONIA mg-at N m ⁻³	PHOSPHATE mg-at P m ⁻³	SILICATE mg-at Si m ⁻³
0	18.0			0.16		0.12	3.50
5	19.01	38.30	20.0	0.14		0.11	3.55
10		28.24		0.10		0.04	3.27
15	18.50	28.56	20.3	0.40		0.18	3.26
20	14.71	30.08	22.3	0.01		0.11	3.38
25	10.73	30.18	23.1	0.14		0.04	12.36
30	4.86	30.62	24.3	0.23		0.16	19.26
Integral							
0-20				3.63		2.23	67.69
0-30				4.93		3.10	166.00
DEPTH M	CHLOROPHYLL a mg m ⁻³	PHEOPIGMENTS mg m ⁻³	PARTICULATE CARBON mg m ⁻³	PARTICULATE NITROGEN mg m ⁻³	Secchi Depth: 11 m		
0	0.31	0.04	226.5	26.6			
5	0.32	0.08	204.0	16.1			
10	0.29	0.20	170.0	17.9			
15	0.32	0.53	142.2	20.8			
20	0.39	0.73	186.9	27.2			
25	0.23	0.30	135.0	19.0			
30	0.10	0.30	281.1	37.5			
Integral							
0-20	6.40	5.98	3614.8	409.0			
0-30	8.78	10.05	5459.7	665.6			

DATE: August 8, 1978

DEPTH	TEMPERATURE °C	SALINITY ‰	DENSITY	NITRATE + NITRITE mg-at N m ⁻³	AMMONIA mg-at N m ⁻³	PHOSPHATE mg-at P m ⁻³	SILICATE mg-at Si m ⁻³
0	18.9	28.54	20.2	1.19		0.40	7.31
5	19.64	28.59	20.0	1.63		0.40	14.30
10		28.59		1.25		0.29	8.30
15	18.51	29.02	20.6	0.68		0.18	6.45
20	15.35	29.27	21.5	0.19		0.33	8.76
25	11.29	29.51	22.5	2.01		0.65	13.17
30	4.18	30.15	23.9	0.37		0.32	24.75
Integral							
0-20				21.25		6.18	185.43
0-30				32.70		11.05	335.05
DEPTH M	CHLOROPHYLL a mg m ⁻³	PHEOPIGMENTS mg m ⁻³	PARTICULATE CARBON mg m ⁻³	PARTICULATE NITROGEN mg m ⁻³	Secchi Depth: 10 m		
0	0.45	0.00	178.9	13.0			
5	0.52	0.00	219.0	20.0			
10	0.13	0.14	154.0	15.7			
15	1.46	0.00	138.4	16.8			
20	0.52	0.00	180.6	16.8			
25	0.16	0.14	312.7	57.4			
30	0.02	0.19	399.7	21.4			
Integral							
0-20	12.98	0.71	3455.7	336.5			
0-30	15.13	1.90	6470.1	718.9			

DATE: August 14, 1978

DEPTH	TEMPERATURE °C	SALINITY ‰	DENSITY	NITRATE + NITRITE mg-at N m ⁻³	AMMONIA mg-at N m ⁻³	PHOSPHATE mg-at P m ⁻³	SILICATE mg-at Si m ⁻³
0	19.6	28.21	19.7				
5	20.62	28.70	19.8				
10							
15	20.01	28.71	20.0				
20	16.37						
25	11.40						
30	4.65						
DEPTH M	CHLOROPHYLL a mg m ⁻³	PHEOPIGMENTS mg m ⁻³	PARTICULATE CARBON mg m ⁻³	PARTICULATE NITROGEN mg m ⁻³			
0	0.07	0.11	195.3	16.1			
5	0.31	0.00	165.0	11.1			
10	0.91	0.00	178.3	14.6			
15	0.45	0.00	165.9	13.4			
20	0.55	0.33	191.6	18.0			
25	0.26	0.16	527.4	84.9			
30	0.05	0.28	219.0	37.5			
Integral							
0-20	9.90	1.10	3512.9	280.6			
0-30	12.70	3.43	7173.4	619.1			

DATE: August 28, 1978

DEPTH	TEMPERATURE °C	SALINITY ‰	DENSITY	NITRATE + NITRITE mg-at N m ⁻³	AMMONIA mg-at N m ⁻³	PHOSPHATE mg-at P m ⁻³	SILICATE mg-at Si m ⁻³
0	17.30	28.07	20.2	1.57		1.84	6.88
5	18.30	28.16	20.0	0.30		0.16	3.41
10		28.38		0.69		0.06	5.25
15	18.31	28.61	20.3	0.70		0.07	4.68
20	18.40	28.71	20.4	0.44		0.15	4.37
25	18.27	28.76	20.5	0.42		0.23	4.51
26		28.94		0.47		0.16	7.88
28		29.00		0.24		0.06	5.81
30		29.02		0.65		0.32	9.98
32		29.03		0.08		0.15	12.11
33	14.4	29.96	22.2	0.56		0.24	15.56
34		29.99		1.58		0.16	16.19
Integral							
0-20				13.48		6.43	94.78
0-30				18.30		8.75	153.25
DEPTH M	CHLOROPHYLL a mg m ⁻³	PHEOPIGMENTS mg m ⁻³	PARTICULATE CARBON mg m ⁻³	PARTICULATE NITROGEN mg m ⁻³	Secchi Depth: 11 m		
0	1.03	0.23	166.7	8.9			
5	0.80	0.36	202.2	23.0			
10	1.94	1.04	48.4	1.2			
15	0.68	0.42					
20	0.57	0.38	127.2	13.9			
25	0.68	0.36	107.6	9.7			
26	0.09	0.04					
28	0.80	0.57					
30	0.91	0.30	92.3	2.0			
32	1.03	0.29					
33	1.83	0.86					
34	1.03	0.39					
Integral							
0-20	21.10	10.63	2426.8	215.8			
0-30	28.35	14.08	3513.5	426.3			

DATE: August 31, 1978 (1030)

DEPTH	TEMPERATURE °C	SALINITY ‰	DENSITY	NITRATE + NITRITE mg-at N m ⁻³	AMMONIA mg-at N m ⁻³	PHOSPHATE mg-at P m ⁻³	SILICATE mg-at Si m ⁻³
0		28.97		0.19	0.23	0.20	5.34
5	18.17	28.99	20.7	0.43	0.27	0.11	5.10
10	18.17	28.97	20.7	0.37	1.74	0.29	9.08
15	18.15	28.99	20.7	0.37	2.06	0.22	5.93
20	18.20	28.98	20.7	0.38	0.47	0.10	10.15
25	18.08	29.01	20.7	0.14		0.08	7.02
28		29.07		0.19		0.21	6.13
30	13.59	29.34	21.9	0.60		0.42	11.81
32		29.55		2.48		0.75	17.66
34		29.93		4.91		1.07	26.09
Integral							
0-20				7.28	22.10	3.85	139.28
0-30				10.43		5.55	229.28
DEPTH M	CHLOROPHYLL a mg m ⁻³	PHEOPIGMENTS mg m ⁻³	PARTICULATE CARBON mg m ⁻³	PARTICULATE NITROGEN mg m ⁻³			
0	0.80	0.83	316.0	27.5			
5	1.71	0.23	497.7	43.6			
10	1.94	0.43	375.5	38.9			
15	2.05	0.36	258.4	25.5			
20	1.94	0.37	375.4	37.9			
25	2.17	0.36	214.7	21.3			
28	2.17	0.25	303.8	34.4			
30	1.37	0.63	252.8	22.6			
32	1.14	0.23	148.9	17.8			
34	0.57	0.22	292.7	28.0			
Integral							
0-20	35.35	8.05	7386.5	703.5			
0-30	54.48	12.40	10030.5	961.3			

DATE: August 31, 1978 (1605)

DEPTH	TEMPERATURE °C	SALINITY ‰	DENSITY	NITRATE + NITRITE mg-at N m ⁻³	AMMONIA mg-at N m ⁻³	PHOSPHATE mg-at P m ⁻³	SILICATE mg-at Si m ⁻³
0	17.43	28.98	20.8	1.77		0.36	3.51
5	18.50	29.00	20.6	1.57		0.40	3.28
10	18.25	29.00	20.7	0.38		0.13	3.09
15	18.25	29.01	20.7	1.01			3.90
20		29.03		0.38		0.12	3.32
25	17.99	29.08	20.8	0.12	0.25	0.26	3.56
30	12.44	29.49	22.3	2.19	1.42	0.81	16.38
Integral							
0-20				20.18		3.85	68.43
0-30				27.20		8.18	135.48
DEPTH M	CHLOROPHYLL $\frac{a}{mg\ m^{-3}}$	PHEOPIGMENTS mg m ⁻³	PARTICULATE CARBON mg m ⁻³	PARTICULATE NITROGEN mg m ⁻³			
0	1.14	0.33	333.0	22.8			
5	1.45	0.39	825.8	52.8			
10	2.47	0.51	565.1	69.1			
15	1.83	0.38	407.9	40.1			
20	1.37	0.10	379.2	34.4			
25	1.83	0.07	280.9	38.4			
30	0.68	0.21	175.1	19.8			
Integral							
0-20	35.03	7.48	10774.5	953.0			
0-30	49.30	8.60	13564.8	1280.5			

DATE: August 31, 1978 (1700-1750)

DEPTH	TEMPERATURE °C	SALINITY ‰	DENSITY	NITRATE + NITRITE mg-at N m ⁻³	AMMONIA mg-at N m ⁻³	PHOSPHATE mg-at P m ⁻³	SILICATE mg-at Si m ⁻³
25	17.92	29.04	20.8	0.32	0.08	0.24	3.60
26	17.90	29.05	20.8	2.16	0.82	0.10	4.15
28		29.13		0.23	1.04	0.30	5.72
29	14.05	29.34	21.8	1.05	0.38	0.88	12.76
31	8.90	29.77	23.1	3.91	2.46	1.03	22.04
33	5.53	30.21	23.9	3.94	2.74	0.60	27.27
34	6.29	30.13	23.7	5.33	3.06	0.82	26.41
DEPTH M	CHLOROPHYLL a mg m ⁻³	PHEOPIGMENTS mg m ⁻³	PARTICULATE CARBON mg m ⁻³	PARTICULATE NITROGEN mg m ⁻³			
25	1.60	0.30	172.2	21.1			
26	1.94	0.16	297.1	27.3			
28	1.71	0.23	358.4	37.9			
29	3.88		439.0	45.6			
31	0.57	0.27	567.0	48.3			
33	0.23	0.40	331.9	39.2			
34	0.34	0.29	121.1	6.9			

DATE: August 31, 1978 (2040-2110)

DEPTH	TEMPERATURE °C	SALINITY ‰	DENSITY	NITRATE + NITRITE mg-at N m ⁻³	AMMONIA mg-at N m ⁻³	PHOSPHATE mg-at P m ⁻³	SILICATE mg-at Si m ⁻³
0		28.93		0.12		0.34	3.18
5	18.40	28.95	20.6	0.16		0.18	3.07
10	18.32	28.96	20.6	0.20		0.23	2.84
15	18.20	28.97	20.7	0.44		0.17	2.87
20	18.12	28.97	20.7	0.24		0.21	3.10
25	18.02	29.00	20.7	0.18		0.26	3.25
27	14.81			0.21		0.54	10.91
29	13.70			1.13		1.15	15.36
30	13.68	29.36	21.9	1.35		0.66	12.78
31	10.95			3.24		0.79	21.45
32	6.66			3.69		0.76	23.43
Integral							
0-20				4.90		4.28	59.60
0-30				9.78		7.75	115.55
DEPTH M	CHLOROPHYLL a mg m ⁻³	PHEOPIGMENTS mg m ⁻³	PARTICULATE CARBON mg m ⁻³	PARTICULATE NITROGEN mg m ⁻³			
0	1.71	0.18	307.3	32.0			
5	1.14	0.07	418.6	31.5			
10	1.14	0.38	687.1	50.6			
15	1.37	0.47	491.5	43.4			
20	1.48	0.46	291.1	27.8			
25	1.26	0.43	298.9	28.5			
27	2.28	0.03	223.0	15.4			
29	0.46	0.38	65.2	7.2			
30	0.80	0.25	128.3	7.4			
31	0.46	0.23	230.9	22.8			
32	0.34	0.45	158.6	24.0			
Integral							
0-20	26.20	6.20	9482.0	777.0			
0-30	38.23	10.13	12025.0	1007.5			

DATE: September 1, 1978

DEPTH	TEMPERATURE °C	SALINITY ‰	DENSITY	NITRATE + NITRITE mg-at N m ⁻³	AMMONIA mg-at N m ⁻³	PHOSPHATE mg-at P m ⁻³	SILICATE mg-at Si m ⁻³
0	18.36	28.99	20.6	0.18	0.23	0.10	2.93
5	18.37	28.98	20.6	0.10	0.00	0.15	2.21
15	18.35	28.98	20.6	0.29	0.06	0.23	3.00
25	17.00	29.47	21.3	0.09	0.18	0.29	5.79
27	12.29	29.47	22.3	1.31	0.16	0.60	14.24
30	8.71	29.87	23.2	4.36	1.70	0.95	22.16
32	7.56	29.98	23.4	3.66	1.87	0.54	17.98
Integral 0-30				15.68	6.78	8.23	152.73
DEPTH M	CHLOROPHYLL a mg m ⁻³	PHEOPIGMENTS mg m ⁻³	PARTICULATE CARBON mg m ⁻³	PARTICULATE NITROGEN mg m ⁻³			
0	1.48	0.25	284.9	37.9			
5	1.94	0.00	314.9	36.9			
15	1.94	0.16	256.6	35.4			
25	1.71	0.00	147.6	32.7			
27	2.17	0.04	304.0	38.4			
30	2.05	0.00	261.4	25.3			
32	0.34	0.13	346.7	19.5			
Integral 0-30	55.60	2.23	7400.5	1034.0			

DATE: September 11, 1978

DEPTH	TEMPERATURE °C	SALINITY ‰	DENSITY	NITRATE + NITRITE mg-at N m ⁻³	AMMONIA mg-at N m ⁻³	PHOSPHATE mg-at P m ⁻³	SILICATE mg-at Si m ⁻³
0	15.9	28.35	20.7	1.50	0.27	0.69	5.23
5	16.69	28.95	21.0	1.37		0.49	3.07
10	16.68	28.99	21.0	1.10		0.38	2.66
15		28.96		1.26		0.43	2.83
20	16.70	28.98	21.0	2.03		0.30	2.89
25	16.62	28.97	21.0	1.43		2.97	22.16
30		29.99		1.45		0.20	3.04
Integral							
0-20				27.48		8.98	63.10
0-30				43.33		10.58	93.03
DEPTH M	CHLOROPHYLL a mg m ⁻³	PHEOPIGMENTS mg m ⁻³	PARTICULATE CARBON mg m ⁻³	PARTICULATE NITROGEN mg m ⁻³	Secchi Depth: 9 m		
0	1.14	0.75	207.7	26.0			
5	1.26	0.85	232.6	20.8			
10	0.57	0.69	327.6	37.7			
15	0.34	1.81	251.3	27.0			
20	0.80	0.78	149.8	15.9			
25	0.57	0.59	183.3	18.7			
30	0.34	0.55	227.6				
Integral							
0-20	15.35	20.58	4949.5	532.0			
0-30	21.40	26.85	6805.5				

DATE: October 11, 1978

DEPTH	TEMPERATURE °C	SALINITY ‰	DENSITY	NITRATE + NITRITE mg-at N m ⁻³	AMMONIA mg-at N m ⁻³	PHOSPHATE mg-at P m ⁻³	SILICATE mg-at Si m ⁻³
0	11.7	28.83	21.9				
5	12.63	28.82	21.7				
10	12.76	28.82	21.7				
15	12.60	28.81	21.7				
20	12.75	28.82	21.7				
25	12.63	28.82	21.7				
30		28.84					
DEPTH M	CHLOROPHYLL a mg m ⁻³	PHEOPIGMENTS mg m ⁻³	PARTICULATE CARBON mg m ⁻³	PARTICULATE NITROGEN mg m ⁻³	Secchi Depth: 12 m		
0	0.80	0.00	254.2	16.4			
5	1.25	0.00	121.5	13.5			
10	0.34	0.50	111.2	13.1			
15	1.14	0.17	170.9	17.3			
20	0.46	0.44	139.3	16.9			
25	0.57	0.11		15.3			
30	0.91	0.24	201.1	21.1			
Integral							
0-20	16.80	4.45	3002.0	302.1			
0-30	23.08	6.70	4704.0	473.6			

DATE: October 22, 1978

DEPTH	TEMPERATURE °C	SALINITY ‰	DENSITY	NITRATE + NITRITE mg-at N m ⁻³	AMMONIA mg-at N m ⁻³	PHOSPHATE mg-at P m ⁻³	SILICATE mg-at Si m ⁻³
0	11.1	28.84	22.0	1.30		1.24	15.32
5	12.10	28.78	21.8	1.44		1.02	5.26
10	12.09	28.73	21.7	1.34		0.98	4.14
15	11.91	28.75	21.8	1.15		0.74	3.41
20	12.00	28.76	21.8	1.09		0.73	2.98
25	11.87	28.78	21.8	1.07		0.64	2.56
30		28.80		1.08		0.62	3.28
Integral							
0-20				25.63		18.60	109.80
0-30				36.40		25.20	132.25
DEPTH M	CHLOROPHYLL a mg m ⁻³	PHEOPIGMENTS mg m ⁻³	PARTICULATE CARBON mg m ⁻³	PARTICULATE NITROGEN mg m ⁻³			
0	0.34	0.13	172.2	17.7			
5	0.34	0.18	130.9	15.3			
10	0.11	0.36	140.1	18.9			
15	0.23	0.24	204.0	23.6			
20	0.11	0.25	196.4	13.2			
25	0.23	0.08	152.2	11.5			
30	0.11	0.15	248.7	23.8			
Integral							
0-20	4.53	4.85	3228.1	366.1			
0-30	6.23	6.25	5167.8	515.8			

DATE: October 30, 1978

DEPTH	TEMPERATURE °C	SALINITY ‰	DENSITY	NITRATE + NITRITE mg-at N m ⁻³	AMMONIA mg-at N m ⁻³	PHOSPHATE mg-at P m ⁻³	SILICATE mg-at Si m ⁻³
0	9.3	28.81	22.3	0.62	0.51	0.51	2.90
5				0.68			
10		28.82		0.61	0.44	0.41	2.93
15		28.79		0.39	0.30	0.34	2.53
20		28.81		0.53	0.17	0.47	3.08
25		28.81		0.63	0.33	0.45	2.80
27	10.24	28.83	22.1	0.38	0.38	0.40	2.84
29	10.37	28.81	22.1	0.37	0.21	0.39	2.79
30		28.83		0.32	0.65	0.28	1.80
31	10.00	28.82	22.2	0.37	0.37	0.32	2.71
32		28.84		0.45	0.61	0.42	2.63
33	10.36	28.83	22.1	0.41	0.27	0.40	3.08
Integral							
0-20				10.95	8.80	8.50	56.83
0-30				16.23	12.55	12.55	83.03
DEPTH M	CHLOROPHYLL a mg m ⁻³	PHEOPIGMENTS mg m ⁻³	PARTICULATE CARBON mg m ⁻³	PARTICULATE NITROGEN mg m ⁻³			
0	1.08	0.00	144.8	12.7			
5	1.14	0.07	158.1	16.4			
10	0.80	0.00	104.6	7.4			
15	0.74	0.00	173.0	12.7			
20	0.77	0.04	217.5	13.2			
25	0.63	0.02	176.7	16.1			
27	0.91	0.06	840.9	71.3			
29	0.71	0.10	144.9	11.9			
30	0.60	0.01	565.1	33.9			
31	0.75	0.08	158.7	10.5			
32	0.57	0.09	438.9	37.1			
33	0.43	0.28	277.6	31.8			
Integral							
0-20	16.71	0.45	3084.3	247.3			
0-30	24.60	0.90	5924.3	721.0			

DATE: November 1, 1978

DEPTH	TEMPERATURE °C	SALINITY ‰	DENSITY	NITRATE + NITRITE mg-at N m ⁻³	AMMONIA mg-at N m ⁻³	PHOSPHATE mg-at P m ⁻³	SILICATE mg-at Si m ⁻³
0	9.2	28.73	22.2	0.65	0.85	0.52	4.85
5	10.3	28.68	22.0	0.70	1.52	0.58	5.38
10	10.4	28.75	22.0	0.60	0.58	0.94	4.63
15	10.2	28.81	22.1	0.56	0.62	0.47	3.71
20	10.3	28.82	22.1	0.49	0.74	0.45	3.27
25	10.1	28.83	22.2	0.41	0.67	0.53	2.65
27	10.2	28.83	22.1	0.61		0.53	3.26
29	10.2	28.84	22.1				
30	10.2	28.83	22.1	0.46		0.50	3.51
31	10.1	28.84	22.2	0.43		0.39	3.00
32		28.86		0.61		0.49	3.31
33		28.85		0.40		0.44	2.47
Integral							
0-20				12.15	17.58	12.38	88.90
0-30				16.58		17.40	119.10
DEPTH M	CHLOROPHYLL $\frac{a}{\text{mg m}^{-3}}$	PHEOPIGMENTS mg m ⁻³	PARTICULATE CARBON mg m ⁻³	PARTICULATE NITROGEN mg m ⁻³			
0	0.80	0.04	282.0	24.4			
5	1.00	0.05	352.9	31.6			
10	0.80	0.07	356.8	30.1			
15	0.66	0.07	273.5	25.1			
20	0.64	0.04	414.6	37.8			
25	0.68	0.06	306.3	38.2			
27	0.53	0.07	153.7	14.3			
29	0.38	0.04	188.5	17.9			
30	0.63	0.06	342.5	43.0			
31	0.40	0.06	344.5	28.2			
32	0.43	0.19	607.9	84.2			
33	0.41	0.13	180.9	16.1			
Integral							
0-20	15.90	1.16	6657.5	589.5			
0-30	22.48	1.70	10081.8	982.0			

Appendix II

Sedimentation and Organic Carbon, Nitrogen and Plant Pigments in Settled
Material collected at Station 7

Dates of Exposure	Depth (m)	Dry Matter Deposited $\text{g m}^{-2} \text{d}^{-1}$ (s.d.)	Percent		Chlorophyll a g g^{-1}	Pheopigments g g^{-1}
			Carbon	Nitrogen		
24/4-2/5	25	2.879 (0.419)	2.05	0.23	253.1	153.1
2/5-8/5	22	7.206 (0.693)	1.65	0.21	234.2	290.5
	25	7.270 (0.849)				
8/5-16/5	22	6.456 (1.303)	3.92	0.46	79.5	219.3
	25	3.361	4.47	0.55	142.9	214.3
16/5-29/5	22	2.233 (0.388)	6.05	0.86	181.9	150.9
	25	4.227 (0.674)	5.87	1.81	111.1	173.3
29/5-5/6	22	1.133 (0.576)	5.37	0.53	37.1	162.9
	25	2.587 (1.111)	4.76	0.49	66.7	380.3
5/6-19/6	22	0.493 (0.090)	8.98	1.84	181.8	254.8
	25	0.993 (0.217)	4.72	0.66	249.7	320.2
19/6-4/7	22	2.977 (0.166)	5.15	0.78	205.0	473.3
	25	2.890 (2.390)	6.53	0.77	181.8	486.4
4/7-10/7	22	1.217 (0.060)	6.48	0.92	27.6	320.0
	25	1.293 (0.075)	6.58	0.98	36.5	362.9
10/7-17/7	22	1.097 (0.152)	4.52	0.42	14.1	151.5
	25	1.200 (0.156)	9.26	0.37	226.8	(354.7)*
17/7-31/7	22	0.850 (0.219)	5.28	0.59	70.6	240.6
	25	1.280 (0.127)	5.17	0.72	102.7	346.5
31/7-14/8	22	0.787 (0.121)	8.21	1.06	(138.6)*	(266.9)*
	25	1.760 (0.111)	4.68	0.62	(131.8)*	(327.5)*

Dates of Exposure	Depth (m)	Dry Matter Deposited $\text{g m}^{-2} \text{ d}^{-1}$	Deposited (s.d.)	Percent		Chlorophyll <u>a</u> g g^{-1}	Pheopigments g g^{-1}
				Carbon	Nitrogen		
28/8-11/9	22	1.013	(0.090)	1.41	0.28	206.6	293.1
	25	1.053	(0.012)	3.37	0.34	160.9	308.5
11/9-11/10	22	4.197	(0.270)	4.77	0.87	147.7	396.6
	25	5.127	(0.977)	6.74	1.31	169.0	272.1
11/10-22/10	22	10.333	(0.718)	8.62	1.43	135.1	128.2
	25	7.740	(1.230)	7.25	1.34	30.6	31.0
22/10-30/10	22	14.027	(1.702)	2.19	0.33	159.8	155.7
	25	14.805	(1.192)	2.00	0.30	74.4	131.3

* values calculated as an average of measurements on dates preceeding and following this date.

Appendix III

Organic content of dry surface sediment (upper 1-2 cm) collected at
station 7 in St. Georges Bay during 1978

Date	Percent Carbon	Percent Nitrogen	C:N	Chlorophyll <u>a</u> $\mu\text{g g}^{-1}$	Pheopigments	Carbon:Chlorophyll <u>a</u>
8/5	0.29	0.04	7.25	10.6	35.9	273.6
16/5	1.04	0.14	7.42	6.6	11.2	1575.8
29/5	0.96	0.14	6.86	2.4	8.3	4000.0
5/6	1.07	0.10	10.70	3.0	12.5	3566.7
19/6	1.30	0.15	8.67	30.6	59.4	424.8
4/7	0.86	0.08	10.75	14.8	34.9	581.1
10/7	1.17	0.12	9.75	4.5	15.8	260.0
17/7	1.29	0.10	12.90	4.7	31.9	2744.7
31/7	1.06	0.12	8.83	8.1	19.3	1308.6
14/8	0.89	0.09	9.89	-	-	-
11/9	1.23	0.12	10.25	25.1	23.5	490.0
11/10	1.32	0.18	7.33	11.8	11.2	1118.6
22/10	0.87	0.10	8.70	16.7	42.7	520.9
30/10	1.85	0.16	11.56	3.8	14.9	4868.4
Mean	1.09	0.12	9.35	11.0	24.7	1671.8
σ	0.34	0.04	1.80	8.8	15.3	1587.5
c.v.	0.32	0.30	0.19	0.80	0.62	0.95